10 YEARS OF UNIVERSITY RECOGNITION
20 YEARS OF ACADEMIC EXCELLENCE

REVA UNIVERSITY
Bengaluru, India

HANDBOOK

B. Tech in Electronics and Computer Engineering (ECM)

2020-2024

(I to IV Year)

RUKMINI EDUCATIONAL
Charitable Trust

www.reva.edu.in

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF ELECTRONICS AND COMMUNICATION ENGINEERING

HANDBOOK

B. Tech. in Electronics and Computer Engineering (ECM)

2020-24
(I to IV Year)

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Chancellor's Message

"Education is the most powerful weapon which you can use to change the world."
- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect, and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I am always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally, and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me, and I believe, it takes teamwork to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom, and knowledge.

Dr. P. Shyama Raju
The Founder and Hon'ble Chancellor, REVA University

Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened several options as well as created multiple challenges. A strong believer and practitioner of the dictum "Knowledge is Power", REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this 'temple of learning' has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - many faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of Reva University.

At REVA University, research, consultancy, and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation, and playing a positive role in nation building. We reiterate our endeavor to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating "GLOBAL PROFESSIONALS".

Welcome to the portals of REVA University!

Dr M Dhanamjaya
Vice-Chancellor

Director's –Message

Since the inception of REVA University, School of Electronics and Communication Engineering is involved in implementing following best practices in various dimensions such as academics, research, outreach activities, student development programs, project based and research based learning, student centric learning, student competitions, industry and in-house internships, abroad internships, skill enhancement activities, motivation for competitive exams, mini projects, major projects, industry mentored projects, multidisciplinary projects, industry visits, technical talks by industry and academicians, certification programs, etc. Individual students are taken care by strong mentoring system wherein faculty members are not only allotted as mentors to students, but also, they will act as local guardians and they will have constant follow up with mentees regarding academic and personal issues till students complete the degree.

The curriculum is carefully designed to meet the current industry trends and to provide insight into future technological developments that lead to inculcate lifelong learning abilities in students. Board of Studies (BoS) comprises people from academics, industry, alumni, and current students which form the strong backbone for our programs wherein constant updates happen in contents/subjects every semester based on current industry needs. Curriculum has good mix of foundation courses, hardcore courses, softcore courses, practical and projects along with open electives on par with global education standards.

Student welfare is given utmost priority at School of Electronics and Communication Engineering. Advanced learning methods are adopted to make learning truly interactive. More focus is on discussion and practical applications rather than rote learning. Notes/handouts/video contents/quizzes are given, and critical thinking questions are asked to test understanding. Experienced, well qualified and friendly faculty members always strive hard to provide best of education to students. The faculty members have number of publications in reputed national and international journals/conferences. The school is also involved in funded research projects.

I am sure the students choosing B Tech and M. Tech programs in School of Electronics and Communication Engineering in REVA University will enjoy the curriculum, teaching and learning environment, well equipped laboratories, digital classrooms infrastructure and the experienced teacher's involvement and guidance.

Dr K M Sudharshan
Director – School of ECE

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RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. **Rukmini Educational Charitable Trust** (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing, and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond road park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 13,000 students study various courses across REVA’s three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 27thFebruary, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom, and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer Centre, the well planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

REVA consistently ranked as one of the top universities in various categories because of the diverse community of international students and its teaching excellence in both theoretical and technical education in the fields of Engineering, Management, Law, Science, Commerce, Arts, Performing Arts, and Research Studies. REVA offers 28 Undergraduate Programmes, 22 Full-time and 2 Part-time Postgraduate Programmes, 18 Ph. D Programmes, and other Certificate/ Diploma/Postgraduate Diploma Programmes in various disciplines.

The curriculum of each programme is designed with a keen eye for detail by giving emphasis on hands-on training, industry relevance, social significance, and practical applications. The University offers world-class facilities and education that meets global standards.

aHighly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed to preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and assisting students' placements.

REVA University recognizing the fact that research, development, and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology, and other areas of study. The interdisciplinary-multidisciplinary research is given the topmost priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries, and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Sensor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nana Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much-required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor& Dean, and supported by well experienced Trainers, Counselors and Placement Officers.

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognized as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitate students to study some of the programs partly in REVA University and partly in foreign university.

The University has also given greater importance to quality in education, research, administration, and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing, and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists, and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director IISc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defense Dr. Sathish Reddy, Scientific Advisor, Ministry of Defense, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

REVA organizes various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events, the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVOTSAVA conducted every year. The event not only gives opportunities to students of REVA but also students at other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions, and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognized by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga class is every day to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

Vision

REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standard.

Mission

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

Objectives

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students, and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner

ABOUT SCHOOL OF ELECTRONICS AND COMMUNICATION ENGINEERING

The School of Electronics and Communication Engineering headed by a highly experienced Professor and is supported by well qualified faculty members. The school has the state-of-art classrooms and well-equipped laboratories. It offers B. Tech. and M. Tech. and PhD programs in various specialized streams. The curriculum of both the graduate and the post graduate degree programs have been designed to meet the current industry trends. B. Tech program aims to prepare human resources to play a leading role in the continuing adventure of modern automated systems and communications. The program offers numerous choices of study for the students based on interest in the current state of art technology. Apart from fundamental courses in Electronics and Communication Engineering, the school facilitates to study in four streams such as Circuits and Devices, Communication Engineering, Signal Processing and Programming. Students are at liberty to choose from these streams in higher semesters. This is reflected in various core subjects offered within the program.
The master's degree programs focus on research and design in the core and IT industries, building and marketing the next generation of product development. These programs provide an opportunity to explore newer dimensions in cutting edge technologies like Electronic Circuits and Communication, Signal Processing and Computer Networks, VLSI and Embedded Systems and pursue research in interested domains for doctoral degree.

Vision

The School of Electronics and Communication Engineering is envisioned to be a leading center of higher learning with academic excellence in the field of electronics and communication engineering blended by research and innovation in tune with changing technological and cultural challenges supported with leadership qualities, ethical and moral values.

Mission

- Establish a unique learning environment to enable the students to face the challenges in the field of Electronics and Communication Engineering and explore multidisciplinary which serve the societal requirements.
- Create state-of-the-art laboratories, resources, and exposure to the current industrial trends to enable students to develop skills for solving complex technological problems of current times and also provide a framework for promoting collaborative and multidisciplinary activities.
- Promote the establishment of Centers of Excellence in niche technology areas to nurture the spirit of innovation and creativity among faculty and students.
- Offer ethical and moral value-based education by promoting activities which inculcate the leadership qualities, patriotism and set high benchmarks to serve the society.

Programme Overview – B. Tech in Electronics and Computer Engineering

B. Tech in Electronics and Computer Engineering aims to integrate two separate engineering domains to meet the interdisciplinary demands of electronics and computer industries in today's world. Among the Indian engineering aspirants, electronics and computer engineering is emerging as a popular career choice for quite some time. To opt for a career as an electronics and computer engineer, one should have an inquisitive mind and an interest in applying science and mathematics to solve real-world problems. Also, one should know how to make optimum use of technologies to make positive impact on peoples' lives.

The role of B. Tech graduate of an electronics and computer engineer is to identify and recommend system improvements to improve technical performance, conduct system evaluations and make appropriate recommendations to modify designs or repair equipment, define and execute testing and maintenance procedures for electronic software and components, design electronic software and components for commercial applications and inspect electronics to ensure compliance with all applicable regulations and safety standard.

Electronics and Computer Engineering encompasses not just the software aspects of computing but also the hardware. Knowing how the hardware works as well as the software, enables the design of systems that incorporate both counterparts and presents an understanding of the whole process from writing software programs that work on a particular operating system to the communication of this with the hardware.

Combining the two disciplines of electronics engineering and computer engineering gives the graduates an excellent grounding in both specialized areas and prepares the grads for a wide range of careers, in both or either fields. This cross-discipline study provides an early advantage of becoming a multi-skilled professional Engineer with a thorough understanding of the concepts and techniques from other closely related areas that are likely to influence and affect the career of graduates, such as object-oriented programming or artificial intelligence.

The benefits of choosing **Electronics and Computer Engineering** are as follows.

- Ample opportunities exist in the field of Electronics and Computer Engineering, such as hardware electronics, computer programming, operating systems, computer architectures & graphics, networking and the structure and operation of the internet, enabling to develop a thorough understanding of modern computer systems. In combining the two disciplines- Electronics and Computers- one will gain an excellent grounding in both the domains plus the chance to explore the exciting interface between the two.
- Interdisciplinary teaching within the University gives access to cross-discipline modules taught by subject specialists
- Provides hands-on practical experience of designing and constructing electronic systems using computer simulation and practical laboratory work.
- Provides a platform to venture into a startup and establish as an entrepreneur.
- Provides a platform to focus on the research and innovation which leads to socio-economic reforms.

Program Educational Objectives (PEOs)

After few years of graduation, the graduates of B. Tech. (Electronics and Computer Engineering) will

- ❖ **PEO-1:** Have successful professional career in industry, government, and software organization as innovative engineers
- ❖ **PEO-2:** Successfully solve engineering problems related to Electronics and Computer Engineering by communicating effectively either as a team or as a team member and lead the team
- ❖ **PEO-3:** Pursue higher studies and have an attitude of lifelong learning through cultural, technical and outreach activities
- ❖ **PEO-4:** Serve the society regionally, globally and will take up entrepreneurship for the growth of the economy and generate employment

Program Outcomes (POs)

On successful completion of the program, the graduates of B. Tech. (Electronics and Computer Engineering) program will be able to

- **PO-1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in Electronics and computer Engineering.
- **PO-2: Problem analysis:** Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.
- **PO-3: Design/development of solutions:** Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO-4: Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO-5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO-6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO-7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO-8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- **PO-9: Individual and teamwork:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
- **PO-10: Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations and give and receive clear instructions.
- **PO-11: Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one’s own work, as a member and leader in a team. Manage projects in multidisciplinary environments.
- **PO-12: Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)

On successful completion of the program, the graduates of B. Tech. (Electronics and Computer Engineering) program will be able to

- **PSO-1:** Isolate and solve complex problems in the domains of Electronics and Computer Engineering using latest hardware and software tools and technologies, along with analytical and managerial skills to arrive at cost effective and optimum solutions either independently or as a team.

- **PSO-2:** Implant the capacity to apply the concepts of electronics, data analytics, computer networks, cloud computing, artificial intelligence, and machine learning, etc., in the design, development of hardware and software for the application engineering lifecycle systems.

- **PSO-3:** Design, develop and build electronics and software systems to solve real life industry problems using modern tools and techniques.

(Framed as per the provisions under Section 35 (ii), Section 7 (x) and Section 8 (xvi) & (xxi) of the REVA University Act, 2012)

1. Title and Commencement:

1.1 These Regulations shall be called **"REVA University Academic Regulations – B. Tech., Degree Program 2020-21 Batch subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management**

1.2 These Regulations shall come into force from the date of assent of the Chancellor.

2. The Programs:

These regulations cover the following B. Tech., Degree programs of REVA University offered during 2020-21

B Tech in:
Bioelectronics Engineering
Civil Engineering
Computer Science and Engineering
Computer Science and Information Technology
Computer Science and Systems Engineering
Computer Science and Engineering (AI and ML)
Electrical and Electronics Engineering
Electrical and Computer Engineering
Electronics and Communication Engineering
Electronics and Computer Engineering
Information Science and Engineering
Mechanical Engineering
Mechatronics Engineering

3. Duration and Medium of Instructions:

3.1 Duration: The duration of the B Tech degree program shall be FOUR years comprising of **EIGHT** Semesters. A candidate can avail a maximum of 16 semesters - 8 years as per double duration norm, in one stretch to complete B. Tech degree, including blank semesters, if any. Whenever a candidate opts for blank semester, he/she must study the prevailing courses offered by the School when he/she resumes his/her studies.

3.2 The medium of instruction shall be English.

4. Definitions:

4.1 Course: "Course" means a subject, either theory or practical or both, listed under a programme; Example: "Fluid Mechanics" in B Tech Civil Engineering program, Engineering Thermodynamics in B. Tech., Mechanical program are examples of courses to be studied under respective programs.

Every course offered will have three components associated with the teaching-learning process of the course, namely:

L	**Lecture**
T	**Tutorial**
P	**Practice**

Where:
L stands for **Lecture** session consisting of classroom instruction.
T stands for **Tutorial** session consisting participatory discussion / self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.
P stands for **Practice** session and it consists of Hands-on Experience / Laboratory Experiments / Field Studies / Case Studies / Project Based Learning or Course end Project/Self Study/ Online courses from listed portals that equip students to acquire the much required skill component.

4.2 Classification of Courses

Courses offered are classified as: Core Courses, Open Elective Courses, Project work/Dissertation

4.2.1 **Core Course:** A course which should compulsorily be studied by a candidate choosing a particular program of study

4.2.2 **Foundation Course:** The foundation Course is a mandatory course which should be completed successfully as a part of graduate degree program irrespective of the program of study

4.2.3 **Hard Core Course (HC) simply core course:** The **Hard-Core Course** is a Core Course in the main branch of study and related branch(es) of study, if any, that the candidates have to complete compulsorily

4.2.4 **Soft Core Course (SC) (also known as Professional Elective Course)**
A Core course may be a **Soft Core** if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study

4.2.5 **Open Elective Course (OE):**
An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an **Open Elective Course**

4.2.6 **Project Work / Dissertation:**
Project work / Dissertation work is a special course involving application of knowledge in solving / analysing /exploring a real-life situation / difficult problem to solve a multivariable or complex engineering problems. The project will be conducted in two phases, phase-I (7th Semester), Consists

of literature survey, problem identification, formulation, and methodology. In Phase-II (8th Semester) student should complete the project work by designing or creating an innovative process or development of product as an outcome. A project work carrying **TWO**, **FOUR or SIX** credits is called Minor Project work / Dissertation. A project work of **SIX, EIGHT, or TEN,** credits is called Major Project work / Dissertation. **A Minor Project work may be a hard core, or a Soft Core as decided by the BOS / concerned. But the Major Project shall be Hard Core.**

4.2.7 **"Program"** means the academic program leading to a Degree, Post Graduate Degree, Post Graduate Diploma Degree, or such other degrees instituted and introduced in REVA University.

5. Eligibility for Admission:

5.1. The eligibility criteria for admission to B Tech Program of 4 years (8 Semesters) is given below:

Sl. No.	Program	Duration	Eligibility
1	Bachelor of Technology (B Tech)	4 Years (8 Semesters)	Passed 10+2 examination with Physics and Mathematics as compulsory subjects, along with any one of the following subjects, namely, Chemistry, Bio-Technology, Computer Science, Biology, Electronics and Technical Vocational subject Obtained at least 45% marks (40% in case of candidate belonging to SC/ST category) in the above subjects taken together.
2	Bachelor of Technology (B Tech)	Lateral entry to second year	A. Passed Diploma examination from an AICTE approved Institution with at least 45% marks (40% in case of candidates belonging to SC/ST category) in appropriate branch of Engineering / Technology. B. Passed B. Sc Degree from a recognized University as defined by UGC, with at least 45% marks (40% in case of candidates belonging to SC/ST category) and passed XII standard with mathematics as a subject. C. Provided that in case of students belonging to B. Sc. Stream, shall clear the subjects of Engineering Graphics / Engineering Drawing and Engineering Mechanics of the first year Engineering program along with the second-year subjects. D. Provided further that, the students belonging to B. Sc. Stream shall be considered only after filling the seats in this category with students belonging to the Diploma stream.

			E. Provided further that student, who have passed Diploma in Engineering & Technology from an AICTE approved Institution or B. Sc., Degree from a recognized University as defined by UGC, shall also be eligible for admission to the first year Engineering Degree courses subject to vacancies in the first-year class in case the vacancies at lateral entry are exhausted. However, the admissions shall be based strictly on the eligibility criteria as mentioned in A, B, D, and E above.
	Bachelor of Technology (B Tech)	Lateral entry to fourth year (final year)	Any candidate with genuine reason from any University / Institution in the country upon credit transfer could be considered for lateral admission to the respective semester in the concerned branch of study, provided he/she fulfils the University requirements.
4	B. Tech. in Bioelectronics		Pass in PUC / 10+2 examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry / Biotechnology / Biology / Computer Science / Electronics / Technical Vocational subjects and obtained minimum 45% marks (40% in case of candidates belonging to SC / ST category) in the above subjects taken together of any board recognized by the respective State Government / Central Government / Union Territories or any other qualification recognized as equivalent there to.

5.2 Provided further that the eligibility criteria are subject to revision by the Government Statutory Bodies, such as AICTE, UGC from time to time.

6. Courses of Study and Credits

6.1 Each course of study is assigned with certain credit value

6.2 Each semester is for a total duration of 20 weeks out of which 16 weeks dedicated for teaching and learning and the remaining 4 weeks for final examination, evaluation, and announcement of results

6.3 The credit hours defined as below:
In terms of credits, every one hour session of L amounts to 1 credit per Semester and a minimum of two hour session of T or P amounts to 1 credit per Semester or a three hour session of T / P amounts to 2 credits over a period of one Semester of 16 weeks for teaching-learning process.
1 credit = 13 credit hours spread over 16 weeks or spread over the semester

The total duration of a semester is 20 weeks inclusive of semester-end examination.
The following table describes credit pattern

Table -2: Credit Pattern					
Lectures (L)	**Tutorials (T)**	**Practice (P)**	**Credits (L: T:P)**	**Total Credits**	**Total Contact Hours**
4	2	0	4:1:0	5	6
3	2	0	3:1:0	4	5
3	0	2	3:0:1	4	5
2	2	2	2:1:1	4	6
0	0	6	0:0:3	3	6

a. The concerned BoS will choose the convenient Credit Pattern for every course based on size and nature of the course

7. Different C**ourses of Study**:

Different C**ourses of Study** are labeled as follows:

a. Core Course (CC)
b. Foundation Course (FC)

c. Hard Core Course (HC)

d. Soft Core Course (SC)
e. Open Elective Course (OE)

f. Project Work / Dissertation:
g. A project work carrying **TWO, FOUR or SIX** credits is called Minor Project work / Dissertation. A project work of **EIGHT, TEN, TWELVE or SIXTEEN** credits is called Major Project work / Dissertation. A Project work may be a hard core, or a Soft Core as decided by the BoS / concerned.

These are defined under Section 4 of these regulations.

8. Credits and Credit Distribution

8.1 **A candidate has to earn 160 credits for successful completion of B Tech degree** with the distribution of credits for different courses as given in table below:

Course Type	**Credits (Range) For B Tech Degree (8 Semesters)**
Foundation Core Course	A minimum of 06 but not exceeding 12
Hard Core Course	A minimum of 118 but not exceeding 121
Soft Core Course	A minimum of 15 but not exceeding 21

Open Elective	A minimum of 04 but not exceeding 12

8.2. The concerned BOS based on the credits distribution pattern given above shall prescribe the credits to various types of courses and shall assign title to every course including project work, practical work, field work, self-study elective, as **Foundation Course (FC), Hard Core (HC) or Soft Core (SC), Open Elective (OE).**

8.3. Every course including project work, practical work, field work, self-study elective should be entitled as **Foundation Course (FC), Hard Core (HC) or Soft Core (SC) or Open Elective (OE)** or **Core Course** (**CC**) by the BoS concerned. However, following shall be the **Foundation Courses** with credits mentioned against them, common to all branches of study.

Sl. No.	**Course Title**	**Number of Credits**
	Foundation Courses	
1	English for Technical Communication / Communicative Skills	2-3
2	Environmental Studies / Environmental Sciences	2
3	Indian Constitution and Professional Ethics	2
4	MOOC / Internship /Soft Skill Training	6-15

8.4**.** The concerned BOS shall specify the desired Program Educational Objectives, Program Outcomes, Program Specific Outcomes and Course Outcomes while preparing the curriculum of a particular program.

8.5. A candidate can enrol for a maximum of 28 credits and a minimum of 19 credits per Semester. However, he / she may not successfully earn a maximum of 28 credits per semester. This maximum of 28 credits does not include the credits of courses carried forward by a candidate.

8.6 **Only such full-time candidates who register for a minimum prescribed number of credits in each semester from I semester to VIII semester and complete successfully 160 credits in 8 successive semesters shall be considered for declaration of Ranks, Medals, Prizes** and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full-time students and for hostel facilities.

8.7 Add- on Proficiency Certification:

To acquire Add on Proficiency Certification a candidate can opt to complete a minimum of 4 extra credits either in the same discipline /subject or in different discipline / subject in excess to 160 credits for the B Tech Degree program**.**

8.7.1. Add on Proficiency Diploma / Minor degree/ Honor Degree:

To acquire Add on Proficiency Diploma/ Minor degree/ Honor Degree: a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different discipline / subject in excess to 160 credits for the B Tech Degree program.

The Add on Proficiency Certification / Diploma/ Minor degree/ Honor Degree: so, issued to the candidate contains the courses studied and grades earned.

9 Assessment and Evaluation

9.1 The Scheme of Assessment will have two parts, namely.

i. Internal Assessment (IA); and
ii. Semester End Examination (SEE)

9.2 Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester End Examination (SEE) of UG Engineering programs shall carry 50:50 marks respectively (i.e., 50 marks internal assessment; 50 marks semester end examination).

9.3 The 50 marks of internal assessment shall comprise of:

Internal Test	30 marks
Assignments / Seminars / Model Making / Integrated Lab / Project Based Learning / Quizzes etc.	20 marks

9.4 There shall be **two Internal Tests** conducted as per the schedule announced below. **The Students shall attend both the Tests compulsorily.**

- 1st test is conducted for 15 marks during **6th week** of the Semester.
- 2nd test is conducted for 15 marks during **12th week** of the of the Semester.

9.5 The coverage of syllabus for the said tests shall be as under:

- Question paper of the **1st test should be based on first 40 %of the total syllabus**.
- Question paper of the **2nd test should be based on second 40 %of the total syllabus**.
- An assignment must be designed to cover the last **20% of the Syllabus**

9.6 There shall be one Assignment / Project Based Learning / Field Visit / Quiz test carrying 20 marks covering the last 20% of the Syllabus

9.7 The Semester End Examination for 50 marks shall be held in the 18th and 19th week of the beginning of the semester and the syllabus for the semester end examination shall be entire syllabus.

9.8 A test paper is set for a maximum of 30 marks to be answered in 1 hour duration. A test paper can have 4 main questions. Each main question is set for 10 marks. The main question can have 2-3 sub questions all totalling 10 marks. Students are required to answer any three main questions. Each question is set using Bloom's verbs. The questions must be set to assess the course outcomes described in the course document even with the choice is given in questions.

9.9 The question papers for internal test shall be set by the internal teachers who have taught the course. If the course is taught by more than one teacher all the teachers together shall devise a common question paper(s). However, these question papers shall be scrutinized by the Question Paper Scrutiny Committee to bring in the uniformity in the question paper pattern and as well to maintain the necessary standards.

9.10 The evaluation of the answer scripts shall be done by the internal teachers who have taught the course and set the test paper.

9.11 Assignment/seminar/Project based learning/simulation-based problem solving/field work should be set in such a way, students be able to apply the concepts learnt to a real life situation and students should be able to do some amount self-study and creative thinking. While setting assignment care should be taken such that the students will not be able to plagiarise the answer from web or any other resources. An assignment / Quiz can be set for a maximum of 20. Course instructor at his/her discretion can design the questions as a small group exercise or individual exercise. This should encourage collaborative learning and team learning and self-study.

9.12 Internal assessment marks must be decided well before the commencement of Semester End examinations

9.13 Semester End Examination: The Semester End Examination is for 50 marks shall be held in the 18th and 19th week of the semester and the entire course syllabus must be covered while setting the question paper.

9.14 Semester End Examination paper is set for a maximum of 100 marks to be answered in 3 hours duration. Each main question be set for a maximum of 25 marks, main questions can have a 3-4 sub questions. A total of 8 questions are set so that students will have a choice. Each question is set using Bloom's verbs. The questions must be set to assess the student's outcomes described in the course document. (Please note question papers must be set to test the course outcomes)

9.15 There shall be three sets of question papers for the semester end examination of which one set along with scheme of examination shall be set by the external examiners and two sets along with scheme of examination shall be set by the internal examiners. All the three sets shall be scrutinized by the Board of Examiners. It shall be responsibility of the Board of Examiners particularly Chairman of the BOE to maintain the quality and standard of the question papers and as well the coverage of the entire syllabus of the course.

9.16 There shall be single evaluation by the internal teachers who have taught the subject. However, there shall be moderation by the external examiner. In such cases where sufficient number of external examiners are not available to serve as moderators internal senior faculty member shall be appointed as moderators.

9.17 Board of Examiners, question paper setters and any member of the staff connected with the examination are required to maintain integrity of the examination system and the quality of the question papers.

9.18 There shall also be a **Program Assessment Committee (PAC)** comprising at-least 3 faculty members having subject expertise who shall after completion of examination process and declaration of results review the results sheets, assess the performance level of the students, measure the attainment of course outcomes, program outcomes and assess whether the program educational objectives are achieved and report to the Director of the School. The Examination Review Committee shall also review the question papers of both Internal Tests as well Semester End Examinations and submit reports to the Director of the respective School about the scope of the curriculum covered and quality of the questions.

9.19 The report provided by the Examination Review Committee shall be the input to the Board of Studies to review and revise the scheme of instruction and curriculum of respective program

9.20 During unforeseen situation like the Covid-19, the tests and examination schedules, pattern of question papers and weightage distribution may be designed as per the convenience and suggestions of the board of examiners in consultation with COE and VC

9.21 University may decide to use available modern technologies for writing the tests and SEE by the students instead of traditional pen and paper

9.22 Any deviations required to the above guidelines can be made with the written consent of the Vice Chancellor

9.23 Online courses may be offered as per UGC norms.
For online course assessment guidelines would be as follows:

1. If the assessment is done by the course provider, then the School can accept the marks awarded by the course provider and assign the grade as per REVA University norms.
2. If the assessment is not done by the course provider then the assessment is organized by the concerned school and the procedure explained in the regulation will apply
3. In case a student fails in an online course, s/he may be allowed to repeat the course and earn the required credits

IAs for online courses could be avoided and will remain at the discretion of the School.

9.24 The online platforms identified could be SWAYAM, NPTEL, Coursera, Edx.org, Udemy, Udacity and any other internationally recognized platforms like MIT online, Harvard online etc.

9.25 Utilization of one or two credit online courses would be:

4-week online course – 1 credit

8-week online course / MOOC – 2 credits

12-week online course / MOOC – 3 credits

9.26 **Summary of Internal Assessment, Semester End Examination and Evaluation** Schedule is provided in the table given below.

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	when	Syllabus Covered	Max Marks	Reduced to	Date by which the process must be completed
1	Test-1	During 6th week	First 40%	30	15	7th week
2	Test -2	During 12th Week	Second 40%	30	15	13th Week
3	Assignment / Quiz	15th Week	Last 20%	20	20	16th Week
4	SEE	18/19th Week	100%	100	50	20th Week

10 Assessment of Students Performance in Practical Courses

The performance in the practice tasks / experiments shall be assessed based on:
a) Knowledge of relevant processes.
b) Skills and operations involved.
c) Results / products including calculation and reporting.

10.1 The 50 marks meant for Internal Assessment (IA) of the performance in carrying out practical shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	10 marks
iii	Performance of mid-term test (to be conducted while conducting second test for theory courses); the performance assessments of the mid-term test include performance in the conduction of experiment and write up about the experiment.	20 marks
	Total	**50 marks**

10.2 The 50 marks meant for Semester End Examination (SEE), shall be allocated as under:

i	Conducting of semester end practical examination	30 marks
ii	Write up about the experiment / practical conducted	10 marks
iii	Viva Voce	10 marks
	Total	**50 marks**

10.3 The duration for semester-end practical examination shall be decided by the concerned School Board.

For MOOC and Online Courses assessment shall be decided by the BOS of the School.

For > 3 credit courses

i	IA-I	25 marks
ii	IA-2	25 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	50 marks
	Total	**100 marks**

For 1 & 2 credit courses

i	IA-I	15 marks
ii	IA-2	15 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	20 marks
	Total	**50 marks**

11. Evaluation of Minor Project / Major Project / Dissertation:

Right from the initial stage of defining the problem, the candidate must submit the progress reports periodically and present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate must submit final report of the project / dissertation for final evaluation. The components of evaluation are as follows:

Component – I	Periodic Progress and Progress Reports (25%)
Component – II	Demonstration and Presentation of work (25%)
Component – III	Evaluation of Report (50%)

12. Requirements to Pass a Course:

A candidate's performance from IA and SEE will be in terms of scores, and the sum of IA and SEE scores will be for a maximum of 100 marks (IA = 50, SEE = 50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate must secure a minimum of 25% (13 marks) in Semester End Examination (SEE) which is compulsory.

The Grade and the Grade Point: The Grade and the Grade Point earned by the candidate in the subject will be as given below:

Marks, P	**Grade, G**	**Grade Point (GP=V x G)**	**Letter Grade**
90-100	10	v*10	O

80-89	9	v*9	A+
70-79	8	v*8	A
60-69	7	v*7	B+
55-59	6	v*6	B
50-54	5.5	v*5.5	C+
40-49	5	v*5	C
0-39	0	v*0	F
ABSENT			AB

O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B-Above Average; C+-Average; C-Satisfactory; F – Unsatisfactory.

Here, P is the percentage of marks (P= [IA + SEE]) secured by a candidate in a course which is **rounded to nearest integer**. V is the credit value of course. G is the grade and GP is the grade point.

a. Computation of SGPA and CGPA

The Following procedure to compute the Semester Grade Point Average (SGPA).
The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a given semester, i.e.: **SGPA (Si) = ∑ (Ci x Gi) / ∑Ci where** Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	3	A+	9	3X9=27
Course 2	3	A	8	3X8=24
Course 3	3	B+	7	3X7=21
Course 4	4	O	10	4X10=40
Course 5	1	C	5	1X5=5
Course 6	2	B	6	2X6=12
Course 7	3	O	10	3X10=30
	19			159

Thus, **SGPA = 159 ÷ 19 = 8.37**

Illustration No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	A	8	4X8=32
Course 2	4	B+	7	4X7=28
Course 3	3	A+	9	3X9=27
Course 4	3	B+	7	3X7=21
Course 5	3	B	6	3X6=18
Course 6	3	C	5	3X5=15
Course 7	2	B+	7	2X7=21
Course 8	2	O	10	2X10=20
	24			175

Thus, SGPA = 175 ÷ 24 = 7.29

Illustration No.3

Course	**Credit**	**Grade Letter**	**Grade Point**	**Credit Point (Credit x Grade point)**
Course 1	4	O	10	4 x 10 = 40
Course 2	4	A+	9	4 x 9 = 36
Course 3	3	B+	7	3 x 7 = 21
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B+	7	3 x 7 = 21
Course 7	2	A+	9	2 x 9 = 18
Course 8	2	A+	9	2 x 9 = 18
	24			**199**

Thus**, SGPA = 199 ÷ 24 = 8.29**

b. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (160) for B. Tech degree in Engineering & Technology is calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e:

CGPA = ∑(Ci x Si) / ∑Ci

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

Illustration:

CGPA after Final Semester

Semester (ith)	**No. of Credits (Ci)**	**SGPA (Si)**	**Credits x SGPA (Ci X Si)**

1	19	6.83	19 x 6.83 = 129.77
2	21	7.29	21 x 7.29 = 153.09
3	22	8.11	22 x 8.11 = 178.42
4	22	7.40	22 x 7.40 = 162.80
5	22	8.29	22 x 8.29 = 182.38
6	22	8.58	22 x 8.58 = 188.76
7	22	9.12	22 x 9.12 = 200.64
8	10	9.25	10 x 9.25 =92.50
Cumulative	**160**		**1288.36**

Thus, **CGPA** = $\frac{19x6.83+21x7.29+22x8.11+22x7.40+22x8.29+22x8.58+22x9.12+10x9.25}{\mathbf{160}}$ = 8.05

c. **Conversion of grades into percentage:**

Conversion formula for the conversion of CGPA into Percentage is:
Percentage of marks scored = CGPA Earned x 10
Illustration: CGPA Earned 8.05 x 10=80.5

d. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

13. Classification of Results

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows.

CGPA	Grade (Numerical Index) G	Letter Grade	Performance	FGP Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA <5	5	C	Satisfactory	Pass
< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

Overall percentage=10*CGPA

a. **Provisional Grade Card**: The tentative / provisional grade card will be issued by the Controller of Examinations at the end of every semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average (SGPA).**

b. Final Grade Card: Upon successful completion of B Tech Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Controller of Examinations.

14. Attendance Requirement:

14.1 All students must attend every lecture, tutorial, and practical classes.

14.2 In case a student is on approved leave of absence (e g: - representing the University in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 75% of the classes taught.

14.3 Any student with less than 75% of attendance in aggregate of all the courses including practical courses / field visits etc, during a semester shall not be permitted to appear to the end semester examination and such student shall seek re-admission

15. Re-Registration and Re-Admission:

15.1 In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

15.2 In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and he / she shall seek re-admission to such dropped semester.

16. Absence during Internal Test:

In case a student has been absent from an internal test due to the illness or other contingencies he / she may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School, for conducting a separate internal test. The Director of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

17. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. He/she can do so before the commencement of respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance committee is final.

i. Grievance Committee:

In case of students having any grievances regarding the conduct of examination, evaluation and announcement of results, such students can approach Grievance Committee for redressal of grievances.

For every program there will be one grievance committee. The composition of the grievance committee is as follows: -

- The Controller of Examinations - Ex-officio Chairman / Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

19. Eligibility to Appear for Semester End Examination (SEE)

Only those students who fulfil a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc., as part of the program shall be eligible to appear for Semester End Examination

20. Provision for Supplementary Examination

In case a candidate fails to secure a minimum of 25% (13 marks) in Semester End Examination (SEE) and a minimum of 40% marks together with IA and SEE to declare pass in the course, such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The candidate who is unsuccessful in each course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

21. Provision to Carry Forward the Failed Subjects / Courses:

The student who has failed in a maximum of 4 courses in odd and even semesters together shall move to next semester of succeeding year(s) of study till 8^{th} semester. And he / she shall appear for Semester End examination of failed courses of previous semesters concurrently with odd semester end examinations and / or even semester end examinations of current year of study.

Case 1: A student who has failed in a maximum of 4 courses in 1^{st} and 2^{nd} semester together shall move to the 3^{rd} semester of the succeeding year.

Case 2: A student who has failed in a maximum of 4 courses from semester 1 to 4 together shall move to the 5^{th} semester of the succeeding year.

Case 3: A students who has failed in a maximum of 4 courses from semester 1 to 6 together shall move to the 7^{th} semester of the succeeding year.

22. Challenge Valuation:

a. A student who desires to apply for challenge valuation shall obtain a photocopy of the answer script(s) of semester end examination by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the grade awarded to him/her by surrendering the grade card and by applying along with the prescribed fee to the Controller of Examinations within 10 days after the announcement of the results. This challenge valuation is only for semester end examination.

b. The answer scripts (in whatever form) for which challenge valuation is sought for shall be evaluated by the external examiner who has not involved in the first evaluation. The higher of two marks from first valuation and challenge valuation shall be the final.

23. About any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

24. All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.

School of Electronics & Communication Engineering
Board of Studies for B. Tech in Electronics & Computer Engineering (ECM) - 2022

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1	**Mr. C R Yaswanth Simha,** Technical Analyst, Computa Centre Pvt. Ltd, Bengaluru	**Alumni**	**Mr. C R Yaswanth Simha,** Technical Analyst, Computa Centre Pvt. Ltd, Bengaluru	yaswanth.reddy@computacenter.com **Mobile : 9030608910**
Current Student Member				
1	**Ms. Manasi Angadi,** 6th Semester, Electronics and Computer Engineering	**Student**	**Ms. Manasi Angadi,** 6th Semester, Electronics and Computer Engineering**,** REVA University, Rukmini Knowledge Park, Bengaluru 560 064	r19lc021@ece.reva.edu.in **Mobile: 6364931114**

B. Tech in Electronics and Computer Engineering
Scheme of Instructions 2020-24 Batch

I SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20AS0102	Calculus and Differential Equations	HC	3	0	0	3	3
2	B20AS0104	Engineering Chemistry	HC	3	0	0	3	3
3	B20CI0101	Introduction to Python Programming	HC	2	0	1	3	4
4	B20EN0101	Principles of Electrical and Electronics	HC	3	0	1	4	5
5	B20ME0103	Elements of Mechanical and Civil Engineering	HC	3	0	0	3	3
TOTAL				**14**	**0**	**2**	**16**	**18**
Practical /Term Work / Sessional								
6	B20AS0109	Biology for Engineers	HC	1	0	0	1	1
7	B20ME0102	Design Thinking	HC	1	0	1	2	3
			TOTAL	**2**	**0**	**1**	**3**	**4**
TOTAL SEMESTER CREDITS				**19**				
TOTAL CUMULATIVE CREDITS				**19**				
TOTAL CONTACT HOURS				**22**				

II SEMESTER

Sl. No	Course Code	Title of the Course	HC/ FC/ SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20AS0203	Integral Transforms	HC	4	0	0	4	4
2	B20AS0202	Engineering Physics	HC	3	0	1	4	5
3	B20CS0101	Introduction to Data Science	HC	2	0	1	3	4
4	B20EN0201	Analog Electronics	HC	3	0	1	4	5
TOTAL				**12**	**0**	**3**	**15**	**18**
Practical /Term Work / Sessional								
5	B20EC0101	IoT and Applications	HC	1	0	1	2	3
6	B20ME0104	Entrepreneurship	HC	1	0	0	1	1
7	B20ME0101	Computer Aided Engineering Drawing	HC	2	0	1	3	4
TOTAL				**4**	**0**	**2**	**6**	**8**
TOTAL SEMESTER CREDITS					**21**			
TOTAL CUMULATIVE CREDITS					**40**			
TOTAL CONTACT HOURS					**26**			

III SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20AS0305	Linear algebra and Partial Differential Equations	FC	3	0	0	3	4
2	B20EN0301	Linear Integrated Circuits	HC	3	0	1	4	5
3	B20EP0301	Digital Electronics and Verilog	HC	3	0	1	4	5
4	B20EP0302	Design and Analysis of Algorithms	HC	2	0	1	3	4
5	B20EN0304	Problem solving using C Programming	HC	2	0	1	3	4
TOTAL				**14**	**0**	**3**	**17**	**22**
Practical /Term Work / Sessional								
6	B20EN0305	Course based project on Linear Integrated Circuits	HC	0	0	1	1	2
7	B20AS0303	Environmental Science	FC	2	0	0	2	2
8	B20MG0301	Management Science	FC	2	0	0	2	2
9	B20AHM301 / B20AHM302	Advanced Kannada/Basic Kannada	MC	1	0	0	0	1
TOTAL				**5**	**0**	**1**	**5**	**7**
TOTAL SEMESTER CREDITS					**22**			
TOTAL CUMULATIVE CREDITS					**62**			
TOTAL CONTACT HOURS					**29**			

IV SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20EP0401	Discrete Mathematics and Graph Theory	FC	3	1	0	4	5
2	B20EP0402	Relational Database Management Systems	HC	2	0	1	3	4
3	B20EP0403	Control Systems Engineering	HC	3	0	1	4	5
4	B20EN0403	Microcontroller and Applications	HC	3	0	1	4	5
5	B20EN0404	Object Oriented Programming and Data Structures using C++	HC	2	0	1	3	4
TOTAL				**13**	**1**	**4**	**18**	**23**
Practical /Term Work / Sessional								
6	B20EN0405	Course Based project on Microcontroller and Applications	HC	0	0	1	1	2
7	B20AH0301	Communication Skills	FC	2	0	0	2	2
8	B20LS0301	Indian Constitution and Professional Ethics	FC	2	0	0	2	2
9	B20AHM401	Universal Human Values	MC	0	0	0	0	1
			TOTAL	**4**	**0**	**1**	**5**	**7**
TOTAL SEMESTER CREDITS					**23**			
TOTAL CUMULATIVE CREDITS					**85**			
TOTAL CONTACT HOURS					**30**			

V SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20EP0501	Embedded Systems	HC	3	0	0	3	3
2	B20EP0502	Machine Learning	HC	3	0	0	3	3
3	B20EP0503	Unix Shell Programing	HC	1	1	1	3	5
4	B20EP0504	Java Programming	HC	1	1	0	2	3
5	B20EPS5XX	Professional Elective-1	SC	3	0	0	3	3
6	B20EPS5XX	Professional Elective-2	SC	3	0	0	3	3
7	B20XXO5XX	Open Elective-1	OE	3	0	0	3	3
TOTAL				**18**	**0**	**4**	**20**	**23**
Practical /Term Work / Sessional								
8	B20EP0505	Embedded Systems Lab	HC	0	0	1	1	2
9	B20EP0506	Machine Learning Lab	HC	0	0	1	1	2
10	B20EP0507	Java Programming Lab	HC	0	0	1	1	2
11	B20EP0508	Technical Documentation	FC	1	0	0	1	1
12	B20EP0509	Research based Project	HC	0	0	2	2	4
TOTAL				**1**	**0**	**3**	**6**	**11**
TOTAL SEMESTER CREDITS					**26**			
TOTAL CUMULATIVE CREDITS					**111**			
TOTAL CONTACT HOURS					**34**			

VI SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20EP0601	UI/UX Design	HC	1	1	1	3	5
2	B20EP0602	Web Technologies	HC	1	1	0	2	3
3	B20EN0603	Computer Networks	HC	3	0	0	3	3
4	B20EP0604	Basic VLSI Design	HC	3	0	0	3	3
5	B20EPS6XX	Professional Elective-3	SC	3	0	0	3	3
6	B20XXO6XX	Open Elective-2	OE	3	0	0	3	3
TOTAL				**14**	**2**	**1**	**17**	**20**
Practical /Term Work / Sessional								
7	B20EP0605	Web Technologies Lab	HC	0	0	1	1	2
8	B20EN0606	Computer Networks Lab	HC	0	0	1	1	2
9	B20EP0606	Basic VLSI Design Lab	HC	0	0	1	1	2
10	B20EP0607	Mini project/Internship	HC	0	0	2	2	4
11	B20PA0501	Indian Tradition and Culture	FC	1	0	0	1	2
TOTAL				**1**	**0**	**5**	**6**	**12**
TOTAL SEMESTER CREDITS					**23**			
TOTAL CUMULATIVE CREDITS					**134**			
TOTAL CONTACT HOURS					**32**			

VII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20EP0701	Data Analytics using R	HC	1	1	1	3	5
2	B20EP0702	Cyber Security and Blockchain	HC	1	1	1	3	5
3	B20EPS7XX	Professional Elective-4	SC	3	0	0	3	3
4	B20EPS7XX	Professional Elective-5	SC	3	0	0	3	3
5	B20XXO7XX	Open Elective-3	OE	3	0	0	3	3
TOTAL				**11**	**2**	**2**	**15**	**19**
Practical /Term Work / Sessional								
6	B20EN0703	Major Project Phase – 1	HC	0	0	1	1	2
TOTAL				**0**	**0**	**1**	**1**	**2**
TOTAL SEMESTER CREDITS					**16**			
TOTAL CUMULATIVE CREDITS					**150**			
TOTAL CONTACT HOURS					**21**			

VIII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20XXO8XX	Open Elective-4	OE	3	0	0	3	3
TOTAL				**3**	**0**	**0**	**3**	**3**
Practical /Term Work / Sessional								
2	B20EN0801	Major Project Phase – 2	HC	0	0	0	7	14
TOTAL				**0**	**0**	**0**	**7**	**14**
TOTAL SEMESTER CREDITS					**10**			
TOTAL CUMULATIVE CREDITS					**160**			
TOTAL CONTACT HOURS					**17**			

	Professional Electives					
PE	**Course Code**	**Domain1: Electronics and Communication**	**Course Code**	**Domain 2: Computers**	**Course Code**	**Domain3: Interdisciplinary**
PE-1 / 5th SEM	B20EPS511	Sensors and Instrumentation Engineering	B20EPS512	Computer Organization and Operating Systems	B20EPS513	Mechatronics
PE-2 / 5th SEM	B20EPS521	Networks and Signals	B20EPS522	Cloud Computing	B20EPS523	Research Methodology & IPR
PE-3 / 6th SEM	B20EPS631	Fundamentals of Analog and Digital Communication	B20EPS632	Agile Software Development and Devops	B20EPS633	Robotics and Automation
PE-4/ 7th SEM	B20EPS741	Computer Vision and Image Processing	B20EPS742	Natural Language Processing	B20EPS743	Computational Intelligence
PE-5 / 7th SEM	B20EPS751	ASIC Design	B20EPS752	Quantum Computing	B20EPS753	Social Media Analysis

Semester	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**
Credits	**19**	**21**	**22**	**23**	**26**	**23**	**16**	**10**	**160**

OPEN ELECTIVES OFFERED FROM SCHOOL OF ECE							
5TH SEM /OE1		**6TH SEM /OE2**		**7TH SEM /OE3**		**8TH SEM /OE4**	
Course code	**Course Name**	**Course code**	**Course Name**	**Course code**	**Course Name**	**Course code**	**Course Name**
B20ECO501	PCB Fabrication	B20ECO601	Principles of Analog and Digital Communication	B20ECO701	Introduction to CMOS VLSI	B20ECO801	Automotive Electronics
B20ECO502	Embedded Systems	B20ECO602	Sensors and Instrumentation	B20ECO702	Microprocessors and Microcontrollers	B20ECO802	Robotics and Automation

I SEMESTER
Detailed Syllabus

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20AS0102	Calculus and Differential Equations	HC	3	0	0	3	3
2	B20AS0104	Engineering Chemistry	HC	3	0	0	3	3
3	B20CI0101	Introduction to Python Programming	HC	2	0	1	3	4
4	B20EN0101	Principles of Electrical and Electronics	HC	3	0	1	4	5
5	B20ME0103	Elements of Mechanical and Civil Engineering	HC	3	0	0	3	3
TOTAL				**14**	**0**	**2**	**16**	**18**
Practical /Term Work / Sessional								
6	B20AS0109	Biology for Engineers	HC	1	0	0	1	1
7	B20ME0102	Design Thinking	HC	1	0	1	2	3
TOTAL				**2**	**0**	**1**	**3**	**4**
TOTAL SEMESTER CREDITS					**19**			
TOTAL CUMULATIVE CREDITS					**19**			
TOTAL CONTACT HOURS					**22**			

<table>
<tr><td>Course Title</td><td colspan="4">Calculus and Differential Equations</td><td colspan="2">Course Type</td><td colspan="2">Theory</td></tr>
<tr><td>Course Code</td><td>B20AS0102</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">I sem</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SE
E</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

This is a fundamental course of applied Mathematics which is useful in understanding the concepts of Electronics and electrical communication engineering students. This course begins with understanding concepts of calculus like Taylors and McLaurin's series. Further it covers reduction formulae which are useful in evaluating standard integrals. Further it enables students to understand and solve linear differential equations.

COURSE OBJECTIVE:

The objectives of this course are to:

1. Apply the knowledge of differential calculus in the field of wave theory and communication systems
2. Analyse and apply the knowledge of Partial differentiation in the field of Engineering.
3. Understand the knowledge and multiple integrals to determine area, volume, etc.
4. Apply the knowledge of linear differential equations in modeling.

COURSE OUTCOMES: (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of differential calculus in the field of wave theory and communication systems.	1, 2,3,4,5,6	1, 3
CO2	Analyse and apply the knowledge of Partial differentiation in the field of Engineering.	1, 2,3,4,5,6	1, 3
CO3	Understand the knowledge and multiple integrals to determine area, volume, etc.	1, 2,3,4,5,6	1, 3
CO4	Apply the knowledge of linear differential equations in modeling.	1, 2,3,4,5,6	1, 3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyse	Evaluate	Create
CO1			✓			
CO2				✓		
CO3		✓				
CO4			✓			

COURSE ARTICULATION MATRIX

CO#/ Pos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PS O3**
CO1	3	3	2	1	2	1							3		3
CO2	3	3	2	2	2	2							3		3
CO3	3	3	3	2	1	3							3		3
CO4	3	3	2	2	1	2							3		3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY

Contents
UNIT - 1
Calculus-I Successive differentiation- nth derivatives (no proof and simple problems only), Leibnitz Theorem (without proof) and problems. Mean value theorem theorems-Rolle's theorem (no proof), Lagrange's mean-value theorems, Cauchy's mean-value theorem problems, and mean value theorem of integral calculus (no proof). Taylor's series and McLaurin's series expansion for function of one variable (only problems).

UNIT - 2
Calculus-II Partial Differentiation: Partial derivatives-Euler's theorem-problems, Total derivative and chain rule. Jacobians-definition and problems (only to find J and illustrative example to verify $JJ^{'}=1$). Taylor's Expansion of function of two variables (only problems- up to 2nd order).Maxima and Minima for a function of two variables (simple problems). Lagrange's multiplier method.
UNIT - 3
Calculus-III Reduction formulae for the integrals of $\sin^n x$, $\cos^n x$, $\sin^m x \cos^n x$ and evaluation of these integrals with standard limits(direct result) - Problems. Multiple Integrals – Double integrals, change of order of integration (simple problems), and triple integrals. Beta and Gamma functions, properties, Relation between beta and gamma functions and simple problems.
UNIT - 4
Differential equations Differential equations of first order: solution of linear equations, Bernoulli's equations, Exact equations. (reducible to exact not included) Linear Differential Equations: Definitions, Complete solution, Operator D, Rules for finding the complementary function, Inverse operator, Rules for finding the particular integral. Method of variation of parameters (simple problems), Cauchy's and Legendre's linear differential equations

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.
2. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition, 2014.

JOURNALS:

1. https://www.ajol.info/index.php/jorind/cart/view/50976/39662
2. https://www.academia.edu/Documents/in/Multivariable_Calculus

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/111/104/111104085/
2. https://nptel.ac.in/courses/111/107/111107108/
3. https://nptel.ac.in/courses/111/107/111107108/

PROBLEM BASED LEARNING

1.	If $z = \ log(x^2 + y^2)\ find\ \frac{\partial z}{\partial x}\ and\ \frac{\partial z}{\partial y}$
2.	If $x + y + z = logz\ find\ \frac{\partial z}{\partial x}\ and\ \frac{\partial z}{\partial y}$

3.	If $u = x^3 - 3xy^2 + x + e^x cosy + 1$, show that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$
4.	If $u = \log\left(\frac{x^2+y^2}{x+y}\right)$ show that $xu_x + yu_y = 1$
5.	Verify $u_{xy} = u_{yx}$ for the following functions, i. $u = \sin^{-1}(y/x)$ ii. $u = x^y$ iii. $u = log\left(\frac{x^2+y^2}{x+y}\right)$
6.	If $u = log\sqrt{x^2+y^2+z^2}$, show that $(x^2+y^2+z^2)\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right) = 1$
7.	State and prove Euler's theorem for Homogeneous functions.
8.	If $u = \frac{x^3+y^3}{\sqrt{x+y}}$ show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{5}{2}u$
9.	If $u = sin^{-1}\left(\frac{x^3+y^3}{x-y}\right)$, show that $xu_x + yu_y = 2tanu$
10.	Find the Jacobian of u, v, w w.r.t x, y, z given $u = x + y + z,\ v = y + z,\ w = z$
11.	If $x = rsin\theta\ cos\varphi,\ \ y = rsin\theta\ sin\varphi,\ \ z = rcos\theta$ show that $\frac{\partial(x,y,z)}{\partial(r,\theta,\varphi)} = r^2 sin\theta$
12.	If $x = rsin\theta\ cos\varphi,\ \ y = rsin\theta\ sin\varphi,\ \ z = rcos\theta$ show that $\frac{\partial(x,y,z)}{\partial(r,\theta,\varphi)} = r^2 sin\theta$
13.	Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy\ dy\ dx$
14.	Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y\ dx\ dy$
15.	Evaluate $\iint y$ dxdy over the region bounded by the 1st quadrant of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
16.	Evaluate $\iint xy\ (x+y)$dxdy taken over the area between $y\ = x^2 and\ y = x$
17.	Evaluate by change of order of integration $\int_0^1 \int_x^1 \frac{x}{\sqrt{x^2+y^2}}\ dy\ dx$
18.	Evaluate by change of order of integration $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y}\ dx\ dy$
19.	Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\ dx\ dy$ by changing to polar coordinates.
20.	Evaluate $\int_{-1}^1 \int_0^z \int_{x-z}^{x+z} (x+y+z)$ dx dy dz
21	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz$ dx dy dz
22	Express $\int_0^1 x^m\ (1-x^n)^p dx$ in terms of β function and evaluate $\int_0^1 x^5\ (1-x^3)^{10} dx$
23	Given that $\int_0^\infty \frac{x^{m-1}}{(1+x)}\ dx = \frac{\pi}{\sin m\pi}$ by data. $\Gamma(m)\Gamma(1-m) = \frac{\pi}{\sin m\pi}$ for $0 < m < 1$
24	Solve $\frac{dy}{dx} = e^{3x-2y} + x^2 e^{-2y}$
25	Solve $e^x tany\ dx + (1 - e^{x)}\ dy = 0$
26	Solve $\frac{dy}{dx} = \frac{y}{x-\sqrt{xy}}$
27	Solve i. $y^2 + x^2\frac{dy}{dx} = xy\frac{dy}{dx}$ ii. $\frac{dy}{dx} = \frac{y}{x} + sin\left(\frac{y}{x}\right)$
28	Solve $(y^3 - 3x^2y)dx - (x^3 - 3xy^2 dy = 0)$
29	Solve y $e^{xy}dx + (xe^{xy} + 2y)dy = 0$
30	Solve $\left(x^2+y^2+x\right)dx + xydy = 0$
31	Solve i. $\left(x^3+y^2\right)dx - 2xydy = 0$ ii. $\left(x^2+y^2+2x\right)dx + 2ydy = 0$

32	Solve: $\frac{dy}{dx} + y\cot x = \cos x$
33	Solve $\frac{dy}{dx} + 3x^2y = x^5e^{x^3}$
34	Solve $\frac{dy}{dx} - \frac{2y}{x} = x + x^2$
35	Solve $x\frac{dy}{dx} + y = x^3y^6$
36	Solve: $\frac{dy}{dx} + y\cot x = \cos x$
37	Solve $\frac{d^2y}{dx^2} + 10\frac{dy}{dx} + 25y = 0$
38	Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 3y = 0$
39	Solve $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 3\frac{dy}{dx} - y = 0$
40	Solve $\frac{d^2y}{dx^2} - 4y = cosh2x + 3^x$
41	Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 6e^{3x} + 7e^{-2x} - log2$
42	Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 12y = sin2x + e^{-4x}$
43	Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 12y = 2x + x^2$
44	Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 4y = e^x\cos x$
45	Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xcosx$
46	Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^{2x} - 4$
47	Solve by the method of variation of parameters $(D^2 + 4)y = tan2x$
48	Solve by the method of variation of parameters $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^xtanx$
49	Solve by the method of variation of parameters $\frac{d^2y}{dx^2} + y = secx\ tanx$
50	Solve by the method of variation of parameters $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$
51	Solve by the method of variation of parameters $\frac{d^2y}{dx^2} + a^2y = secax$
52	Solve $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = logx$
53	Solve $(1+2x)^2\frac{d^2y}{dx^2} - 2(1+2x)\frac{dy}{dx} - 12y = 6x + 5$
54	Solve $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 2y = x\sin(logx)$
55	Solve $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 2\sin[log[1+x]]$
56	Solve $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = logx\sin(logx)$

Course Title	**Engineering Chemistry**				**Course Type**		**Theory**	
Course Code	**B20AS0104**	**Credits**	**3**		**Class**		**I sem**	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Theory	3	3	3				
	Practice							
	Tutorial				Theory	Practical	CI	SE
	Total	**3**	**3**	**3**	**39**	**0**	50%	50%

COURSE OVERVIEW

Engineering chemistry covers very relevant topics compatible with ECE, EEE and C&IT/CSE students and make them aware of importance of various aspects of basic science in engineering. The subject of Engineering chemistry covers area of light and matter interaction, clean energy storage and conversion devices, corrosion phenomenon and control which is widely an interdisciplinary subject of discussion. Further the course focus on the chemistry of engineering materials, and various applications. This area of science is very much interdisciplinary in its nature and gives a platform for students to strengthen their engineering knowledge to enlighten on the energy conversion and storage devices, which have become very attractive field of research in engineering stream. The subject deals with various engineering materials, their properties and applications in the field of engineering.

COURSE OBJECTIVE

The objectives of this course are to:

1. Explain the interaction of light and matter, quantum yield and photosensitization
2. Design construction and applications of energy storage and conversion devices
3. Classify the types of Corrosion, corrosion control and metal finishing techniques
4. Discuss the applications of engineering materials like Polymers composite, sensors and Nano material in various fields.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	PO	PSOs

CO1	Analyze the phenomenon of light and matter interaction , photopolymerization and photosensitization	1.2, 4,6	1
CO2	Discuss the electrode processes in energy storage and energy conversion	1,2,3,	3
CO3	Apply the knowledge of corrosion science and metal finishing essential for corrosion control and commercially available materials like PCB and circuits	1,2,3, 7	1
CO4	Illustrate the properties of nano materials, composite materials, sensors and their applications in various fields.	1,2, 3,7	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyse (L4)	Evaluate (L5)	Create (L6)
CO1	√					
CO2		√		√		
CO3		√	√			
CO4	√	√		√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3		1		2							1		
CO2	2	1	3	2			2					2			1
CO3	2	2	1				1						1		
CO4	1	2	3				2							2	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Contents

UNIT - 1

Light and Matter Interaction

Electro-magnetic spectrum-Applications in Engineering, Interaction of EM radiation with matter, work function of matter, Electrons in matter. Bonding theories: MOT, Band structure of matters HOMO-LUMO. Photochemical and thermal reactions: Laws of photochemistry, quantum yield, high and low quantum yield reactions. Jablonski diagram – photo physical and photochemical processes, photo-sensitization, photo-

polymerization and commercial application of photochemistry.

UNIT - 2

Clean Energy Storage and Conversion Devices

Introduction to electrochemistry, basic concepts of Batteries and characteristics. Classification: Primary (Dry cell, Li-MnO2) and Secondary (Pb-acid, Li-ion) batteries. Super capacitors: classification, construction and applications in hybrid vehicles. Fuel cells: Alkaline fuel cells, Solid oxide fuel cells and phosphoric acid fuel cell. Photo-conversion devices: Photovoltaic cell, antireflective coating, panels and arrays. Production of single crystal semiconductor by Crystal pulling technique (Czochralski technique), zone refining process of Si.

Problems: Calculation of energy and power density, capacity of a Battery and capacitance of super capacitors for electric vehicle applications.

UNIT - 3

Corrosion and Metal Finishing

Electrochemical theory of corrosion, types of Corrosion- differential metal corrosion, differential aeration corrosion, boiler corrosion, and grain boundary corrosion, Corrosion studies on Al, Fe with pourbiax diagram, Factors affecting rate of corrosion-Primary, secondary. Corrosion control: Galvanizing & tinning, cathodic protection & Anodic Protection.

Metal Finishing: Theory of electroplating, Factors required to study electroplating Effect of plating variables in electroplating process, Electroplating of gold (acid, neutral and alkaline cyanide bath). Electro less plating of copper and PCB manufacture by Electro less plating of copper.

UNIT - 4

Chemistry of Engineering Materials

Polymer composites: Carbon fiber, Kevlar synthesis and applications, Conducting polymers: synthesis, electron transport mechanism and applications in poly acetylene and poly aniline. Liquid crystals: Introduction classification and applications in electronic display devices. Nano materials: Introduction, classification based on dimensionality, quantum confinement. Size dependent properties- surface area, magnetic properties (GMR phenomenon), and thermal properties. Synthesis, Properties and applications of Fullerenes, CNT and Graphene.

Sensors: Physical and chemical sensors, Biosensors for bio electronic applications.

TEXT BOOKS:

B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 43nd edition, 2015.

1. R.V.Gadag & Nithyanandashetty, “Engineering Chemistry” , International Publishing house, Third

Edition.2009.
2. S.S. Dara and S. Chand, " A Text Book of Engineering Chemistry", S. Chand Publishing house, New Delhi ,1986.
3. R. Venugopal, Pushpa Iyengar, B.S. Jayaprakash and Shivakumariah, "Engineering chemistry", Subhash Publications, Third Edition,2010.

REFERENCE BOOK

1. Mars G. Fontana," Corrosion Engineering", Tata McGrail , Publishing pvt. Ltd, Third Edition,2005.
2. Charles P. Poole Jr., Frank J. Owens ,"Introduction to Nanotechnology", Wiley India Publishers, First Edition,2003.
3. Krishan K Chawla ,"Composite materials – Science and Engineering" , Springer International Edition, Fourth edition, 2019.

JOURNALS/MAGAZINES

1. https://www.sciencedirect.com/journal/water-science-and-technology
2. https://iwaponline.com/wst
3. https://www.scitechnol.com/nanomaterials-molecular-nanotechnology.php
4. https://www.journals.elsevier.com/journal-of-energy-storage

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/105/105/105105201/
2. https://nptel.ac.in/courses/112/108/112108150/

PROBLEM BASED LEARNING

Sl. No.	**Problems**
1	Calculation of wavelength and frequencies of the radiations
2	Calculation of band structure by HOMO and LUMO
3	Determination of cell potentials
4	Calculation of energy density and power density of a battery.
5	Determination of capacitance of a super capacitor
6	Crystal field stabilization energy

PROJECT BASED LEARNING

To enhance the skillset in the integrated course, the students are advised to execute course-based

Design projects. Some sample projects are given below:

No.	**Suggested Projects**
Collection of literature for the materials for the semi-conducting applications	
1.	Synthesis of a semiconductor materials for the electronic applications
2.	Construction of a PCB for the electronic device

3.	Synthesis of conducting polymers
4.	Synthesis of Energy storage materials
5.	Fabrication of efficient aqueous battery or super capacitor

<table>
<tr><td>Course Title</td><td colspan="4">Introduction to Python Programming</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>B20CI0101</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">I/II Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes
Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Theory</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>4</td><td>4</td><td>26</td><td>26</td><td>50 %</td><td>50 %</td></tr>
</table>

COURSE OVERVIEW

Python is a Programming Language that can be treated in a procedural way, an object-orientated way or a functional way. It can be used on a server to create web applications, create workflows, connect to database systems, read and modify files, handle big data and perform complex mathematics. It can implement object oriented features and exception handling, It can parse the strings using regular expressions. It can be used for implementing the machine learning algorithms to develop solutions for interdisciplinary problems apart from any general problems leading to automation.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamentals of python programming language constructs and their applications.
2. Inculcate knowledge of parsing of regular expressions and their usage in various application domains.
3. Gain expertise in Object oriented programming and NumPy package.
4. Discuss the files, Pandas and Data Virtualization concepts.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of fundamentals of python programming to solve real world problems.	1 to 4, 8, 9 , 12	1
CO2	Develop solutions for text processing and other application domains by making use of regular expressions.	1 to 3, 5,9,12	1

CO3	Apply features of object oriented and NumPy package to develop computationally intensive applications to analyze and interpret the data.	1 to 5, 9, 12	2
CO4	Create data science solutions with the help of files, Pandas and Data Visualization.	1,4,5,9,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO #	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√	√		
CO4			√	√	√	√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2				1	1			1	3		
CO2	3	2	3		2				1			1		3	
CO3	3	1	2	1	[illegible]				1			1			3
CO4	3			2	2				1			1	3	3	3

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Introduction to Computer Fundamentals: Computer Components, accessories, specifications of computers and external devices. Flowchart symbols and guidelines, types and advantages, Algorithm design. **Python Fundamentals:** Introduction to Python: History, Applications, Your First Python Program, Constants, Variables, Naming conventions, simple data types, Type casting, Assignment statements, expressions, Boolean data type, Trigonometry functions, operators, precedence of operators, libraries, keywords, Python Collections, I/O statements, conditional statements, loops, functions, user defined functions. Introduction to GitHub and applications.
UNIT - 2
Strings: Unicode, Formatting Strings, Format Specifiers, other Common String Methods, Slicing a String. **Regular Expressions:** Case Study: Street Addresses, Case Study: Roman Numerals, Checking for Thousands, Checking for Hundreds, Using the {n, m} Syntax, Checking for Tens and Ones.

UNIT - 3
Object Oriented Programming: Defining Classes, The init() Method, Instantiating Classes, OOP features: Abstraction. Encapsulation, Single Inheritance, Polymorphism. **Files:** Reading from Text Files, Writing to text files, Reading and Writing the Binary Files.
UNIT - 4
Numpy: Introduction to numpy, Creating arrays, Indexing Arrays, Array Transposition, Universal Array Function, Array Processing, Array Input and Output. **Pandas and Data Visualization:** Introduction, Series and Data Frames in pandas and Data Visualization.

PRACTICE:

Sl. No.	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
	Part-A		
1.	a). **"LIST1"** is a list that contains **"N"** different SRN of students read using a user defined function with the help of **input() function**. It is required to add SRN of "M" more students that are to be appended or inserted into "**LIST1**" at the appropriate place. The program must return the index of the SRN entered by user.	Windows/Linux OS, IDE, Jupyter	Create and perform operations on list.
	b).**"TUPLE1"** and **"TUPLE2"** are two tuples that contain "N" values of different data types read using the user defined function "**READ**" with the help of **input() function**. Elements of **"TUPLE1"** and **"TUPLE2"** are to be read one at a time and the "larger" value among them should be placed into **"TUPLE3".** Display all tuples.	Windows/Linux OS, IDE, Jupyter	Create and perform operations on Tuples.
2.	a).**SET1** and **SET2** are two sets that contain unique integers. **SET3** is to be created by taking the union or intersection of **SET1** and **SET2** using the user defined function **Operation**(). Perform either union or intersection by reading choice from user. Do not use built in functions union() and intersection() and also the operators "|" and "&".	Windows/Linux OS, IDE, Jupyter	Create and perform Union and Intersection, Operations on Sets.
	b).The Dictionary "**DICT1**" contains **N** Elements and each element in dictionary has the operator as the **KEY** and operand's as **VALUES**. Perform the operations on operands using operators stored as keys. Display the results of all operations.		Create dictionary and perform operation using user defined function.
3.	a).A substring "**Substr**" between index1 and index2 is to be extracted from the given input string "**Str1**", which is read using input(). Display the substring "**Substr**" using a user defined function if available in string "**Str1"**, otherwise display NULL.	Windows/Linux OS, IDE, Jupyter	String operations.

	b) A string containing multiple words is to be read from the user one at a time, after reading perform following operations. i) Convert all the strings to uppercase and display ii) Split the words of a string using space as the separation character and display.		
4.	a).Consider the text file, "**Std.txt**", with the details of students like SRN, NAME, SEMESTER, SECTION AND AVG_MARKS. Read the file, "**Std.txt**" and display the details of all the students of 4th Semester " A" Section who have scored more than 75%.	Windows/Linux OS, IDE, Jupyter	File Handling.
	b).Consider the text file "**Emp.txt**", with the details of Employees like EMP_CODE, EMP_NAME, BASIC_SALARY, DA, GROSS_SALARY, NET_SALARY, LIC, PF and TOTAL-DEDUCTIONS. Read EMP_CODE, EMP_NAME, BASIC_SALARY, DA, LIC and PF from the user using input() and compute the following: i) TOTAL_DEDUCTIONS= (LIC+PF) ii) GROSS_SALARY= BASIC_SALARY+ DA iii)NET_SALARY= GROSS_SALARY –		File Handling.
5.	a). A "**CAR**" has the attributes COMPANY_NAME, MODEL, COLOR, MANUFACUTING_YEAR and PRICE. A Class is required to be created for "**CAR**" to store the above attributes and perform the following operations: i) Get the details of "**CAR**" object from user and store into Array of objects ii) Display the details of "**CAR**" object based on "COMPANY",	Windows/Linux OS, IDE, Jupyter	Classes and objects usage.
	b). Airline Reservation System contains the attributes of passengers such as NAME, PAN_NO. MOBILE_NO, EMAIL_ID, SOURCE, DESTINATION, SEAT-NO, AIR-FARE and TRAVEL_DATE. A Class is required to be created for "**Airlilne**" with the above attributes and perform the following operations: i) Get the details of "Airline" object from user and store into Array of objects ii) List details of all the passengers who travelled From "Bengaluru to London"		

6.	a). "**Arr_1**" is an integer array of size M x N. Size and content of the array is to be read using input() by using the user defined function READ_DATA(). It is required to display the i) Diagonal elements of "**Arr_1**" ii) Elements of m^{th} row (row no should be entered by user) iii) Elements of n^{th} column (column no should be entered by user)	Windows/Linux OS, IDE, Jupyter	NumPy arrays usability.
	b).The dictionary "**DICT1**" contains the pass percentage of each semester of B. Tech in CSE, where, " Semester" acts as the key and "Pass Percentage" acts as the value. A Python Pandas dataframe is required to be created using the dictionary "**DICT1**" and display it using a user defined function.		Pandas Series usability.
	Part-B (Mini Project: Library Management System)		
1.	Develop a program to create the **class "USER"** with the attributes USER_NAME, USER_ID, SCHOOL_NAME, ADDRESS, PHONE_NO, EMAIL_ID, DOB and AGE. The functions add_user(), delete_user(), edit_user(), search_user() should be part of the class. Instantiate "User" class with 10 objects. Read the attributes of each "User" object using input() and store them in the file "**User_File.txt**".	Windows/Linux OS, IDE, Jupyter	Create a class user to read the attributes of user and store them in a file.
2	Develop a program to get the name of the "User" object whose details are to be deleted. Read the "**User_File.txt**" and delete the "User" object if found. Display the contents of "**User_File.txt**" after deletion.	Windows/Linux OS, IDE, Jupyter	Create a class user to read the attributes and delete the object.
3	Develop a program to get the name of the **"User"** object whose details are to be edited (modified). Edit the details of the user object in the file "**User_File.txt**" and display the contents after	Windows/Linux OS, IDE, Jupyter	To create a class and edit the file.
4	Develop a program to create the **class "BOOK"** with the attributes TITLE, AUTHOR, PUBLISHER, YEAR, PRICE, SCHOOL_NAME and the functions add_book(), delete_book(), edit_book() and search_book(). Instantiate "Book" class with 10 objects. Read the attributes of each "**BOOK**" object using input () and store them in the file "**Book_File.txt**".	Windows/Linux OS, IDE, Jupyter	Create a class book to read the attributes of user and store them in a file.
5	Develop a program to get the name of the "**BOOK**" object whose details are to be deleted. Read the "**Book_File.txt**" and delete the "**BOOK**" object whose details match with the data entered. Display the contents of "**Book_File.txt**" after deletion.	Windows/Linux OS, IDE, Jupyter	Create a class book to read the attributes and delete the object.

6	Develop a program to get the name of the **“BOOK”** object whose details are to be edited (modified). Edit the details of the “**Book**” object in the file “**Book_File.txt**” and display the contents after modification.	Windows/Linux OS, IDE, Jupyter	To create a class and edit the file.
7	Develop a program to create the class **“TRANSACTION”** with the attributes USER_ID, USER_NAME, AUTHOR, TITLE, EDITION, ISSUE_DATE,DUE_DATE and RETURN_DATE and the functions issue_book(), return_book() and search_book(). Instantiate “Transaction” class with 10 objects. Read the attributes of each “Transaction” object using input() and store them in the file “**TransactionFile.txt**”. Develop a program to **issue the book** as requested by the user. Update the attributes in “Transaction _File” and display the contents of file.	Windows/Linux OS, IDE, Jupyter	Create class and perform string operations.
8	Develop a program to **return the book**. Edit the details of the user like USER_ID, USER_NAME, AUTHOR, TITLE, EDITION, ISSUE_DATE, DUE_DATE and RETURN_DATE in “**TransactionFile.txt**” and display the contents after modification. Compute the fine amount to be paid if return_date is not same as due_date. If both return_date and due_date are same and put zero in fine_amount.	Windows/Linux OS, IDE, Jupyter	Create class and perform string operation.
9	Develop a program to search for a book using its **“author”**. Display the message **“available**” if search is successful otherwise display the message “not available”.	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and
10	Develop a program to get a **list of users** by referring to **“User_File.txt” and “Transaction_File.txt”.**	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and
11	Develop a program to get **List of Books in stock** by referring to **“Book_File.txt” and “Transaction_File.txt”.**	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and
12	Develop a program to get **List of Books Issued** by referring to **“User_File”, “Book_File” and “Transaction_File”.**	Windows/Linux OS, IDE, Jupyter	Create class and object, perform file operations and regular expressions.
13	Develop a project by integrating User, Books, Transaction and Reports Modules.	Windows/Linux OS, IDE, Jupyter	Module integration and project development.

TEXT BOOKS:

1. Mark Pilgrim, “Dive into Python 3”, Apress special edition, second edition, 20l5.

2. Travis E. Oliphant, “Guide to NumPy”, Trelgol publishers,2006.

REFERENCE BOOKS:

1. A B Choudhary, “Flowchart and Algorithms Basics” Mercury Learning and Information,2020
2. Mark Lutz, “Learning Python”, Oreilly. 2003.
3. John M. Zelle, “PYTHON Programming: An Introduction to Computer Science”, Franklin, Beedle& Associates. 2004.
4. Michael Dawson, “Python Programming for the Absolute Beginners”, 3rd Edition, CENAGE Learning.
5. Wesley J. Chun, “Core Python Programming”, 2nd Edition, Prentice Hall.
6. Steve Holden and David Beazley, “Python Web Programming”, New Riders, 2002. Springer, Kent D. Lee, “Python Programming Fundamentals”, 2nd Edition.
7. John V. Guttag, “Introduction to Computation and Programming using Python”, MIT Press, 2016.
8. https://www.tutorialspoint.com/computer_fundamentals/computer_fundamentals_tutorial.pdf

JOURNALS/MAGAZINES

1. https://www.codemag.com/Magazine/ByCategory/Python
2. http://ijaerd.com/papers/special_papers/IT032.pdf
3. https://iopscience.iop.org/article/10.1088/1742-6596/423/1/012027
4. https://ieeexplore.ieee.org/document/4160250
5. Python for scientific computing

SWAYAM/NPTEL/MOOCs:

1. Coursera – Python for everybody, University of Michigan
2. Coursera – Python Basics, University of Michigan
3. https://nptel.ac.in/courses/106/106/106106182/
4. https://www.edx.org/learn/python

SELF-LEARNING EXERCISES:

a) Explore PYTHON library for IOT programming
b) More exploration on GIThub
c) Data Visualization packages
d) C modules interface

<table>
<tr><th>Course Title</th><th colspan="4">Principles of Electrical and Electronics</th><th colspan="2">Course Type</th><th colspan="2">Integrated</th></tr>
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Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td></tr>
</table>

Principles of Electrical and Electronics	-	-	-	-	Theory	Practical	**CIE**	**SE**
	Total	**4**	**5**	**5**	**39**	**26**	**50 %**	**5 0 %**

COURSE OVERVIEW:

The Basic Electrical and Electronics typically deals with the study of Electrical parameters like AC and DC voltage and current and behaviour of voltage and current in passive elements also in active elements like: BJT, Diodes and FET. The concepts of Electromotive force and Magneto motive force generated in motors, generators and transformers are explained. The concepts of electrical circuits and electromagnetism are applied to analyse the complex problems arise in the power system networks. Through this course Students will get extensive exposure to digital and analog electronics basics.

COURSE OBJECTIVES:

The objectives of this course are:

1. Make the students to understand basics of electrical circuits.
2. Study the working principle and construction details of electrical machines.
3. Understand the diode characteristics and its applications.
4. Understand the working principle and characteristics of BJT, FETs
5. Familiarize the students with the number systems
6. Carry out validation of logical expressions using Boolean algebra.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe basic composition of electrical circuits and their behavior.	1,2,3	1,2,3
CO2	Analyze the working principle and construction details of electrical machines	1,2,3	1,2,3
CO3	Assess the outcomes of various diode circuits.	1,2,3,	1,2,3
CO4	Analyze working principle and characteristics in three configurations of BJT	1,2	1,2
CO5	Analyze working principle and characteristics of FET.	1,2	1,2
CO6	Design the digital circuits using various logic gates	1,2,3,	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**

CO1	✓	✓				
CO2	✓			✓		
CO3	✓				✓	
CO4	✓			✓		
CO5	✓			✓		
CO6	✓					✓

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1										1	2	1
CO2	3	3	3										3	2	1
CO3	3	3	2										3	3	2
CO4	3	3											3	3	
CO5	3	3											3	3	
CO6	3	3	2										3	3	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1 **Basics of Electrical Engineering :** Introduction to electrical engineering, AC, Sinusoidal voltage and currents, Magnitude and phase, polar and rectangular representation R-L, R-C and R-L-C series and parallel circuits(both admittance and impedance method), power factor, phasor diagrams(lead and lag circuits), Kirchhoff's Current Law, Kirchhoff's Voltage law, Mesh and Nodal analysis, Source transformation, Star-delta transformation (for DC Circuits only).
UNIT - 2 **Magnetic Circuits, Motors and Transformers:** Definition of magnetic circuit and basic analogy between electric and magnetic circuits, Faradays laws, permittivity, permeability, EMF, MMF equations, Reluctance, Energy and power, 3 phase AC (introduction), Comparison between 1 phase and 3 phase AC. Principle of operation, Construction and EMF equations: DC Generator, DC Motors, Transformers, types of transformer. Numerical examples as applicable.

UNIT - 3

Semiconductor Diodes and Transistors: P-N junction diode, V-I Characteristics, Half-wave rectifier, Full-wave rectifier, Bridge rectifier, Capacitor filter circuit, Zener diode voltage regulators, Clipping and clamping circuit, Numerical examples as applicable.

Bipolar junction Transistors BJT configuration: BJT Operation, Common Base, Common Emitter and Common Collector Characteristics, Numerical examples as applicable, SCR, Introduction to FETs.

UNIT - 4

Digital Electronics and Number Systems: Introduction, Switching and Logic Levels, Digital Waveform. Number Systems and its conversions: Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System. Binary addition, Binary subtraction. Boolean Algebra Theorems, De Morgan's theorem. Digital Circuits: Logic gates, Algebraic Simplification, Realization of all logic and Boolean expressions

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	To verify KCL and KVL	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
2	Testing of Lead & Lag networks by using R-C components.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
3	To Study and test the working of DC motor	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
4	Study and analysis of V-I Characteristics of Silicon, Germanium and Zener PN Junction diodes (Both Forward and Reverse Characteristics).	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
5	To find the Voltage regulation of Zener diode	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
6	Design half wave, Full wave-center tap and Bridge rectifier with and without capacitive filter and measure efficiency and ripple factor.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
7	Design of Clippers and clampers with reference voltages	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
8	Study and analysis of V-I	Measuring instruments (Ammeter,	Design and circuit

	Characteristics of SCR.	Multimeter, CRO) and design equations	debugging. Working in a team
9	Study and analysis of input output characteristic of CE configuration of BJT.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
10	Verification of basic logic gates using discrete components	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team

TEXT BOOKS:

1. Kulshreshtha C,"Basic Electrical Engineering" Tata McGraw Hill, 2nd Edition, 2011.
2. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.
3. D.P. Kothari, I. J. Nagrath, "Basic Electronics", McGraw Hill Education (India) Private Limited, 2014.

REFERENCE BOOK:

1. Robert L. Boylestad and Louis Nashelsky, "Introduction to Electricity, Electronics and Electromagnetics" Prentice Hall, 5th edition, 2001

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://www.electricaleasy.com/p/electrical-machines.html
2. https://www.aast.edu/pheed/staffadminview/pdf_retreive.php?url=45_24985_EE328_2016_1__2_1_Lecture2all.pdf&stafftype=staffcourses
3. https://www.sciencedirect.com/topics/engineering/magnetic-circuits
4. https://cnx.org/contents/FOAgj46E@1.1:CF55C3SF@1/chapter-1-Magnetic-Circuits-and-Magnetic-Materials
5. https://circuitglobe.com/what-is-a-magnetic-circuit.html
6. https://blog.oureducation.in/analysis-of-magnetic-circuits-of-transformer/
7. https://www.learncbse.in/semiconductor-diodes-and-transistors/#:~:text=The%20devices%20whose%20action%20is,is%20called%20an%20electronic%20devices.&text=The%20electronic%20devices%20are%20two,pentode%20(five%20electrodes)%20etc.
8. https://www.sciencedirect.com/science/article/pii/B9780128114070000027
9. https://www.renesas.com/us/en/support/technical-resources/engineer-school/electronic-circuits-02-diodes-transistors-fets.html
10. https://circuitglobe.com/difference-between-diode-and-transistor.html

SWAYAM/NPTEL/MOOCs:

- https://nptel.ac.in/courses/108/108/108108076/
- https://nptel.ac.in/courses/108/105/108105053/
- https://nptel.ac.in/courses/108/104/108104139/
- https://nptel.ac.in/courses/108/102/108102097/

<table>
<tr><td>Course Title</td><td colspan="3">ELEMENTS OF MECHANICAL ENGINEERING AND CIVIL</td><td colspan="2">Course Type</td><td colspan="2">Theory</td></tr>
<tr><td>Course Code</td><td>B20ME0103</td><td>Credits</td><td>3</td><td colspan="2">Class</td><td colspan="2">I sem</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes
Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Tutorial</td><td>0</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

This course introduces the Mechanical and Civil Engineering concepts, underlying the fact that this knowledge is essential for all Engineers. The students are made to understand the concept of internal combustion engines and power transmission systems. The students are also exposed to the knowledge of mechanical machine tools with its operations on lathe, drilling, and CNC machines. The students are introduced to the domain of fabrication processes like Soldering, Welding and 3D printing technology Along with this student are made to expose to scope of Civil engineering, role of civil engineers in different infrastructure& economic development of the country. Students will also learn about basic concept of forces, force systems and beams.

COURSE OBJECTIVE:

The objectives of this course are to:

1. Develop the basic knowledge of IC engines, refrigeration-air conditioning and power transmission systems.
2. incorporate the concepts of manufacturing processes using different machine tools, welding techniques, CNC and 3D printing technology.
3. learn basics of civil engineering and concepts of idealization.
4. Develop knowledge and problem solving capability on different system of forces and concepts of Friction, Centroid and Moment of Inertia.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the fundamentals of IC engines, refrigeration-air conditioning and power transmission systems.	1,2	3
CO2	Explain the manufacturing processes using lathe, drilling, welding, CNC machines and 3D printing technology	1,2	3
CO3	Explain the basics of Civil Engineering and concepts of idealization.	1,2	1,2
C04	Comprehend the action of forces and compute the numerical problems	1,2	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√				
CO2		√				
CO3		√				
C04			√			

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2													1
CO2	3	2													1
CO3	3	3											3	2	
C04	3	3											2	2	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENTS

THEORY

Contents

UNIT – 1
Introduction to Mechanical Engineering: Overview of Mechanical Engineering, Importance and applications of Mechanical Engineering in different fields. **Thermal Energy Systems:** Introduction to IC Engines, Classification, parts of IC Engine, working of 4-stroke Petrol engine with PV-diagram. Simple numerical on calculation of IP, BP and Mechanical efficiency, Introduction to refrigeration system, working of vapour compression refrigeration and window spit air conditioning system. Applications of refrigeration systems
UNIT – 2
Power Transmission System: Introduction to drives, classification, belt drives (open and crossed-No derivations) and gear drives and types of gear, Numerical on gear drives. **Mechanical Machine Tools:** Introduction- lathe, classification, major parts of engine lathe, operations, Drilling machine, classification working bench drilling machine and operations, CNC Machines-Block diagram and applications. Introduction to 3D Printing technology **Joining processes-**Welding: Working of electric arc welding and soldering, Differences between welding and soldering, Applications and safety tools
UNIT – 3
Introduction to Civil Engineering: Scope of Civil Engineering, Types of Infrastructure, Effect of Infrastructure facilities, Role of Civil Engineers in the Infrastructure and Economic Development of Country. **Introduction to Engineering Mechanics:** Basic concepts of idealization, Newton laws of Motion, Elements of force, system of forces, principles of physical Independence, superposition and Transmissibility of forces. Moment of force –Couple, Moment of couple and its characteristics, Equivalent Force – Couple system.
UNIT – 4
Equilibrium of Forces: Types of forces acting on the body, free body diagrams, Equations of Equilibrium, Resolution and composition of forces, Lami's theorem. **Coplanar Concurrent Force System:** Parallelogram Law of forces, principle of resolved parts, composition of concurrent forces, Resultant of Concurrent forces, Equilibrium of Concurrent Coplanar Force System- Simple Numerical. **Coplanar Non – concurrent Force System:** Varignon's principle of Moments, Resultant of Non – Concurrent force systems, Equilibrium of Non – concurrent Coplanar force system - Simple Numerical. **Support Reaction and Basics:** Types of loads, supports and beams, Basic concepts of Friction, Centroid and Moment of Inertia.

TEXT BOOKS:

1. K.R. Gopalkrishna (2012)" Elements of Mechanical Engineering", 12th Edition, Subhash Publishers, Bengaluru.
2. Roy & Choudhury, "Elements of Mechanical Engineering", Media Promoters & Publishers Pvt. Ltd, Mumbai, 2000.
3. Mikell P Groover : Automation, Production Systems, and Computer Integrated Manufacturing , Pearson India, 2007, 4th Edition
4. BK Kolhapure, "Elements of Civil Engineering", Eastern Book Promoters
5. S. S. Bhavikatti, "Elements of Civil Engineering", New Age International Publisher, New Delhi, 3rd edition 2009.

REFERENCE BOOKS:

1. SKH Chowdhary, AKH Chowdhary, Nirjhar Roy(2001),"The Elements of Workshop Technology - Vol I & II, 11th edition, Media Promotors and publisher, Mumbai
2. Avikshit Saras, "3D Printing-Made Simple", BPB Publications-New Delhi
3. M.N.Shesha Prakash and Ganesh.B.Mogaveer,"Elements of Civil Engineering and Engineering Mechanics", PHI Learning, 3rd Revised edition
4. B C Punmia, "Elements of Civil Engineering", Laxmi publications

JOURNALS/MAGAZINES

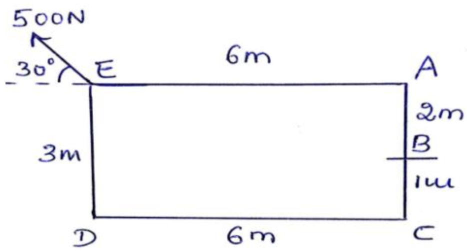
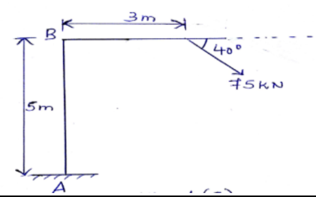
1. International Journal of Machine Tools and Manufacture
2. International Journal of Refrigeration.
3. Civil Engineering and Construction Review-Magazine

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/112/103/112103262/#
2. https://www.my-mooc.com/en/mooc/fundamentals-manufacturing-processes-mitx-2-008x/
3. https://www.coursera.org/learn/3d-printing-applications

PROBLEM BASED LEARNING

Sl. No.	Problem
1	4 Cylinder, four stroke petrol engine of Volkswagen Polo has a piston diameter 300 mm and stroke 500 mm . The mean effective pressure is 8 bar and speed is 350 rpm. The net load on the brake drum is 1080 N The effective diameter of the brake 1.5 m. Find I.P, B.P, and
2	A Toyota FORTUNER car having 4 stroke and 4 cylinder running at 450 rpm, has bore diameter 100 mm and stroke length 120mm. The details of the indicator diagram are as follows. Area of indicator diagram = 4 cm^2 Length of the indicator diagram = 6.5 cm, and the spring value of the spring used is 10 bar/cm. Calculate the indicated power.
3	A TATA Zest car having four stroke petrol engine has a piston diameter 300 mm and stroke 500 mm. The mean effective pressure is 5 bar and speed is 250 rpm. The net load on the brake drum is 1000 N The effective diameter of the brake 1.5 m. Find I.P, B.P, and mechanical
4	KIA Carnival engine has the following details i.Number Cylinder = 8 ii.Cylinder diameter = 25 cm ii.Stroke of the piston = 40 cm v.Crankshaft speed = 250 rpm v.Brake load = 70 kg i.Brake drum diameter = 2 m ii.Mean effective pressure = 6 bar Calculate

Sl. No.	Problem
5	Find the moment of 500N force about points A,B,C and D as shown in fig 
6	Determine the magnitude, X and Y intercepts to the resultant of the force system acting on the laminar.
7	Find the X and Y intercepts of the resultant of the system of coplanar forces acting on the laminar. Each square has a side of 10mm
8	Find the moment about A and B as shown in fig 

PROJECT BASED LEARNING:
To enhance the skill set in the integrated course, the students are advised to execute course-based **Design projects**. Some sample projects are given below:

Sl. No.	Suggested Projects
1.	Demo Model for 4-Stroke Petrol Engines
2.	Preparation of metallic Shoe stand using electric ARC welding
3.	Illustrate the road network connection on Indian map
4.	Demo Model of different types of beams

Course Title	**BIOLOGY FOR ENGINEERS**			**Course Type**	**Theory**
Course Code	**B20AS0109**	**Credits**	**1**	**Class**	**I sem**

Course Structure	TLP	Credits	Contact Hours	Work Load	13Hrs/ Semester		Assessment Weightage	
	Theory	1	1	1				
	Practice	-	-	-	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**1**	**1**	**1**	**13**	**0**	**50%**	**50%**

COURSE OVERVIEW

Course Description: Understanding biological systems, principles and concepts in order to create usable, tangible, economically viable product or process has become need of the hour. Hence irrespective of the parent engineering discipline, knowledge and expertise from pure and applied sciences is necessary to create product or process related to healthcare, agriculture, environmental issues and many more. Any engineer will have a high probability of using biology related skills and concepts to create products and processes beneficial to the mankind and as well for the sustainable environmental friendly approach. For example, the knowledge can be used to create medical devices, diagnostic equipment's, bioreactor designing, agriculture related equipment/instruments or anything related to surface science, fluid mechanism and polymer science. This course is designed to lay foundation in the field of Cell biology, Molecular biology and Genetics, so that anyone who is interested can design better product/process to enhance the overall quality of life.

COURSE OBJECTIVES

The objectives of this course are to:

1. Inculcate the basic concepts of biology from engineering perspective among students
2. Understand the interplay between biology and engineering disciplines
3. Conceptualize the engineering design/process/product for life science challenges

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand and explain the biology concepts from engineering perspective.	1	1
CO2	Apply the principles of Biology either for the process/product development from the engineering perspective.	1,2	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)

CO1	√	√				
CO2	√	√	√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												1	
CO2	2	2											1	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Contents
Introduction to Biology, Evolution and Origin of Life, Biomolecules-Lipids, Biomolecules: Carbohydrates, Water, Biomolecules: Amino acids, Proteins, Biomolecules: Enzymes, Biomolecules: Nucleotides, Cell structure and function – Prokaryotes, Cell structure and function – Eukaryotes, Cell cycle-Mitosis and Meiosis, Mendelian genetics: Mendelian inheritance, Genetic diseases and Mendelian inheritance, Central Dogma – Replication, Transcription and Translation.

TEXT BOOKS:

1. Biology for Engineers, G.K. Suraishkumar, Oxford University Press, 2019
2. Biology for Engineers, As per AICTE curriculum, Wiley publication,
3. Biology for Engineers, Dr. Sohini Singh, Dr.T anu Allen, Vayu Education of India.

REFERENCE BOOKS:

1. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by P. S. Verma and V.K. Agarwal, 2018
2. Handbook of Genetics, Sambamurthy, Friends Publisher, 2010

JOURNALS/MAGAZINES

Current Sciences

SWAYAM/NPTEL/MOOCs:

https://onlinecourses.nptel.ac.in/noc19_ge31/preview

Coursera: Biology everywhere

PROBLEM BASED LEARNING

Sl. No.	

1	Case Study: Biobased electrical engineering for sustainable society.
2	Case Study: Biosensors and its applications in agriculture/Medicine electrical mechanical
3	Case Study: Computational biology in Health care.

<table>
<tr><td>Course Title</td><td colspan="4">DESIGN THINKING</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>B20ME0102</td><td>Credits</td><td colspan="2">2</td><td colspan="2">Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="5">Design Thinking</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Theory</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>2</td><td>3</td><td>3</td><td>13</td><td>26</td><td>50%</td><td>50 %</td></tr>
</table>

COURSE OVERVIEW:

Today, innovation is everyone's business. At every level, in every kind of organization, design thinking provides the tools that one needs to become an innovative thinker and uncover creative opportunities. For example, companies like Procter, Gamble and GE have incorporated Design Thinking into their strategy and marketing. The course draws on methods from engineering and design, and combines them with ideas from the arts, tools from the social sciences, and insights from the business world.

In this course, students start in the field, where they discover the needs of the target audience. They then iterate ideas on teams to develop a range of promising possible solutions, create rough prototypes to take back out into the field, and learn to test with real people in the target audience.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Impart knowledge on design thinking process for understanding designs.
2. Provide design skills to analyze design thinking issues and apply the tools and techniques of design.
3. Inculcate attitude to solve societal problems using design thinking tools.

COURSE OUTCOMES (CO's):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Identify the problems that fall under the purview of human centered design process for creative problem solving.	1,2, 9, 10, 12	1, 2
CO2	Create empathy maps to visualize user attitudes and Develop innovative products or services for a customer base using ideation techniques	1,2,9,10, 12	2
CO3	Build simple prototypes for problems using gathered user requirements.	1,3, 9, 10, 12	1,2
CO4	Improve prototype by testing it with a specific set of users for making it sustainable by following ethics.	1,4,8,9,10, 12	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓					
CO2			✓			
CO3			✓			
CO4				✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							2	2		2	3	2	
CO2	1	3							2	3		2		2	

CO3	2		3						3	3		2	2	3	
CO4	2			2				1	3	2		2	2	3	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT – 1 **Design Thinking Process:** Types of the thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking. Problem Exploration, Case Studies from Embrace-Stanford Innovation Challenge, IDEO, GE Healthcare, The Good Kitchen- Denmark Program etc, identifying the target users for the problem selected, Survey on existing solutions for the problem identified. **Empathizing:** Powerful Visualizing tool – a method to connect to the user, Creating Empathy maps – Case studies.
UNIT – 2 **Defining the problems:** POV statements from User perspective. Idea generation: Methods to spark the innovative ideas – Brainstorming, Mind map, Story board, Provocation etc **What is a prototype? -** Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype. **Prototyping for digital products:** What's unique for digital, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users.

PRACTICE SESSION:

Sl. No	**Name of the Practice Session**	**Tools and Techniques**	**Expected Skill /Ability**
1	Identifying the problem that can be solved using Design Thinking approach	Observation and survey	Develop identifying human centered problems
2	Build the empathy maps for simple problems like single user	Visualization	Develop ability to understand other's emotions
3	Build the detailed empathy maps for problem identified in the teams formed	Visualization	Develop ability to understand other's emotions
4	Presentation by student teams	PPT	Develop ability to express their views
5	Obtain the insights into user's problems and make PoV statement	Understanding	Develop making problem statements from user

			perception
6	Presentation by student teams	PPT	Develop ability to express their views
7	Carry out Brain storming between the groups and generate as many as ideas possible	Ideation tools	Develop innovative mind set
8	Prototype for best 3 ideas selected	Sketching, simple model making etc	Develop prototyping techniques
9	Presentation by student teams	PPT	Develop ability to express their plan
10	Test the developed prototype with set of identified users	Google forms , cold calls, social media etc.	Develop understanding of various testing methods
11	Pitching final solution	PPT	Develop ability to express their views

TEXT BOOKS:

1. Gavin Ambrose, Paul Harris, **"**Basics Design-Design Thinking", AVA Publishing, 2010
2. Kathryn McElroy, "Prototyping for Designers: Developing the best Digital and Physical Products", O'Reilly,2017.

REFERENCE BOOKS:

1. Michael G. Luchs, Scott Swan , Abbie Griffin,"Design Thinking – New Product Essentials from PDMA", Wiley, 2015.
2. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", 2012.

JOURNALS/MAGAZINES/ADDITIONAL SOURCES

1. Leonard, D., and Rayport, J. F. 1997. Spark Innovation through Empathic Design. In Harvard Business Review, November-December 1997,102-113.
2. https://www.ideo.com
3. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
4. https://www.ibm.com/design/thinking/page/toolkit
5. https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we
6. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking
7. https://youtu.be/M66ZU2PCIcM
8. https://thisisdesignthinking.net/2017/07/innogy_energy_ecarsharing/

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/109/104/109104109/
2. https://nptel.ac.in/courses/110106124/

II SEMESTER
Detailed Syllabus

Sl. No	Course Code	Title of the Course	HC/ FC/ SC/ OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20AS0203	Integral Transforms	HC	4	0	0	4	4
2	B20AS0202	Engineering Physics	HC	3	0	1	4	5
3	B20CS0101	Introduction to Data Science	HC	2	0	1	3	4
4	B20EN0201	Analog Electronics	HC	3	0	1	4	5
TOTAL				**12**	**0**	**3**	**15**	**18**
Practical /Term Work / Sessional								
5	B20EC0101	IoT and Applications	HC	1	0	1	2	3
6	B20ME0104	Entrepreneurship	HC	1	0	0	1	1
7	B20ME0101	Computer Aided Engineering Drawing	HC	2	0	1	3	4
TOTAL				**4**	**0**	**2**	**6**	**8**
TOTAL SEMESTER CREDITS					**21**			
TOTAL CUMULATIVE CREDITS					**40**			
TOTAL CONTACT HOURS					**26**			

Title	**Integral Transforms**				Course Type	Theory	
Course Code	**B20AS0203**	**Credits**	**4**		Class	II sem	
Course Structure			Contact	Work	Total Number of Classes	Assessment Weightage	
	Theory	4	4	4			
	Practice	-	-	-	Theory	Practical	**CIE**	**SEE**
	Tutorial	-	-	-				
	Total	4	4	4	52	0	50%	50%

COURSE OVERVIEW:

This course is an essential one for electrical and electronics engineering students. This course covers the concept of Laplace transforms, Fourier series, Fourier transforms and z- transforms.

COURSE OBJECTIVES

The objectives of this course are to:
1. Apply the knowledge of Laplace transformation from the time domain to the frequency domain

2. familiarization of Fourier series and their applications and be notionally aware of their convergence.

3. Analyze the spectral characteristics of signals using Fourier analysis

4. Apply the knowledge of Z-transform in the areas like signal processing, control engineering etc.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of Laplace transformation from the time domain to the frequency domain, which transforms differential equations into algebraic equations and convolution into multiplication	1,2,3,4,5,6	1,2,3
CO2	Interpret Fourier series and their applications and be notionally aware of their convergence.	1,2,3,4,5,6	1,2,3
CO3	Analyze the spectral characteristics of signals using Fourier analysis.	1,2,3,4,5,6	1,2,3

CO4	Apply the knowledge of Z-transform in the areas like signal processing, control engineering etc.	1,2,3,4,5,6	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1			√			
CO2						√
CO3			√			
CO4			√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2							3	3	2
CO2	3	3	3	2	1	2							3	3	2
CO3	3	3	3	2	1	2							3	3	3
CO4	3	3	3	2	1	2							3	3	2

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Contents
UNIT – 1 Definition, Transforms of elementary functions, properties of Laplace Transforms (without proof) problems. Transforms of periodic functions (only statement and problems), Unit step functions and unit impulse functions.

Inverse Laplace transforms- Problems, convolution theorem (without proof) no verification and only evaluation of problems, solution of linear differential equation using Laplace transforms.
UNIT – 2 Convergence and divergence of infinite series of positive terms - definition, Periodic functions, Dirichlet's conditions and Fourier series of period functions of period 2π and arbitrary period , half range Fourier series , Complex form of Fourier series and Practical Harmonic analysis. Illustrative examples from engineering field.
UNIT – 3 Infinite Fourier Transform-Fourier sine and cosine transforms, Finite Fourier sine and cosine transforms, properties of Fourier transforms, Convolution theorem for F-transforms, Parseval's identity for F-transform. Applications of F-transforms to boundary value problems.
UNIT - 4 Z-transforms - Definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems (proof), inverse Z-transform, application of Z-transform to solve difference equations.

TEXT BOOKS:

1. B. V Raman "Higher Engineering Mathematics" by TMH publisher

2. E. Kreyszig "Advanced Engineering Mathematics" Johnwilley &SonsInc 8th Edition

REFERENCE BOOKS:

1. P.V. O'Neil " Advanced Engineering Mathematics" Thomson publisher

2. Potter & Goldberg "Mathematical Methods": PHI. publisher

JOURNALS/MAGAZINES

https://www.researchgate.net/publication/323218108_A_review_on_applications_of_laplace_transformations_in_various_fields

https://www.researchgate.net/journal/1069-5869_Journal_of_Fourier_Analysis_and_Applications

SWAYAM/NPTEL/MOOCs:

https://nptel.ac.in/courses/111/106/111106139/

https://nptel.ac.in/courses/111/106/111106111/

https://nptel.ac.in/courses/111/106/111106111/

PROBLEM BASED LEARNING:

1.	Find the Laplace transform of $f(t) = \begin{cases} t, & 0 < t < 4 \\ 5, & t > 4 \end{cases}$
2.	Find the Laplace transform of $f(t) = \begin{cases} sin2t, & 0 < t < \pi \\ 0, & t > \pi \end{cases}$
3.	Show that $\int_0^\infty t^3 e^{-t} sint\, dt = 0$
4.	Show that $\int_0^\infty te^{-2t} sin4t\, dt = \frac{1}{25}$
5.	Find the value of $\int_0^\infty te^{-3t} cos2t\, dt$ using Laplace Transform
6.	Evaluate $\int_0^\infty \frac{e^{-t}sint}{t} dt$ using Laplace transforms
7.	Evaluate $\int_0^\infty \frac{cos6t - cos4t}{t} dt$ using Laplace transforms
8.	Evaluate $\int_0^\infty \frac{e^{-at} - e^{-bt}}{t} dt$ using Laplace transforms
9.	If $f(t) = t^2,\ 0 < t < 2$ and $f(t+2) = f(t)$ for $t > 0$, find $L\{f(t)\}$
10.	A periodic function of period $2a$, is defined by $(t) = \begin{cases} E & for\ 0 \le t \le a/2 \\ -E & for\ a/2 \le t \le a \end{cases}$, then show that $L\big(f(t)\big) = \frac{E}{s} tanh\left(\frac{as}{4}\right)$
11.	If $L\big(f(t)\big) = F(s)$ then prove that $L\{f(t-a)U(t-a)\} = e^{-as}F(s)$
12.	Find inverse Laplace transform of the following (i) $\frac{s+5}{s^2-4s+13}$ (ii) $\frac{s^2}{(s+1)^3}$ (iii) $\frac{7s+4}{4s^2+4s+9}$
13.	Find inverse Laplace transform of the following (i) $log\left(\frac{s+a}{s+b}\right)$ (ii) $log\left(1 - \frac{a^2}{s^2}\right)$
14.	Using convolution theorem find inverse LT of the following functions (i) $\frac{s}{(s^2+a^2)^2}$ (ii) $\frac{s^2}{(s^2+a^2)(s^2+b^2)}$

15.	Solve by using Laplace transforms $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$ given $y(0) = y'(0) = 0$
16.	Solve by using Laplace transforms $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 5e^{2x}$ given $y(0) = 2, y'(0) = 1$
17.	Solve by using Laplace transforms $x'' - 2x' + x = e^{2t}$ with $x(0) = 0,\ x'(0) = -1$
18.	Obtain the Fourier series of $f(x) = x - x^2$ in $-\pi < x < \pi$. Hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} - - - -$
19.	Sketch the graph of the function $f(x) = \|x\|\ \ in\ -\pi < x < \pi$ and hence obtain Fourier series. Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} - - - -$
20.	Obtain the Fourier series for the function $f(x) = x$ in the interval$(-3,3)$.
21	Obtain the Fourier series expansion for the function $f(x) = \begin{cases} 1 + 2x & in\quad -3 < x < 0 \\ 1 - 2x & in\quad 0 < x < 3 \end{cases}$
22	Obtain the Fourier series for the function $f(x) = 2x - x^2$ in the interval$(0,3)$.
23	Obtain the sine half range Fourier series of $f(x) = x^2$ in $0 < x < \pi$
24	Find a cosine series for $f(x) = (x-1)^2,\quad 0 \le x \le 1$.
25	Find the complex Fourier transform of the function $f(x) = \begin{cases} 1, & for\quad \|x\| \le a \\ 0, & for\quad \|x\| > a \end{cases}$ Hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$
26	Find the complex Fourier transform of the function $f(x) = \begin{cases} x, & for\quad \|x\| \le \alpha \\ 0, & for\quad \|x\| > \alpha \end{cases}$ where α is a positive constant.
27	Find the inverse Fourier sine transform of $\hat{f}_s(\alpha) = \frac{1}{\alpha} e^{-a\alpha},\quad a > 0$.

28	Solve the integral equation $\int_0^\infty f(\theta)\, cos\, \alpha\theta\, d\theta = \begin{cases} 1-\alpha, & 0 \le \alpha \le 1 \\ 0, & \alpha > 1 \end{cases}$ and hence evaluate $\int_0^\infty \frac{sin^2 t}{t^2} dt$
29	Solve the integral equation $\int_0^\infty f(\theta)\, cos\, \alpha\theta\, d\theta = \begin{cases} 1-\alpha, & 0 \le \alpha \le 1 \\ 0, & \alpha > 1 \end{cases}$ and hence evaluate $\int_0^\infty \frac{sin^2 t}{t^2} dt$
30	Property: Prove that $Z_T(n^k) = -z \frac{d}{dz} Z_T(n^{k-1})$, where k is a positive integer.
31	$Z_T(u_n) = \bar{u}(z)$ then $Z_T(u_{n+k}) = z^k\left[\bar{u}(z) - u_0 - u_1\, z^{-1} - u_2\, z^{-2} - \cdots - u_{k-1}\, z^{-(k-1)}\right]$
32	Find the z-transforms of the following. (i) $k^n n$ (ii) $k^n n^2$ (iii) e^{-an} (iv) $e^{-an}\, n$
33	Obtain Z-transform of $cosn\theta$ and $sinn\theta$. Hence deduce Z-transforms of the following. $k^n\, cosn\theta$ (ii) $k^n\, sinn\theta$ (iii) $e^{-an}\, cosn\theta$ (iv) $e^{-an}\, sinn\theta$
34	Find the Z-transform of $(n+1)^2$
35	Find the Z-transform of $2n + sin\left(\frac{n\pi}{4}\right) + 1$
36	Initial value theorem Statement: If $Z_T(u_n) = \bar{u}(z)$ then $\lim_{z\to\infty} \bar{u}(z) = u_0$
37	Initial value theorem Statement: If $Z_T(u_n) = \bar{u}(z)$ then $\lim_{z\to\infty} \bar{u}(z) = u_0$
38	Find the inverse Z-transform of $\frac{z}{(z-1)(z-2)}$
39	Find $Z_T^{-1}\left[\frac{5z}{(2-z)(3z-1)}\right]$
40	Compute the inverse Z-transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$
41	Solve by using Z-transforms: $y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = 0 = y_1$.
42	Solve by using Z-transforms: $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = 0 = y_1$.

Course Title	**Engineering Physics**				**Course Type**		**Regular**
Course Code	B20AS0202	**Credits**	**4**		**Class**		**I sem**
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage
	Theory	3	3	3			
	Practice	1	2	1	Theory	Practical	CI	SE
	Tutorial	0	-	-				
	Total	**4**	**5**	**4**	**39**	**26**	**50%**	**50%**

COURSE OVERVIEW

Engineering Physics is very important and necessary basic subject for all branches of engineering students. It provides the fundamental knowledge of basic principles of Physics which is required for basic foundation in engineering education irrespective of branch. This course introduces the basic concepts of Physics and its applications to Electronics Engineering courses by emphasizing the following concepts: electrical properties, semiconductor physics, dielectrics, and optical properties. This course has basic laws expressions and theories which helps to increase the scientific knowledge to analyze upcoming technologies. The course also consists of real time and numerical examples which makes subject interesting and attractive.

COURSE OBJECTIVES:

This course enables graduating students to

1. Understand the basic concepts and principles of Physics to analyze practical engineering problems and apply its solutions effectively and efficiently.
2. Gain the knowledge of different physical phenomena, electrical/magnetic/optical properties and semiconductor physics.
3. Understand design issues, practical oriented skills and problem solving challenges.

COURSEOUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs

CO1	Explain the properties of the materials and classify them into various categories.	1,2,4,5,6,10,12	1,2,3
CO2	Extract various semiconducting parameters like carrier concentration, drift velocity, effective mass, etc.	1,2,3,4,5,6,10, 12	1,2,3
CO3	Understand the origin of magnetism and its applications, different kind dielectric materials and the polarization.	1,2,3,4,5,6,10, 12	1,2,3
C04	Understand the light matter interaction, carriers generation and recombination, nano-materials and their interesting properties.	1,2,3,4,5,6,10, 12	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
C04	✓	✓	✓			

COURSE ARTICULATIONMATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		1	1	2				1		1	1	1	1
CO2	3	3	2	2	2	2				1		1	2	2	1
CO3	1	2	2	1	1	1				1		1	1	1	1
C04	1	2	2	1	1	1				1		1	1	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY

Contents
UNIT – 1
ELECTRICAL PROPERTIES OF MATERIALS Classical free electron theory – Expression for electrical conductivity – Thermal conductivity, expression – Wiedemann-Franz law – Quantum free electron theory-Success and failures – electrons in metals – Schrodinger Wave Equation(qualitative)- Particle in a one dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states(qualitative) – metals and insulators – Electron effective mass.
UNIT – 2
SEMICONDUCTOR PHYSICS Intrinsic Semiconductors – Energy band diagram – concept of hole-direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors – Carrier concentration in N-type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport – Einstein's relation – Hall effect and devices.
UNIT – 3
MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS Magnetism in materials – magnetic field and induction – magnetization – magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials – Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory. Dielectric materials: Polarization processes – dielectric loss – internal field – Clausius-Mosotti relation- dielectric breakdown – high-k dielectrics.
UNIT – 4
OPTICAL PROPERTIES OF MATERIALS Classification of optical materials – carrier generation and recombination processes – Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) – photocurrent in a P- N diode – solar cell –photo detectors – LED – Organic LED – Laser diodes – excitons –**NANOELECTRONIC DEVICES** Introduction – electron density in bulk material – Size dependence of Fermi energy– quantum confinement – quantum structures – Density of states in quantum well, quantum wire and quantum dot structures, Carbon Nano Tubes and their properties.

Text Books

1. M.N. Avadhanulu and P.G. Kshirsagar, "A Text book of Engineering Physics", S. Chand & Company Ltd, New Delhi, 10th revised Ed

2. Gaur and Gupta, "Engineering Physics", Dhanpat Rai Publications 2017

REFERENCE BOOKS:

1. Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill Edu Pvt Ltd- New Delhi, 6 th Ed 2006
2. S O Pillai, "Solid State Physics", New Age International Publishers, 8th Ed
3. S M Sze, Physics of Semiconductor devices, Wiley, 2004

PRACTICE SESSION:

Sl. No.	Title of the Experiment	Tools and Techniques	Expected Skill /Abili
1.	Variation of Resistivity of intrinsic Semi-conductor crystal using four probe method	Four probe apparatus, oven, Ge crystal with non-conducting bottom surface	Circuit connections, mathematical calculations
2.	Determination Value of Planck's constant by using light emitting diode	4-5 different LED's, voltmeter and powersupply, Planck's constant apparatus set up, patch cards	Circuit connections, mathematical calcultions, analysing the results
3.	Attenuation and propagation characteristics of optical fiber cable.	Diode laser, digital dc micrometer (0-200µA), two OFC (1.5m &2.5m), optical sensor mounted on a stand and fitted to chunk.	Analysing and mathematical skills
4.	Determination of numerical aperture of a given optical fiber.	Optical Trainer Kit, Fiber Cable, NA Measurement	Mathematical and analysing skills
5.	To find the laser parameters–wavelength and divergence of laser light by diffraction method.	Light detecting microscope, relative intensity meter, laser light	
6.	Photo Diode Characteristics (Study of I–V characteristics in reverse bias and variation of photocurrent as a function of reverse voltage and intensity	A battery eliminator, voltmeter, millimeter, experimental board and power supply, photodiode	Analysing and mathematical calculations, circuit connections
7.	Dielectric constant of a capacitor by charging and discharging of a capacitor	Dielectric constant apparatus kit (consisting of capacitor, power apply and resistor, voltmeter), patch	Analysing skills and mathematical calculations, circuit connections
8.	Determination of particle size using laser.	Laser source, lycopodium particles, glass pate, screen	Analysing skills and mathematical calculations,
9.	Band gap of intrinsic Semi-conductor	Four probe apparatus, oven, Si crystal with non-conducting bottom surface	Circuit connections, mathematical calculations

10	Series and parallel LCR Circuits (Determination of resonant frequency and quality factor)	Function generator, series resonance kit (power supply, resistor, inductor, ammeter), patch cards	Analysing skills and mathematical calculations, circuit connections

PROJECT BASED LEARNING

To enhance the skill set in the integrated course, the students are advised to execute course-based **Design projects**. Some sample projects are given below:

Sl. No.	Suggested sample Projects
1.	Build a model of different types of sensors.(smoke detectors, water level detectors,)
2.	Preparation of graphene from graphite using a battery.
3.	Collect different type of materials and compare their mechanical and magnetic properties.
4	Demo and presentation of different types of LED’s available in the market

Course Title	**Introduction to Data Science**				**Course Type**		**Integrated**	
Course Code	**B20CS0101**	**Credits**	**3**		**Class**		**I Semester**	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	2				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**4**	**4**	**26**	**26**	**50%**	**50%**

COURSE OVERVIEW:

Data Science is an interdisciplinary, problem-solving oriented subject that is used to apply scientific techniques to practical problems. The course orients on preparation of datasets and programming of data analysis tasks. This course covers the topics: Set Theory, Probability theory, Tools for data science, ML algorithms and demonstration of experiments by using MS-Excel.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the fundamental concepts of Excel.
2. Illustrate the use of basic concepts of Data Science in the real world applications.
3. Demonstrate the use of SQL commands in real world applications.
4. Discuss the functional components of Data Science for real world applications

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Make use of the concepts of Data Science in developing the real world applications.	1, 2, 3, 4, 5	1,2,3
CO2	Apply the SQL commands in developing the real-world applications.	1, 2, 3, 4, 5	1,2,3
CO3	Build the data analytics solutions for real world problems, perform analysis, interpretation and reporting of data.	1, 2, 3, 4, 5	1, 2, 3
CO4	Create the real world AI based solutions using different machine learning algorithms	1, 2, 3, 4, 5	1, 2, 3

BLOOM'S LEVEL OF THE	Bloom's Level					
	Remember(L1)	Understand(L2)	Apply(L3)	Analyze(L4)	Evaluate(L5)	Create(L6)
CO1			✓			
CO2			✓			
CO3			✓	✓		
CO4			✓	✓	✓	✓

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**3**	**2**	**2**	**2**								**3**	**3**	**3**
CO2	**2**	**2**	**2**	**2**	**2**								**3**	**3**	**3**
CO3	**3**	**3**	**2**	**2**	**2**								**3**	**3**	**3**
C04	**3**	**3**	**3**	**2**	**2**								**3**	**3**	**3**

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

UNIT – 1

Introduction to Microsoft Excel

Creating Excel tables, understand how to Add, Subtract, Multiply, Divide in Excel. Excel Data Validation, Filters, Grouping. Introduction to formulas and functions in Excel. Logical functions (operators) and conditions. Visualizing data using charts in Excel. Import XML Data into Excel How to Import CSV Data (Text) into Excel, How to Import MS Access Data into Excel, Working with Multiple Worksheets.

UNIT – 2

Introduction to Data Science

What is Data Science? Probability theory, bayes theorem, bayes probability; Cartesian plane, equations of lines, graphs; exponents.

Introduction to SQLSQL: creation, insertion, deletion, retrieval of Tables by experimental demonstrations. Import SQL Database Data into Excel

UNIT – 3

Data science components

Tools for data science, definition of AI, types of machine learning (ML), list of ML algorithms for classification, clustering, and feature selection. Description of linear regression and Logistic Regression. Introducing the Gaussian, Introduction to Standardization, Standard Normal Probability Distribution in Excel, Calculating Probabilities from Z-scores, Central Limit Theorem, Algebra with Gaussians, Markowitz Portfolio Optimization, Standardizing x and y Coordinates for Linear Regression, Standardization Simplifies Linear Regression, Modeling Error in Linear Regression, Information Gain from Linear Regression.

UNIT – 4

Data visualization using scatter plots, charts, graphs, histograms and maps

Statistical Analysis: Descriptive statistics- Mean, Standard Deviation for Continuous Data, Frequency, Percentage for Categorical Data

Applications of Data Science

Data science life cycle, Applications of data science with demonstration of experiments either by using Microsoft Excel.

PRACTICE:

<table>
<tr><th>sl.no</th><th>Title of the Experiment</th><th>Tools and Techniques</th><th>Expected Skill/Ability</th></tr>
<tr><td>1.</td><td>The height (in cm) of a group of fathers and sons are given below, Find the lines of regression and estimate the height of son when the height of father is 164 cm.
<table>
<tr><td>Plot the graph. Hgt of Fathers</td><td>158</td><td>166</td><td>163</td><td>165</td><td>167</td><td>170</td><td>167</td><td>172</td><td>177</td><td>181</td></tr>
<tr><td>Hgt of Sons</td><td>163</td><td>158</td><td>167</td><td>170</td><td>160</td><td>180</td><td>170</td><td>175</td><td>172</td><td>175</td></tr>
</table></td><td>MS Excel</td><td>Create and perform operations on Excel data set by applying Linear regression</td></tr>
<tr><td>2.</td><td>Using the data file DISPOSABLE INCOME AND VEHICLE SALES, perform the following:
i) Plot a scatter diagram.
ii) Determine the regression equation.
iii) Plot the regression line (hint: use MS Excel's Add Trendline feature).
iv) Compute the predicted vehicle sales for disposable income of $16,500 and of $17,900.
v) Compute the coefficient of determination and the coefficient of correlation</td><td>MS Excel</td><td>Perform prediction and visualization of data</td></tr>
</table>

<table>
<tr>
<td>3.</td>
<td>Managers model costs in order to make predictions. The cost data in the data file INDIRECT COSTS AND MACHINE HOURS show the indirect manufacturing costs of an ice-skate manufacturer. Indirect manufacturing costs include maintenance costs and setup costs. Indirect manufacturing costs depend on the number of hours the machines are used, called machine hours. Based on the data for January to December, perform the following operations.

i) Plot a scatter diagram.
ii) Determine the regression equatine (hint: use MS Excel's Add Trendline feature).
iii) Compute the predicted indirect manufacturing costs for 300 machine hours and for 430 machine hours.
iv) Compute the coefficient of determination and the coefficient of correlation</td>
<td>MS Excel</td>
<td>Perform prediction and visualization of data</td>
</tr>
<tr>
<td>4.</td>
<td>Apply multiple linear regression to predict the stock index price which is a dependent variable of a fictitious economy based on two independent / input variables interest rate and unemployment rate.

<table>
<tr><th>year</th><th>month</th><th>interest rate</th><th>unemployment rate</th><th>stock index price</th></tr>
<tr><td>2020</td><td>10</td><td>2.75</td><td>5.3</td><td>1464</td></tr>
</table></td>
<td>MS Excel</td>
<td>Perform prediction and visualization of data</td>
</tr>
<tr>
<td>5.</td>
<td>Calculate the total interest paid on a car loan which has been availed from HDFC bank. For example, Rs.10,00,000 has been borrowed from a bank with annual interest rate of 5.2%

<table>
<tr><th>Sl No.</th><th>A</th><th>B</th></tr>
<tr><td>1</td><td>Principal</td><td>Rs.10,00,000</td></tr>
<tr><td>2</td><td>Annual interest rate</td><td>5.20%</td></tr>
<tr><td>3</td><td>Year of the loan</td><td>3</td></tr>
<tr><td>4</td><td>Starting payment number</td><td>1</td></tr>
<tr><td>5</td><td>Ending payment number</td><td>36</td></tr>
<tr><td>6</td><td>total interest paid during period</td><td>?</td></tr>
</table></td>
<td>MS Excel</td>
<td>Create Excel data and perform EMI estimator</td>
</tr>
</table>

<table>
<tr><td>6.</td><td>Create a supplier database of 10 records with SUPPLIER_ID as primary key, SUPPLIER_NAME, PRODUCTS, QUANTITY, ADDRESS, CITY, PHONE_NO and PINCODE, Where SUPPLIER_NAME, PRODUCTS, QUANTITY and PHONE_NO, should not be NULL.</td><td>SQL</td><td>Creating Tables</td></tr>
<tr><td>7.</td><td>Create the customer database of a big Market with CUSTOMER_ID as primary key, CUSTOMER_NAME, PHONE_NO, EMAIL_ID, ADDRESS, CITY and PIN_CODE. Store at least twenty customers details where CUSTOMER_NAME and PHONE_NO are mandatory and display the customer data in alphabetical order.</td><td>SQL</td><td>Creating and retrieving Tables</td></tr>
<tr><td>8.</td><td>Apply linear regression to find the weather (temperature) of a city with the amount of rain in centimeters. Create your own database with following details.
<table>
<tr><td>CITY</td><td>Temperature in Centigrade</td><td>Rain in Centimeters</td></tr>
<tr><td></td><td></td><td></td></tr>
</table></td><td>MS Excel</td><td>Apply Linear regression</td></tr>
<tr><td>9.</td><td>Use the linear regression technique to compare the age of humans with the amount of sleep in hours.
<table>
<tr><td>Name</td><td>Age in Years</td><td>Sleep in hours</td></tr>
</table>
Create your own database with above details.</td><td>MS Excel</td><td>Apply Linear regression</td></tr>
<tr><td>10.</td><td>Apply the linear regression, compare the average salaries of batsman depending on the run rate scored/ recorded in the matches. Assume your own database.</td><td>MS Excel</td><td>Apply Linear regression</td></tr>
<tr><td>11.</td><td>Design the ER diagram and create schema of the REVA library management system.</td><td>Entity Relationshi</td><td>Entity Relationship diagrams</td></tr>
<tr><td>12.</td><td>Design the ER diagram and create schema for Hospital Management system.</td><td>Entity Relationshi</td><td>Schema design</td></tr>
</table>

TEXT BOOKS:

1. B.S. Grewal, “Higher Engineering Mathematics”, 43nd edition, Khanna Publishers, 2015.
2. Ramakrishnan and Gehrke , “Database Management systems”, Third Edition, McGraw Hill Publications, 2003.
3. Mastering Data Analysis in Excel - https://www.coursera.org/learn/analytics-excel.
4. Kenneth N. Berk, Carey, “Data Analysis with Microsoft Excel”, S. Chand & Company,2004.

REFERENCE BOOKS:

1. B.V. Ramana, “Higher Engineering Mathematics”, 19th edition,Tata McGraw Hill Publications, 2013.
2. ErwinKreyszig, “Advanced Engineering Mathematics”, 9th edition,Wiley Publications, , 2013.
3. Seymour Lipschutz, John J. Schiller, “Schaum's Outline of Introduction to Probability and Statistics”, McGraw Hill Professional, 1998.

JOURNALS/MAGAZINES:

1. https://www.journals.elsevier.com/computational-statistics-and-data-analysis
2. https://www.springer.com/journal/41060
   International Journal on Data Science and Analytics
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8254253
   IEEE Magazine on Big data and Analytics

SWAYAM/NPTEL/MOOCs:

1. Excel Skills for Business: Essentials, Macquarie University (https://www.coursera.org/learn/excel-essentials)
2. SQL for Data Science, University of California, Davis (https://www.coursera.org/learn/sql-for-data-science)
3. Data Science Math Skills, Duke University (https://www.coursera.org/learn/datasciencemathskills)
4. https://www.edx.org/course/subject/data-science
5. https://onlinecourses.nptel.ac.in/noc19_cs60/preview

SELF-LEARNING EXERCISES:

1. Relational database management system.
2. Advanced MS-Excel

Course Title	**Analog Electronics**				**Course Type**		**Integrated**	
Course Code	**B20EN0201**	**Credits**	**4**		**Class**		**II Semester**	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	**CIE**	**SEE**
	-	-	-	-				
	Total	**4**	**5**	**5**	**39**	**26**	**50%**	**50 %**

COURSE OVERVIEW:

Analog Electronics is the base of Electronics & Communication stream. In this course the working of various amplifiers is explained. Students learn how BJT work at low and high frequencies, what happens in FET amplifiers, Power amplifiers, feedback amplifiers, tuned amplifiers and different types of oscillators and their working is analyzed. Introduction to Op-Amps is given in the end of the course.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand operation of semiconductor devices.
2. Understand how devices such as semiconductor diodes and Bipolar Junction transistors are modeled and how the models are used in the design and analysis of useful circuits.
3. Apply concepts for the design of Amplifiers
4. Verify the design and construct circuits, take measurements of circuit behavior and performance, compare with predicted circuit models and explain discrepancies using simulators.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation.	1,2,3,5	1,2,3
CO2	Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.	4,5	2,3
CO3	Develop experience in building and trouble-shooting simple electronic analog and digital circuits through Simulator	5,,10,11,12	2,3
CO4	Assess the concepts of both positive and negative feedback in electronic circuits.	1,2,3,5	3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓					
CO2			✓			
CO3			✓			
CO4				✓		

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1		3								1	2	1
CO2				1	3									2	1
CO3					1					3	2	1	3		1
CO4	2	2	1		1										1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT – 1 **Transistor Biasing:** (BJT Version) Operating Point, Fixed Bias, Voltage-Divider Bias Configurations, Emitter-Follower, Bias Stabilization, Problems linked to above topics, Simulation using TINA/PSPICE/Multisim Simulator. **BJT AC Analysis:** The r_e Transistor Model, Modeling of Voltage-Divider Bias and Emitter-Follower Configurations, Two-Port Systems Approach, Cascaded Systems, Darlington Connection, Problems linked to above topics, Simulation using TINA/PSPICE/Multisim Simulator.
UNIT – 2 **BJT Frequency Response** Logarithms, Decibels, General Frequency Considerations, Normalization Process, Low-Frequency Response-BJT Amplifier with R_L, Millers Effect Capacitance, High Frequency Response-BJT Amplifier, Multistage Frequency Effects. Problems linked to above topics, Simulation using TINA/PSPICE/Multisim Simulator.

Feedback Amplifiers: Feedback Concepts, Feedback Connection Types, Practical Feedback Circuits- Voltage Series Feedback and Current-Series Feedback . Problems linked to above topics. Simulation using TINA/PSPICE/Multisim Simulator.
UNIT – 3 **Oscillator Circuits:** Condition for oscillations, Oscillator operation, Phase Shift Oscillator, Colpitts, Hartley and Crystal Oscillators. Problems linked to above topics. Simulation using TINA/PSPICE/Multisim Simulator. **Power Amplifiers:** Series-Fed Class A Amplifier, Transformer-Coupled Class A Amplifier, Class B Amplifier Ciruits-Transformer-coupled Push-Pull Circuits, Complementary-symmetry Circuits, Class C and Class D amplifiers. Problems linked to above topics. Simulation using TINA/PSPICE/Multisim Simulator.
UNIT - 4 **Field Effect Transistors:** Construction and Characteristics of JFETs, Transfer Characteristics, Important relations, Depletion-Type MOSFET, Enhancement-Type MOSFET. **Introduction to Operational Amplifiers:** Basic Operational Amplifier Circuit, The 741 IC Op-Amp, Voltage Follower, Non-inverting and Inverting Amplifiers. Operational Amplifier Parameters. Problems linked to above topics. Simulation using TINA/PSPICE/Multisim Simulator.

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	ExpectedSkill /Ability
1	Design a Single stage BJT CE Amplifier and obtain frequency response curve and find Bandwidth, Input & Output Impedances.	Measuring instruments, simulation and design equations	Design and circuit debugging. Working in a team
2	Design a Two stage voltage series BJT Amplifier and Obtain frequency response curve, also find Bandwidth, Input & Output Impedances	Measuring instruments, simulation and design equations	Design and circuit debugging. Working in a team
3	Design a CE mode Cascode amplifier and plot frequency response. Also find Gain & Bandwidth.	Measuring instruments, simulation and design equations	Written Communication skills
4	Design a Class - C tuned Amplifier & find its Efficiency.	Measuring instruments, simulation and design equations	Develop ability to express their views
5	Design a BJT Darlington emitter follower and find Gain, Input & Output Impedances.	Measuring instruments, simulation and design equations	Develop making problem statements

			from user perception
6	Rig-up an R-C Phase Shift oscillator for $f_o \leq$ 10 KHz & Crystal oscillator for f_o>1MHz.	Measuring instruments, simulation and design equations	Develop ability to express their views
7	Design a BJT Hartley & Colpitt's Oscillators for frequency ≥100kHz & simulate the circuit in Multisim	Measuring instruments, simulation and design equations	Develop innovative mind set
8	Demonstrate the working of Class-B push pull power amplifier using transistors find its Efficiency & also simulate the same in Multisim.	Measuring instruments, simulation and design equations	Develop prototyping techniques
9	Design an OPAMP Inverting & Non Inverting Amplifier.	Measuring instruments, simulation and design equations	Develop prototyping techniques

TEXT BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", PHI/Pearson Education, 11th edition, 2015.
2. David A. Bell, "Electronic Devices & Circuits", Prentice Hall of India/Pearson Education, 4th edition, 2007.
3. David A. Bell, "Operational Amplifiers and Linear ICs", Prentice Hall of India, 2nd edition, 2006.

REFERENCE BOOKS

1. Jacob Millman & Christos. C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits ",Tata McGraw Hill, 2nd edition, 2008.
2. Floyd, "Electronic Devices", Prentice Hall of India, Pearson Education, 6th Edition, 2010. Anil Kumar Maini, Varsha Agrawal,"Electronic Devices and Circuits", John Wiley & Sons, 2009.

<table>
<tr><th>Course Title</th><th colspan="4">IoT and Applications</th><th>Course Type</th><th>Integrated</th></tr>
<tr><th>Course Code</th><th>B20EC0101</th><th>Credits</th><th colspan="2">2</th><th>Class</th><th>I/II Semester</th></tr>
<tr><td rowspan="2">Course</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td rowspan="2">Total Number of Classes Per Semester</td><td rowspan="2">Assessment Weightage</td></tr>
<tr><td>Theory</td><td>1</td><td>1</td><td>1</td></tr>
</table>

Structure	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	-	-	-				
	Total	**2**	**3**	**3**	**13**	**26**	**50**	**50**

COURSE OVERVIEW:

The Internet of Things (IoT) expands access to the world-wide web from computers, smart phones, and other typical devices to create a vast network of appliances, toys, apparel, and other goods that are capable of connecting to the Internet. This introductory course focuses on IoT architecture, its domains and communication protocols. The course is supported with hands on sessions that incorporates different types sensors interfaced with IoT board to build IoT projects to solve real time problems. The case study of deployment of IoT in various applications are provided.

COURSE OBJECTIVE (S):

The objectives of this course are to:

1. Explain the architecture of Internet of Things.
2. Inculcate knowledge of IoT devices, Sensors and Communication Protocols in various application domains.
3. Gain expertise in interface of various sensors to IoT Boards.
4. Discuss the various applications of IoT .

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the architecture of IoT eco-system	1	1,2
CO2	Identify IoT devices, architecture, sensors and Communication protocols	1	1,2
CO3	Demonstrate the interface of sensors to IoT board	1,5, 12	1,2
CO4	Realize various Applications of IoT through case studies	1,5, 12	1,2
CO5	Develop simple IoT projects and modules	1,5,9, 12	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√				
CO2		√				
CO3			√			

CO4				√	√	
CO5						√

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3	3	
CO2	3												3	3	
CO3	3		3									3	2	2	
CO4	3		3									3	1	1	
CO5	3		3						2			3	3	3	

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT

THEORY:

Contents
UNIT – 1 **IoT Basics**: Introduction to IoT, How does Internet of Things Works, Features of IoT, Advantages an Disadvantages of IoT, Embedded Devices in IoT, IoT eco-system,IoT Architecture and IoT Devices Components of IoT architecture, Stages of IoT solution architecture, Smart Objects, IoT Devices.
UNIT – 2 **IoT boards in Market: Arduino, Arduino UNO, ESP8266 ,Raspberry Pi,IoT Platform:** Amazon Web Services (AWS) IoT platform, Microsoft Azure IoT platform, Google Cloud Platform IoT, IBM Watson IoT platform, ThingWork IoT platform Technologies Used in IoT: Bluetooth, Wi-Fi, Li-Fi, RFID ,Cellular ,Z-Wave

PRACTICE:

Sl. No.	Title of the Experiment	Tools and Techniques	Expected Skill /Ability
Part-A			

1.	Introduction to IoT Board a. Arduino UNO b. Arduino Nano c. Node MCU d. Ethernet Shield	Hardware	• Identifications of various parts of Arduino and Node MCU boards • Study of Ethernet shield
2.	Working with Arduino IDE (Integrated Development Environment)	Open source Arduino IDE	• Download specified software • Modify code as per the application
3.	a) Demonstration of Multimeter usage b) Demonstration of Breadboard connection for Voltage, Ground, series and parallel connections c) Exercise to read the value of resistor using Colour code chart	Multimeter Breadboard Resistor packs	• Measurement of voltage at various points in IoT boards • Choose the value of Resistor for an application
4.	Reading photo resistor sensor value connected to Arduino Board	Arduino UNO Arduino IDE LDR , Multimeter, Resistor	• Interface of photo sensor to IoT board for light measurement
5.	Reading temperature sensor value connected to Arduino Board	Arduino UNO , Arduino IDE, Temperature sensor, Multimeter	• Interface of Temperature sensor to IoT board for
6.	Reading motion detector sensor value connected to IoT board	Arduino UNO , Arduino IDE, pyro-dielectric sensor, Multimeter	• Interface of Motion detector sensor to IoT board for motion detection detection
7	Reading distance measurement using Ultrasonic sensor Connected to IoT board	Arduino UNO , Arduino IDE, Ultrasonic sensor, Multimeter	Interface of Motion detector sensor to IoT board for motion detection
8	Interface relay to IoT board	Arduino UNO , Arduino IDE, relay Multimeter	Interface relay to IoT board for Switching applications

9	Connect Wifi-ESP8266 to Arduino UNO board , Send and receive data through smart phone.	Arduino UNO ESP8266, Arduino IDE Smart phone	Connect IoT board to Wifi network
Part-B (Case Study projects-Samples)			

Automated lighting system *IoT and Cloud Server Based Wearable* Health Sensor's Monitoring System intelligent Traffic system *Motor Controlling with Android App* *A Smart System connecting E-Health Sensor's and the Cloud* *IoT based Garbage Management System ,* *IoT based submersible motor pumps on/off* *IoT Based Electronic Door Opener,* *IoT Based Garbage Monitoring* *Building Automation System Using GRPS IoT,* *Implementation of Industrial Data Acquisition, management and Guiding using IoT* *Distance based Accident Avoidance System using CAN protocol & Tracking through IoT ,* *Swachh Bharat Waste Collection Management System using IOT*	Smart Parking Smart healthcare *IoT - Industrial Internet of Things Monitoring Of Sensor's Data on Android App* *Integrated Smart Health Care Monitoring System* *Smart E-Agriculture Monitoring Using Internet Of Things* *Smart Home Automation using IOT* *Monitoring of Highway Hybrid Parameter & Controlling Highway Light Through IoT* *IoT Based Smart Agriculture Monitoring System* *IoT Based Agriculture Crop - Field Monitoring System and Irrigation Automation* *Multiple Garbage Box Monitoring & Collection system* *IoT Based Garbage Monitoring System*	Smart water management IoT for smart cities Remote Patient Monitoring ,E Agriculture Monitoring on Webpage *Air Pollution & Water Quality Monitoring System* *An IoT Based Patient Monitoring System using Raspberry Pi ,Underground Cable Fault Detection Over Internet Of Things (Iot) Google Map* *IoT Air & Water Quality Monitoring System,IoT Based Automatic Vehicle Accident Detection and Rescue System* *Patient Health Status Observing Based On IoT and Email Alert* *IoT Based Vehicle Accident Detection and Tracking System on google map webpage* *Data Logger System for weather monitoring using WSN ,Smart intelligent security system for women*

PART C (Mini Project)

1	**Arduino Controlled Light intensity**: design and build a simple , effective circuit called Auto Intensity Control of Street Lights using Arduino	ArduinoUNO,DS3231 RTC Module, LDR 16×2 LCD Display ,LED,10KΩ Potentiometer,10KΩ Resistor, Push Button, Connecting	Design and Implementation of IoT project to solve Engineering Problems.
2	**Thermometer**: build an LCD thermometer with an Arduino UNO and a LM35/36 analog temperature sensor.	Arduino Uno, Temperature Sensor, LCD display, Breadboard and Connecting wires	Design and Implementation of IoT project for Engineering
3	Motion activated light lamp: build an automated project that It switches on and off when there's motion.	Arduino Uno, PIR Motion sensor, breadboard, connecting wires, LED generic.	Design and Implementation of IoT project for Engineering
4	Touchless motion sensor trash can: build touchless motion sensor trash can	Arduino UNO, Ultra sonic sensor, Micro servo motor, Breadboard, Connecting wires	Design and Implementation of IoT project for

TEXT BOOKS:

1. Vijay Madisetti, Arshdeep Bahga , "Internet of Things: A Hands-On- Approach " Second edition 2014, ISBN: 978 0996025515.

REFERENCE BOOKS:

1. Raj Kamal ," Internet of Things: Architecture & design Principle", McGraw Hill Education 2017.

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/learn/iot

2. https://www.coursera.org/learn/interface-with-arduino

SELF-LEARNING EXERCISES:

a) Create Arduino project hub

Course Title	**ENTREPRENEURSHIP**			**Course Type**	**Theory**
Course Code	B20ME0104	**Credits**	**1**	**Class**	**I sem**

<table>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total number of classes per semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Theory</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>1</td><td>1</td><td>1</td><td>13</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW

COURSE DESCRIPTION: This introductory course is designed to introduce you to the foundational concepts of entrepreneurship, including the definition of entrepreneurship, the profile of the entrepreneur, the role of venture creation in society. The course also provides a bird's eye view on the steps to start a venture, financing, marketing as well as support by various institutions towards entrepreneurship.

COURSE OBJECTIVE

The objectives of this course are to

1. Understand the basic terms, concepts in Entrepreneurship Development
2. Analyze and apply for the supporting schemes towards entrepreneurship

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand and explain the key terms, definitions, and concepts used in Entrepreneurship Development	6,7,8,9,10 ,11, 12	
CO2	Plan a start up by applying the knowledge of sources of finance and the supporting schemes offered by state and central governments and other entrepreneurial development organisations	2,3, 6,7,8, 9,10,1 1,12	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√	√				
CO2	√	√	√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1	1	1	1	1	2	1			
CO2		3	1			1	1	1	1	1	3	1			

Note: 1-Low, 2-Medium, 3-High

COURSE CONTENT
THEORY:

Contents
UNIT – 1 **INTRODUCTION TO ENTREPRENEURSHIP** Evolution of term 'Entrepreneurship', Factors influencing entrepreneurship', Psychological factors, Social factors, Economic factors, Environmental factors. Characteristics of an entrepreneur, Difference between Entrepreneur and Entrepreneurship, Types of entrepreneurs. New generations of entrepreneurship viz. social entrepreneurship, Edupreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc., Barriers to entrepreneurship, Creativity and entrepreneurship, Innovation and inventions, Skills of an entrepreneur, Decision making and Problem Solving.
UNIT – 2 **INSTITUTIONAL SUPPORT FOR ENTREPRENEURSHIP** Organization Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) license, Environmental Clearance, National Small Industries Corporation (NSIC), e-tender process, Excise exemptions and

concession, Exemption from income tax, The Small Industries Development Bank of India(SIDBI), Incentives for entrepreneurs.

TEXT BOOKS:

1. K. Ramachandran "Entrepreneurship Development", Tata Mc. Graw Hill, 2008
2. Sangeeta Sharma "Entrepreneurship Development," PHI Publications, 2016

REFERENCE BOOKS:

1. Baringer and Ireland "Entrepreneurship" 11th Edition, Pearson, 2020.
2. P. Narayana Reddy" Entrepreneurship – Text and Cases" Cengage Learning India, I edition, 2010
3. Paul Burns "Corporate Entrepreneurship: Building The Entrepreneurial Organization"
4. Drucker F Peter,:"Innovation and Entrepreneurship",.Heinemann, London. 1985.

JOURNALS/MAGAZINES

1. International Small Business Journal: https://journals.sagepub.com/home/isb
2. Journal of Development Entrepreneurship: https://www.worldscientific.com/worldscinet/jde

SWAYAM/NPTEL/MOOCs:

Entrepreneurship: https://nptel.ac.in/courses/110/106/110106141/

SELF-LEARNING EXERCISES:

1. Introverts participate. If you have a few vocal students asking questions and little participation from others, anonymous questions lower student anxiety, which makes it easier for everyone to participate.
2. You learn what students are thinking about. Anonymity provides cover for students to ask questions they may be too afraid to ask but are curious about.
3. Discussions start. Anonymity means you can invite students to pose "challenging" questions. If you encourage your students to question what they're learning, why it's important, or why they should have to do the work you're assigning, you spark discussions about how entrepreneurship is relevant, which can often be the key to increasing engagement.

PROBLEM BASED LEARNING

Sl.	
1	How to write a Business Plan
2	Creating Marketing, Financial and Organizational Plans.
3	How to apply for financial assistance via various schemes
4	How to file taxes as a Small Business and understand the importance of GST

<table>
<tr><td>Course Title</td><td colspan="4">Computer Aided Engineering Drawing</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>B20ME0101</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Theory</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>0</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>4</td><td>4</td><td>26</td><td>26</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

Engineering Graphics or drawing is known as language of engineers. All phases of engineering process require the conversion of new ideas and design concepts into the basic line language of graphics. There are many areas such as civil, mechanical, electrical, architectural, computer, electronics and industrial applications where knowledge and skills of the drawing play major roles in the design and development of new products or construction. This course emphasizes on projection of point, line, surfaces and solids. It also provides knowledge about representing the object in terms of 3d view and also development of the object.

COURSE OBJECTIVE (S):

The objectives of this course are to

1. Introduce the students to various concepts like dimensioning, conventions and standards of engineering drawings in order to become professionally efficient
2. Enable students to learn about the software tool to prepare engineering drawings
3. Teach the students about the concepts and principles of orthographic projections, development of lateral surfaces and isometric projection of simple solids
4. Communicate the concept/idea with others through the language of technical drawing and sketching

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Construct the simple 2D drawings manually and also by using CAD software	1,5,10,12	1
CO2	Draw orthographic projection of point, line, plane surfaces and simple solids	1,3,5,10, 12	1
CO3	Draw sectional views of a prisms, pyramids, cone and cylinder	1,3,5,10, 12	1
CO4	Develop the lateral surfaces of the solids	1,2, 3,5,10, 12	1,2,3
CO5	Create isometric view of the solids	1,3,5,10, 12	1

BLOOM'S LEVELOF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4				√		
CO5				√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3					3		2	3		
CO2	3		2		3					3		2	3		
CO3	3		2		3					3		2	3		
CO4	3	2	2		3					3		3	3	3	2
CO5	3		2		3					3		3	3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY

Contents
UNIT – 1 Introduction – Geometrical constructions, engineering drawing standards, Introduction to CAD Software. Orthographic projection of points in first and third Quadrant only. Orthographic projection of straight lines inclined to both horizontal and vertical planes. Orthographic projection of regular plane surfaces when the surface is inclined to both HP and VP.
UNIT – 2 Orthographic projection of regular solids like prisms, pyramids cone and cylinder when the axis is inclined to both HP and VP.
UNIT – 3 Sections of solids – Drawing sectional views and true shape of section, Development of surfaces- Parallel line method for prisms and cylinders, Radial line method for pyramids and cones.

UNIT – 4

Isometric projections of simple and combined solids.

PRACTICE:

Sl. No.	Practice	Tools and Techniques	Expected Skill /Ability
1.	Use of solid edge software and familiarization of tools	Solid Edge Software	Use of commands to draw the drawings
2.	Draw the projection of point locating in first and third quadrant	Solid Edge Software	Analyzing and software skill
3.	Draw the projection of lines locating in first quadrant	Solid Edge Software	Draw the views of the line and software skill
4.	Draw the projection of rectangular and pentagonal lamina inclined to both HP and VP	Solid Edge Software	analyzing and software skill
5.	Draw the projection of hexagonal and circular lamina inclined to both HP and VP	Solid Edge Software	analyzing and software skill
6.	Draw the projection of prisms inclined to both HP and VP	Solid Edge Software	interpretation and software skill
7.	Draw the projection of pyramids inclined to both HP and VP	Solid Edge Software	interpretation and software skill
8.	Draw the projection of cone and cylinder inclined to both HP and VP	Solid Edge Software	interpretation and software skill
9	Draw the projection of section of solids in simple position	Solid Edge Software	analyzing and software skill
10	Develop the lateral surface of prisms and cylinder	Solid Edge Software	Creative and software skill
11	Develop the lateral surface of pyramids and cone	Solid Edge Software	Creative and software skill
12	Draw the isometric projection of simple plane surface and simple solids	Solid Edge Software	Analyzing and software skill
13	Draw the isometric projection of two co-axial solids	Solid Edge Software	Analyzing and software skill

TEXT BOOKS:

1. K. R. Gopalakrishna, "Engineering Graphics", Subhas Publications, 2012.
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.

REFERENCE BOOKS:

1. "Fundamental of Engineering Drawing", Luzadder and Duff, Prentice hall of India Pvt Ltd. 11th Edition, 2001.

2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/112/103/112103019/
2. https://www.udemy.com/course/ed/

PROBLEM BASEDLEARNING

Sl.	Problems
1	A point 30 mm above XY line is the front view of two points A and B. The top view of A is 40 mm behind VP and the top view of B is 45 mm in front of VP. Draw the projections of the points and state the Quadrants in which the points are situated.
2	A point 'A' is 30 mm in front of VP & 40 mm above HP. Another point B is 20 mm behind VP & 35 mm below HP. The horizontal distance between the points measured parallel to XY line is 60 mm. Draw the three projections of the points. Join their front and top views.
3	A point P is on HP and 35 mm in front of VP. Another point Q is on VP and below HP. The line joining their front views makes an angle of 300 to XY line, while the line joining their top views makes an angle of 450 with XY line. Find the distance of the point Q from HP.
4	A point is 35 mm below HP, 20 mm behind VP and 25 mm behind / in front / from RPP. Draw its projections and name the side view.
5	A line AB 80 mm long is inclined to HP at 30 degree and inclined to VP at 45degree. Draw front and top views of line and determine their lengths. Also, measure the perpendicular distance of end B from both HP & VP.
6	A line AB has its end A 20 mm above the HP and 30 mm in front of VP. The other end B is 60 mm above HP and 45 mm in front of VP. The distance between end projectors is 70 mm. draw its true length and apparent inclinations.
7	The top view pq of a straight line is 70 mm and makes an angle of 60 degree with XY line. The end Q is 10 mm in front of VP and 30 mm above HP. The difference between the distances of P and Q above HP is 45 mm. draw the projections. Determine its true length and true inclinations with HP and VP.
8	The top view of a line 75 mm long measures 50 mm. The end P is 30 mm in front of VP and 15 mm above HP. The end Q is 15 mm in front of VP and above HP. Draw the projections of the line and find its true inclinations with HP and VP.
9	The distance between the end projectors through the end points of a line AB is 60 mm. the end A is 10 mm above HP and 15 mm in front of VP. The end B is 35 mm in front of VP. The line AB appears 70 mm long in the front view. Complete the projections. Find the true length of the line and its inclinations with HP and VP.
10	The point B of a line AB is on the horizontal plane, the top view of the line makes an angle of 30 degree with XY line, being 80 mm. the point A is on the vertical plane and 50 mm above the horizontal plane. Draw the top and front views of the line and obtain the true length of the line. Also find the inclinations of the line with two planes.

11	The end A of a line AB is in HP and 25 mm in front of VP. The end B is 10 mm in front of VP and 50 mm above HP. The distance between the end projectors when measured parallel to the line of intersection of HP and VP is 80 mm, Draw the projection of the line AB and determine its true length and true inclination with HP and VP.
12	Find the true length and true inclination of a line AB with HP having one of its ends 20 mm in front of VP and 30 mm above the HP. The line is inclined at 40 degree to VP and left side view of the line is 60 mm long and inclined at 60degree to the x1y1 line. Draw all the three views of the line.
13	An equilateral triangular lamina of 25mm side lies with one of its edges on HP such that the surface of the lamina is inclined to HP at 60degree. The edge on which it rests is inclined to VP at 60degree. Draw its projections.
14	A 30 degree-60degree setsquare of 60mm longest side is kept such that the longest side is in HP, making an angle of 30 degree with VP. The set square itself is inclined at 450 to HP. Draw the projections of the setsquare.
15	A square lamina ABCD of 40mm side rests on corner C such that the diagonal AC appears to be at 45 degree to VP. The two sides BC and CD containing the corner C make equal inclinations with HP. The surface of the lamina makes 30 degree with HP. Draw its top and front views.
16	A mirror 30 mm x 40 mm is inclined to the wall such that its front view is a square of 30 mm side. The Longer sides of the mirror appear perpendicular to both HP and VP. Find the inclination of the
17	A pentagonal lamina of sides 25 mm is resting on one of its edges on HP with the corner opposite to that edge touching VP. This edge is parallel to VP and the corner, which touches VP, is at a height of 15 mm above HP. Draw the projections of the lamina and determines the inclinations of the lamina with HP and VP and the distance at which the parallel edge lies from VP.
18	A pentagonal lamina of sides 25 mm is having a side both on HP and VP. The corner opposite to the side on which it rests is 15 mm above HP. Draw the top and front views of the lamina.
19	Draw the top and front views of a hexagonal lamina of 30mm sides having two of its edges parallel to both vertical and horizontal planes and one of its edges is 10 mm from each of the planes of projection. The surface of the lamina is inclined at an angle of 60° to the HP.
20	A hexagonal lamina of sides 30 mm has one of its comers in VP and its surface inclined at an angle of 30° with VP. The diagonal passing through that corner which is in VP appears to be inclined at 45° to HP. Draw the projections of the lamina.
21	A hexagonal lamina of sides 25 mm rests on one of its corners on HP. The corner opposite to the corner on which it rests is 35mm above HP and the diagonal passing through the corner on which it rests is inclined at 30° to VP. Draw its projections. Find the inclination of the surface with HP.

22	Draw the projections of a circular plate of negligible thickness of 50 mm diameter resting on HP on a point A on the circumference, with its plane inclined at 45° to HP and the top view of the diameter passing through the resting point makes 60° with VP.
23	A circular lamina inclined VP appears in the front view as an ellipse of major axis 30 mm and minor axis 15 mm. The Major- axis is parallel to both HP and VP. One end of the minor axis is in both the HP and VP. Draw the projections of the lamina and determine the inclination of the lamina with the VP.
24	A square prism 35mm side of base & 60mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30^o. Draw the projections of the prism when the axis is inclined to HP at 45^o
25	A pentagonal prism 25mm sides of base & 60mm axis length rests on HP on one of its edges of the base. Draw the projections of the prism when the axis is inclined to HP at 40^o & VP at 30^o
26	A Hexagonal prism 25mm sides of base and 50mm axis length rests on HP on one of its edges. Draw the projections of the prism when the axis is inclined to HP at 45^o & appears to be inclined to VP 40^o.
27	A cone 40 mm diameter and 50 mm axis is resting on one generator on HP which makes 30^o inclination with VP. Draw it's projections.
28	A pentagonal pyramid 25mm sides of base and 50mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30^o .Draw the projections of the pyramid when the axis is inclined to HP at 45^o
29	A hexagonal pyramid 30mm sides of base and axis 70mm long is resting on its base on HP with one of the edges of the base parallel to VP. It is cut by sectional plane, perpendicular to VP, inclined at 30° to HP and bisects the axis. Draw the front view, sectional top view & true shape of the section.
30	A vertical cylinder of base diameter 50 mm and axis 65 mm long rests on HP. It is cut by a section plane perpendicular to VP, inclined at 45 degree to HP and at a height of 30mm from the base. Draw its sectional top view and true shape of the section.
31	A hexagonal pyramid 30mm sides of base and axis 70mm long is resting on its base on HP with one of the edges of the base parallel to VP. It is cut by sectional plane, perpendicular to VP, inclined at 30° to HP and bisects the axis. Draw the front view, sectional top view & true shape of the section.
32	A square pyramid base 40mm side and axis 65mm long has its base on HP and all the edges of the base are equally inclined to VP. It is cut to with an inclined plane so as the truncated surface at 45 degree to axis, bisecting it. Draw the development of the truncated pyramid.
33	A Hexagonal prism of base side 30mm and axis length 60mm resting on HP in such a way that two of its edges are parallel to VP. The prism is cut by a section plane which is perpendicular to the VP and inclined at 30^o to the HP at a height of 35mm from the base. Draw the development of the lateral surface of the prism.
34	A pentagonal prism, 30 mm base side & 50 mm axis is standing on HP on its base whose one side is perpendicular to VP. It is cut by a section plane 45 degree inclined to HP, through mid-point of axis.
	Draw FV, sectional top view& sec. Side view. Also draw true shape of section and Development of surface of remaining solid.

35	A hexagonal pyramid 25mm side of base and axis 65mm long is resting on its base on HP with one of the edged of the base parallel to VP. It is cut by a section plane inclined at 60º to HP and perpendicular to VP and intersecting the axis at 30mm above the base. Draw the development of the remaining portion of the pyramid.
36	A cone of base diameter 40 mm and height 50 mm is placed centrally on the top of a square slab side 60 mm and height 25 mm. Draw the isometric projection of the combination.
37	A sphere of diameter 45mm rests centrally over a frustum of cone of base diameter 60mm,top diameter 40mm and height 50mm.Draw its isometric projections.
38	A cube of 35 mm placed centrally on a square slab of 50 mm and thickness 30 mm. Draw the isometric projection of the combination.
39	Draw the isometric projection of the combination. Draw isometric projection of a hexagonal prism of side of base 40mm and height 60mm with a right circular cone of base 40mm as diameter and altitude 50mm, resting on its top such that the axes of both the solids are collinear.
40	A rectangular pyramid of base 40mmx25mm and height 50mm is placed centrally on a rectangular slab side 100mmx60mm and thickness 20mm.Draw the isometric projection of the combination.

PROJECT BASED LEARNING

To enhance the skill-set in the integrated course, the students are advised to execute course-based **Design projects**. Some sample projects are given below:

Sl. No.	Suggested Projects
1	Model making of different solids by using Hardbound sheet.
2	Using Hardbound sheet, prepare the different solids models by development and section methods.
3	Prepare a demo model to show the principle of orthographic projection.
4	Prepare the models for showing the method of Isometric projection.
5	Problem based on Practical approach in view of orthographic projection of lines and planes.
6	Collection or Interpretation of Engineering Drawing sheets Related to Manufacturing, Civil construction, Layouts, Plans and other Applications.
7	Study on Comparison of 3D views and isometric Views.
8	Drawing the Plan of students Home or building (2D)

III SEMESTER
Detailed Syllabus

Sl. No	Course Code	Title of the Course	HC/FC/ SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20AS0305	Linear algebra and Partial Differential Equations	FC	3	0	0	3	4
2	B20EN0301	Linear Integrated Circuits	HC	3	0	1	4	5
3	B20EP0301	Digital Electronics and Verilog	HC	3	0	1	4	5
4	B20EP0302	Design and Analysis of Algorithms	HC	2	0	1	3	4
5	B20EN0304	Problem solving using C Programming	HC	2	0	1	3	4
TOTAL				**14**	**0**	**3**	**17**	**22**
Practical /Term Work / Sessional								
6	B20EN0305	Course based project on Linear Integrated Circuits	HC	0	0	1	1	2
7	B20AS0303	Environmental Science	FC	2	0	0	2	2
8	B20MG0301	Management Science	FC	2	0	0	2	2
9	B20AHM301/ B20AHM302	Advanced Kannada/Basic Kannada	MC	1	0	0	0	1
TOTAL				**5**	**0**	**1**	**5**	**7**
TOTAL SEMESTER CREDITS					**22**			
TOTAL CUMULATIVE CREDITS					**62**			
TOTAL CONTACT HOURS					**29**			

Course Title	Linear Algebra and Partial Differential Equations				Course Type		UG	
Course Code	B20AS0305	Credits	3		Class		III Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-			IA	SEE
	Practice	-	-	-	Theory	Practical		
	Total	3	3	3	39	0	50%	50%

COURSE OVERVIEW:

Linear algebra is the study of linear systems of equations, vector spaces and linear transformations. Solving systems of linear equations is a basic tool of many mathematical procedures used for solving problems in Science and Engineering. The objective of the course is to give introduction to Partial Differential Equations for undergraduate students.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the concepts of linear algebra and solving of system of equations Y = AX.
2. Understand the concepts of basis, dimension, and linear transformation.
3. Understand vector differentiation, div, grad and curl.
4. learn about formation and solving partial differential equations

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of Linear Algebra in Image processing and digital signal processing.	1,2,3,4	1,2
C02	Solve Engineering problems using Rayleigh Power method to find largest Eigen value and Eigen vector	1,2,3,4	1,2
CO3	Apply the knowledge of vector spaces in engineering like digital communication.	1,2,3,4	1,2,3

CO4	Find Surface integral and volume integral of given function to prove Stokes and Divergence theorem	1,2,3,4	1,2,3
CO5	Apply the knowledge of vector calculus in engineering like field theory.	1,2,3,4	1,2
CO6	Apply the knowledge of PDE in solving heat equation, wave equation and Laplace equation	1,2,3,4	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√		
CO2	√	√	√	√	√	
CO3	√	√	√	√	√	
CO4	√	√	√	√	√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2										2	2	1
CO2	3	2	2	2									2	2	1
CO3	3	3	2	1									2	2	1
CO4	3	2	2										2	2	1
CO5	3	3	2	1									2	2	1
CO6	3	3	2	1									2	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents

UNIT - 1 Linear Algebra: Rank of matrix, Echelon form, (*reference-Normal form: one example), Solution of a system of linear equations by Gauss elimination (*reference-Gauss –Jordan methods: one example), Gauss seidel iterative method, Rayleigh Power method to find the largest Eigen value and corresponding Eigen vector. Linear and Inverse transformation. Diagonalization of a matrix, Reduction of a quadratic form to canonical form by orthogonal transformation
UNIT - 2 Vector Space: Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis vectors, dimension of a vector space. Linear transformations- definition, properties and problems. Rank- Nullity theorem (without proof). Matrix form of linear transformations-Illustrative examples
UNIT - 3 Vector Calculus: Curves in space, tangents and normal, Velocity and acceleration related problems, scalar and vector point functions-Gradient, Divergence and curl, directional derivatives. Solenoidal and irrotational vector fields. Vector identities-div ($\emptyset A$), curl ($\emptyset A$), curl (grad$\emptyset$), div (curl A). Line integral-Circulation-work, Surface integral: Green's Theorem, Stokes Theorem.
UNIT - 4 Partial differential equations: Formation of Partial differential equations by eliminating arbitrary constants and arbitrary variables. Equations solvable by direct integration, Solution of Lagrange's linear PDE. Method of variable separable-D heat equation, 1-D wave equation. Non-linear equations of the first order. Charpits method.

Textbooks:

1.B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd edition, 2015.

2.Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.

Reference Books:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.

2. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition, 2014.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

https://www.journals.elsevier.com/linear-algebra-and-its-applications/most-downloaded-articles

https://www.researchgate.net/publication/304178667_A_Study_on_the_Linear_Algebra_Matrix_in_Mathematics

https://www.sciencedirect.com/journal/linear-algebra-and-its-applications/vol/1/issue/1

http://vmls-book.stanford.edu/vmls.pdf

https://www.researchgate.net/publication/317685719_A_Study_of_General_First-order_Partial_Differential_Equations_Using_Homotopy_Perturbation_Method

https://www.journals.elsevier.com/partial-differential-equations-in-applied-mathematics/

SWAYAM/NPTEL/MOOCs:

https://www.youtube.com/watch?v=LJ-LoJhbBA4&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7

https://www.youtube.com/watch?v=9h_Q-R6sXbM&list=PL7oBzLzHZ1wXQvQ938Wg1-soq09GywgOw
https://www.youtube.com/watch?v=Kk5SEzASkZU&list=PL9m2Lkh6odgKbfY03TFRhwjOqW79UdzK8

https://www.youtube.com/watch?v=W3HXK1Xe4nc&list=PLbPn3CUduj5TPQtrwfI70F1SW4LvPf90d

https://www.youtube.com/watch?v=Nonfmx0-LQQ

Course Title	Linear Integrated Circuits				Course Type		HC(Integrated)	
Course Code	B20EN301	Credits	4		Class		III Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practical	1	2	2				
	-							
	Total	4	5	5	39	26	50%	50%

COURSE OVERVIEW:

Linear Integrated Circuits introduces the basic building blocks of Operational amplifiers, stabilization techniques, testing and feedback techniques. The Course also introduces to the design of applications related to analog computation, measurements, rectification, active filtering, timers, Data Converters. This course supports acquiring of knowledge in analysis and design of IC based circuits.

COURSE OBJECTIVES:

The objectives of this course are:

1. Understand the internal components and characteristics and frequency response of Operational amplifier.
2. Explain the linear, non-linear applications of Op-Amp and active filters.
3. Comprehend the applications of Op-Amp as comparators, waveform generators, VCO and PLL operation and its application
4. Discuss various applications of special function Op-Amp ICs such as 555 IC, Voltage Regulator IC
5. Understand the performance of various types of ADC and DAC using Op-Amp

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the internal components, characteristics and frequency response of Op-Amp.	1,2,3,4,5,9, 10	1,2,3
CO2	Identify the linear, non-linear applications of Op-Amp and active filters.	1,2,3,4,5,9, 10	1,2,3
C03	Analyze the operational amplifier applications as Wave form generators.	1,2,3,4,5,9, 10	1,2,3
CO4	Categorize Op-Amp based comparators, waveform generators, VCO and PLL operation and its application.	1,2,3,4,5,9, 10	1,2,3
CO5	Design various applications of special function Op-Amp ICs such as 555 timer, Voltage Regulator IC.	1,2,3,4,5,9, 10	1,2,3
CO6	List and compare the performance of various types of ADC and DAC using Op-Amp	1,2,3,4,5,9, 10	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level

	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√		
CO2	√	√	√	√		
CO3	√	√	√	√		
CO4	√	√	√	√		
CO5	√	√	√	√		
CO6	√	√	√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1				1	1			3	3	1
CO2	3	3	3	2	1				1	1			3	3	1
CO3	3	3	3	2	1				1	1			3	3	1
CO4	3	3	3	2	1				1	1			3	3	1
CO5	3	3	3	2	1				1	1			3	3	1
CO6	3	3	3	2	1				1	1			3	3	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents

UNIT – 1

OP-AMPS Frequency Response, Compensation, and applications:

Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Block diagram of Op-Amp, Modes of Operation - Inverting, Non-Inverting, Circuit stability, frequency and phase response,

UNIT – 2

Non-linear applications of OP-AMP

Clamping circuits, peak detectors, Sample and hold circuit, V-I and I-V converter, Log and Antilog amplifiers, Multiplier and Divider, Triangular/Rectangular waveform generators, waveform generator design, Crossing detectors

UNIT – 3

Voltage regulators, 555 timer and PLL

Series op-amp regulator, IC voltage regulator, 723 general purpose regulators, 555 timer-basic timer circuit, 555 timer used as Astable and Monostable multivibrator, IC565 PLL – Block Schematic, Description of Individual Blocks

UNIT – 4

DATA CONVERTERS:

Introduction, DAC and ADC Specifications. Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Different Types of ADCs - Parallel Comparator Type ADC, Single and dual slope ADC, Successive Approximation ADC,

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Study the characteristics of negative feedback amplifiers	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
2	Design and Test Instrumentation amplifier	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
3	Design and testing of second order low pass filter and high pass filter	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team

4	Design of second order band pass.	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
5	Design and testing of Schmitt Trigger circuit for the given values of UTP and LTP	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
6	Design and testing of Astable multi-vibrator circuits using IC 555 for given frequency and duty cycle.	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
7	Design and testing of PLL	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
8	Design and testing of a rectangular and triangular wave generator.	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
9	Design and testing of integrator and differentiator circuit. .	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
10	Design and testing of a voltage regulator circuit using op-Amp	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team

TEXT BOOKS:

David A Bell, "Operational amplifiers and Linear ICs", PHI/Pearson, 2nd edition, 2004

D. Roy Choudhury and Shail B Jain, " Linear Integrated Circuits", New Age International, 2nd edition, 2006

R. Gayakwad, "Op-amps and Linear Integrated Circuits" (4/e), PHID. A. Bell, Solid state Pulse Circuits (4/e), PHI, 2009

REFERENCE BOOK:

Thomas L. Floyd, David Buchla, “Basic Operational Amplifiers and Linear Integrated Circuits”, Prentice Hall, 1999

Bruce Carter,” Op Amps for Everyone”, ISBN: 978-0-12-391495-8, Fourth Edition.

BIS, ISO standards and Datasheet

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

IEEE transactions on Circuits and Systems

https://en.wikipedia.org/wiki/List_of_linear_integrated_circuits

http://www.fairchildsemi.com/an/AN/AN-88.pdf

https://www.onsemi.com/pub/Collateral/AN-118.pdf.pdf

https://www.onsemi.com/pub/Collateral/AN-140.pdf.pdf

https://web.archive.org/web/20130502174545/http://www.fairchildsemi.com/an/AN/AN-340.pdf

SWAYAM/NPTEL/MOOCs:

https://nptel.ac.in/courses/108/108/108108111/

https://www.coursera.org/lecture/electronics/2-1-introduction-to-op-amps-and-ideal-behavior-Q5Di2

https://www.coursera.org/lecture/electronics/2-5-active-filters-L2ASa

https://www.coursera.org/lecture/sensors-circuit-interface/3-basic-amplifiers-sojqu

https://www.coursera.org/lecture/internet-of-things-sensing-actuation/op-amps-kxEOi

https://static1.squarespace.com/static/60494675b50d044ae4a81842/t/604a10a95e0cc12e7de634d5/1615466669126/analog_circuit_design_coursera.pdf

Course Title	Digital Electronics and Verilog				Course Type		HC(Integrated)	
Course Code	B20EP0301	Credits	4		Class		III Semester	
	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				

	Practical	1	2	2				
	-	-	-	-				
	Total	4	5	5	39	26	50%	50 %

COURSE OVERVIEW:

Electronics is classified based on the type of signal/information into Analog Electronics and Digital Electronics. Digital Electronics deals with signal/information represented using discrete values of 0's and 1's (Binary). Digital electronics are designed using logic gates/circuits and are usually represented using Boolean Equations. Digital Electronics is further classified into Combinational Logic/Circuits and Sequential Logic/Circuits.

Hardware Description Language (HDL) is a computer –Aided Design tool for modern design and synthesis of digital systems. Due to the complexity in design of digital systems, such systems cannot be realized using discrete integrated circuits. They are usually realized using high density, programmable chips, such as Field programmable Gate Arrays (FPGAs). The two widely used hardware description languages are VHDL and Verilog. This course develops students' ability to understand and design the basic building blocks of modern digital systems and provides them with a fundamental knowledge for complicated digital hardware design

COURSE OBJECTIVES:

The objectives of this course are:

Provide the basics behind the digital circuit design in terms of all the necessary building blocks.

Illustrate Boolean laws and systematic techniques for minimization of expressions.

Introduce the Basic concepts of combinational and sequential logic.

Provide foundations of different styles of descriptions in HDLs.

Highlight the Design techniques of digital modules by using different styles of HDL descriptions.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Define a Boolean term, expression, SOP, POS, Min-term etc.	1,2,3	1,3

CO2	Construct the K-map from a Boolean expression and to find the minimal SOP/POS forms	1,2,3,4,5	1,3
CO3	Design digital circuits using gates, encoders, decoders, multiplexers, and de-multiplexers	1,2,3,4,5, 10,11	1,3
CO4	Interpret the output and performance of given combinational and sequential circuits.	1,2,3,4,5, 10,11	1,3
CO5	Summarize the different styles of Verilog programming and its applications.	1,2,3,4,5, 10,11	1,3
CO6	Distinguish Verilog models for realizing combinational and sequential circuits	1,2,3,4,5, 10,11	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1							3			2		3
CO2	3	2	3	1	3					3			2		3
CO3	3	2	3	1	3					3	2		2		3
CO4	3	2	3	1	3					3	2		2		3
CO5	3	2	3	1	3					3	2		2		3
CO6	3	2	3	1	3					3	2		2		3

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1 Principle and Minimization Techniques of combinational: Introduction to combinational logic circuits, generation of switching equation from truth table. Minimization Techniques: Boolean algebra, expression minimization. Min-term, Max-term, Sum of Products (SOP), Product of Sums (POS), Karnaugh map, incompletely specified functions, Introduction to Digital Logic Families. Analysis and Design of Combinational Circuits: Adder/Subtractor, Carry Look Ahead adder, BCD adder. Principle of Encoder and Decoder with cascading of decoders. Principle of Multiplexers and Demultiplexer with cascading of Mux and Boolean function implementation using Mux and decoders, Comparators.
UNIT – 2 Introduction to Sequential circuit: Basic bi-stable element, S R Latch, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation. Registers, Shift Register, Counters: Binary Ripple Up/Down Counter, Design of synchronous Mod- n counter using flip-flop. Design & Applications of Digital Circuits: Sequential Design: Introduction to Mealy and Moore Model circuits. State machine notation, Synchronous sequential circuit analysis and construction of state table and diagram. Case study: sequence generator.
UNIT - 3 Verilog Programming concepts: Structure of Verilog Program, Operators, Data types Data Flow Description: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type –Vectors, Introduction to signal declaration and assignment statements, assigning delays to signal assessment statement, Programs based on Data Flow Description.
UNIT - 4 Introduction to Behavioral Description: Highlights and Structure of HDL Behavioral Description, Introduction to formats of sequential statements with examples. Programs Based on Behavioral Description. Structural Description: Highlights of Structural Description, Organization of the Structural Description Case Study: 1. Design of Shift register module using behavioral description

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Realization of parallel Adder and Subtractor.	Trainer Kit, IC’s, patch cords	Design and circuit debugging. Working in a team
2	Realization of 3 bit Binary to Grey code conversion and vice versa using basic/Universal gates.	Trainer Kit, IC’s, patch cords	Design and circuit debugging. Working in a team
3	Realization of 4:1 MUX and 1:4 DEMUX using basic/universal gates.	Trainer Kit, IC’s, patch cords	Design and circuit debugging. Working in a team
4	Arithmetic circuit realization (Half/Full, Adder/Subtractor) using MUX.	Trainer Kit, IC’s, patch cords	Design and circuit debugging. Working in a team
5	Construction and verification of JK master slave, T, D flip flop using logic gates.	Trainer Kit, IC’s, patch cords	Design and circuit debugging. Working in a team
6	Construction and realization of n-bit ripple up/down counter using IC 7476 and other logic gates.	Trainer Kit, IC’s, patch cords	Design and circuit debugging. Working in a team
7	Design and verification of n-bit synchronous counter using 7476 JK, T and D flip flops.	Trainer Kit, IC’s, patch cords	Design and circuit debugging. Working in a team
8	Write a Verilog program for the following modules – Decoder, Encoder with and without priority, Multiplexer, De-multiplexer, Comparator	Xilinx Software, FPGA Board	Design and circuit debugging. Working in a team
9	Write a Verilog code to describe function of full adder in data flow, behavioral and structural style	Xilinx Software, FPGA Board	Design and circuit debugging. Working in a team

10	Write Verilog code for a 4-bit binary, BCD counters with synchronous and asynchronous reset	Xilinx Software, FPGA Board	Design and circuit debugging. Working in a team
11	Write a Verilog code to control speed and directions of a Stepper motor	Xilinx Software, FPGA Board, Stepper Motor	

TEXTBOOKS:

John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 1st Edition, 2001.

Nazeih M Botros,"HDL Programming : VHDL and Veriolog" Dreamtech Press, 6th Edition 2006.

REFERENCE BOOK:

Samir Palnitkar "Verilog HDL" Pearson Education

Donald D Givone, "Digital Principles and Design", Tata McGraw-Hill 1st Edition, 2002.

D P Leach, A P Malvino, &GouthamSaha, "Digital Principles and applications", Tata McGraw-Hill, 7th Edition, 2010.

Moshe Morris Mano, "Digital Design" Prentice Hall, 3rd Edition, 2008.

Chales H Roth,Jr., "Fundamentals of Logic Design", Cengage learning, 5th Edition, 2004

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

https://ieeexplore.ieee.org/document/1085417

https://www.sciencedirect.com/book/9780340645703/introduction-to-digital-electronics

http://ecc.journalspub.info/index.php?journal=IJDE

https://learnabout-electronics.org/Digital/dig20.php

SWAYAM/NPTEL/MOOCs:

https://nptel.ac.in/courses/117/106/117106086/

https://nptel.ac.in/courses/108/105/108105132/

https://nptel.ac.in/courses/106/105/106105165/

https://www.coursera.org/lecture/cs-algorithms-theory-machines/digital-circuits-91A4N

https://www.coursera.org/learn/digital-systems

Course Title	Design and Analysis of Algorithms				Course Type		UG	
Course Code	B20EP0302	Credits	3		Class		III Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	2	2	2				
	Tutorial	-	-	-				
	Practice	1	2	2				
	-	-	-	-				
	Total	3	4	4	26	26	50%	50 %

COURSE OVERVIEW:

Course describes the various techniques for designing algorithms and for analyzing the time and space efficiency of algorithms. The algorithm design techniques include divide-and-conquer, Decrease-and-Conquer Approach, Greedy algorithms, Dynamic programming and Space and Time Trade-Offs. The algorithm analysis includes computational models, Best/Average/Worst case analysis, and computational complexity (including lower bounds and NP-completeness).

COURSE OBJECTIVES:

The objectives of this course are:

To provide an understanding of algorithmic way to solve Engineering challenges and describe basics of algorithms in various domains.

To provide and understanding the use of appropriate algorithmic design techniques for a given problem.

To design of algorithms using the dynamic programming; greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy.

To discuss the various design approaches based on time and space efficiency.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Determine various aspects of algorithm development of engineering challenge.	1,2,3	1,3

CO2	Determine the right combination of data structures that need to be used for solving the algorithm using a typical computer system.	1,2,3	1,3
CO3	Analyze divide and conquer approach algorthms	1,2,3	1,3
CO4	Apply the algorithmic way of solutions development for typical challenges.	1,2,3,5	1,3
CO5	Design the pseudo code level of solution and optimum utilization of computing system.	1,2,3,5	1,2
CO6	Design and analyze backtracking algorithms	1, 2,3,5	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓	✓	✓			
CO3	✓		✓	✓		
CO4	✓			✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3		1								3	2	3
CO2	3	2	1		1								2	1	3
CO3	3	1	2		1								3	2	3
CO4	3	2	1		1								3	2	1
CO5	3	2	1		1								3	2	1
CO6	3	2	1		1								2	1	3

COURSE CONTENTS:

CONTENTS

UNIT - 1

Introduction-Notion of an Algorithm and Brute Force Approach: Fundamentals of Algorithmic Problem Solving; Fundamentals of the Analysis of Algorithm Efficiency- The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive Algorithms, Mathematical Analysis of Recursive Algorithms, Brute Force Approach: Selection sort, Bubble sort, Sequential search, and String Matching.

UNIT - 2

Divide-and-Conquer and Decrease-and-Conquer Approach: Divide and Conquer: Mergesort, Quicksort, Binary Search; Decrease-and-Conquer: Insertion Sort, Topological Sorting, Depth-First Search and Breadth-First Search.

UNIT - 3

Greedy Approach and Dynamic programming: Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman trees and codes. Dynamic Programming: Fibonacci numbers, The Knapsack Problem, Warshall's Algorithm and Floyd's Algorithm for the all-pairs shortest paths problem.

UNIT - 4

Space and Time Trade-Offs: Sorting by Counting, Input Enhancement in String Matching, Coping with the Limitations of Algorithm Power. Backtracking: N-Queens Problem, Subset-Sum Problem, and Hamiltonian Circuit Problem. Branch-and-Bound: Assignment Problem, Knapsack Problem, Travelling Salesman Problem.

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill/Ability
1	Selection Sort Algorithm Linear Search Algorithm	Brute force Technique	Basic Programming skills
2	Bubble Sort Algorithm String Matching	Brute force Technique	Basic Programming skills
3	Matrix Multiplication Binary Search Algorithm	Divide-and-Conquer Approach	Basic Programming skills
4	Quicksort and Mergesort Algorithm	Divide-and-Conquer Approach	Basic Programming skills

5	DFS and BFS Algorithm	Decrease-and-Conquer Approach	Basic Programming skills
6	Insertion Sort Algorithm	Decrease-and-Conquer Approach	Basic Programming skills
7	Prim's and Kruskal's Algorithm	Greedy Technique	Basic Programming skills
8	Dijkstra's Algorithm	Greedy Technique	Basic Programming skills
9	Warshall's Algorithm Floyd's Algorithm	Dynamic Programming	Basic Programming skills
10	Subset-Sum Problem	Backtracking	Basic Programming skills

TEXTBOOKS:

Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson, 3rd Edition, 2012.

Ellis Horowitz, Satraj Sahni and Rajasekaran, Computer Algorithms/C++, Universities Press, 2nd Edition, 2014.

REFERENCE BOOK:

Michael Goodrich, Roberto Tamassia, Algorithm Design and Applications, Wiley Publishers, 1st Edition, 2014

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

https://www.mdpi.com/journal/algorithms/sections/algorithms_analysis_complexity_theory

https://www.mdpi.com/journal/algorithms

SWAYAM/NPTEL/MOOCs:

https://nptel.ac.in/courses/106/106/106106131/

https://onlinecourses.nptel.ac.in/noc19_cs47/preview

https://www.coursera.org/learn/analysis-of-algorithms

Course Title	Problem Solving Using C Programming			Course Type	UG(Integrated)
Course Code	B20EN0304	Credits	3	Class	III Semester

	LTP	Credits	Contact Hours	Work Load	Total Number of Classes		Assessment in	
					Theory	Practical	IA	SEE
	Lecture	2	2	2				
	Tutorial	-	-	-				
	Practical	1	2	2				
	-	-	-	-				
	Total	3	4	4	26	26	50%	50 %

COURSE OVERVIEW:

C is a general-purpose, high-level language that was originally developed by Dennis M. Ritchie to develop the UNIX operating system at Bell Labs. C programming is a general-purpose, procedural programming language used to develop software like operating systems, databases, compilers, and so on. The main features of C language include low-level access to memory, a simple set of keywords, and clean style. Many later languages have borrowed syntax/features directly or indirectly from C language. Like syntax of Java, PHP, JavaScript, and many other languages are mainly based on C language.

COURSE OBJECTIVES:

The objectives of this course are:

Provide exposure to problem solving through C programming

Explore the structure and syntax of C programming language

illustrate the applications of data types, operators, arrays, and control flow statements in problem solving.

Demonstrate the usage of procedure-oriented programming.

Provide insight into concepts like pointers, structures, and unions

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Develop an algorithm/flowchart to solve the computational problems	1,2,3,5	1,2,3
CO2	Solve data processing applications using appropriate data types, operators, and flow control statements .	1,2,3,4,5,10	1,2,3

CO3	Write C programs using derived data types like arrays and strings to operate on block of data	1,2,3,4,5,10	1,2,3
CO4	Solve complex problems using procedure-oriented (modular) programming approach	1,2,3,4,5,10	1,2,3
CO5	Design and develop computer programs using the concept of pointers, structures, and unions	1,2,3,4,5,10	1,2,3
C06	Demonstrate the creation of file and file operations in C-language	1,2,3,4,5,10	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	□	□	□			
CO2	□	□	□			
CO3	□	□	□			
CO4	□	□	□	□		
CO5	□	□	□		□	
CO6	□	□	□			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	2					1			2	2	1
CO2	3	3	2	1	3					1			3	2	
CO3	3	3	2	1	3					1			3	3	2
CO4	3	3	3	1	3					1			3	3	2
CO5	3	3	3	1	2					1			3	2	3
CO6	3	3	3	1	2					1			3	2	3

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents

UNIT - 1

Introduction to C-language: Algorithms and flowcharts with some conceptual examples.

Program development: Editor, compiler, interpreter, loader, linker, Integrated Development Environment(IDE).

C language and its features, Structure of C program, C tokens, Keywords and Identifiers, Variables, constants, Data types, Input / output functions. Operators and Expressions: Arithmetic Operators, Operators Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional, Special Operators, Evaluation of expressions, Precedence of arithmetic operators.

UNIT - 2

Flow control statements and Arrays: Conditional branching : if, if-else, nested if, else if, switch statements.

Unconditional branching: break , continue , goto, and return statements.

Looping statements: while, do-while and for loops, Loops with break and continue.

Arrays: Single dimensional and two-dimensional arrays, Strings as array of characters, String operations using library

UNIT - 3

Functions, Structures & Union: Function declaration, definition, and calling, Parameter passing mechanisms, call by value & call by reference, Recursion and related examples, Scope of variables : Global, local, and static variables.

Structures & Union : Introduction, Structure definition, declaring and initializing Structure variables, accessing

UNIT - 4

Pointers and File Operations : Introduction to pointers, Accessing the address of variable , Declaring, and initializing pointers, Accessing a variable through its pointer , Pointer types, Pointer expressions, Accessing arrays through pointers.

File Operations: Open, close, read, write, and append operations, reading from file and writing into files using programs, File positioning and built-in file handling functions.

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability

1	Write a Program to calculate and display the volume of a CUBE by reading its height, width and depth from keybiard.	Algorithm, Flowchart, C compiler.	Reading values from input device, calculating and writing results on output device.
2	Write a program to take input of name, rollno and marks obtained by a student in 4 subjects of 100 marks each and display the name, rollno with percentage score secured. NOTE: Also write same program for three students.	Algorithm, Flowchart, C compiler.	Reading values from input device, calculating and writing results on output device.
3	a. Write a program to print whether a given number is even or odd. b. Write a program to print even numbers from 1 to 10.	Algorithm, Flowchart, C compiler.	Writing program skills with conditional statements.
4	a. Write a Program to Check Whether a Number is Prime or not. b. Write a program to find the factorial of a number.	Algorithm, Flowchart, C compiler.	Writing program skills with conditional & looping statements.
5	a. Write a program to find whether a character is consonant or vowel using switch statement. b. Write a program to print the sum of numbers from 1 to 10 using for loop.	Algorithm, Flowchart, C compiler.	Writing program skills with conditional & looping statement.
6	a. Write a program to create an integer array of size 5, read values from input device and print the values of the array. b. Write a Program to Search an element in array.	Algorithm, Flowchart, C compiler.	Writing program skills with array creation and operations on it.

7	a. Write a program to calculate factorial of a number using recursion. b. Write a program to add, subtract, multiply and divide two integers using user-defined type function with return type. c. Write a program to swap two integers using call by value and call by reference methods of passing arguments to a function.	Algorithm, Flowchart, C compiler.	Writing program skills with function declaration and definition.
8	a. Write a C program to create, declare and initialize structure. b. Write a program to declare, initialize an UNION.	Algorithm, Flowchart, C compiler.	Writing program skills with structure and union.
9	a. Write a program to find biggest among three numbers using pointer. b. Write a program to swap value of two variables using pointer. c. Write a program to swap to array using pointers.	Algorithm, Flowchart, C compiler.	Writing program skills with pointers.
10	a. Write a program to create a file called ‘record’ and store information about a person, in-terms of his name, age, and salary. b. Write a program to illustrate how a file stored on the disk is read.	Algorithm, Flowchart, C compiler.	Writing program skills with file handling.

TEXT BOOKS:

B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, Pentice Hall Software Series, 2005.

Herbert Schildt, “C: The Complete Reference”, 4th edition, Tata McGraw Hill, 2000.

Nanjesh Bennur, Dr. C. K. Subbaraya, “Programming in C”, 2nd Edition, Excellent Publishing House, 2015.

REFERENCE BOOK:

E. Balaguruswamy," Programming in ANSI C", 4th edition, Tata McGraw Hill, 2008.

Donald Hearn, Pauline Baker, "Computer Graphics C Version", second edition, Pearson Education, 2004.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

Web: https://www.tutorialspoint.com/cprogramming/index.htm

Journal: "The C programming language and a C compiler", by IBM;

link: https://ieeexplore.ieee.org/document/5387762

Journal: "Research and Development of C Language Programming Experiment Assistant Management Platform Based on Hybrid Architecture", by Elsevier;

link: https://www.sciencedirect.com/science/article/pii/S1877705811020534

SWAYAM/NPTEL/MOOCs:

SWAYAM/NPTEL: "Introduction to Programming in C";

link: https://onlinecourses.nptel.ac.in/noc19_cs42/preview

link: https://nptel.ac.in/courses/106/104/106104128/

MOOC: "Introductory C Programming"

link: https://www.coursera.org/specializations/c-programming

Course Title	Course Based Project on Linear Integrated Circuits				Course Type		[illegible]	
Course Code	B20EN0305	Credits	1		Class		III Semester	
	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	1	2	2				

	-	-	-	-				
	Total	1	2	2	-	26	50%	50 %

Course Based Project/Project Based Learning has been considered a good approach in improving education in Engineering, because, this approach facilitates learning difficult subjects, encourages active learning, and allows developing both the Engineering skills and transversal skills by using a 'learning environment that simulates a real professional challenge'.

Execution:

1. The project is carried out by team of two or three students (student team).

2. Each Student team is guided and monitored by Faculty, the Course coordinator for Linear Integrated Circuits will be the Coordinator for Course based Project(CBP) Course.

3. The problem is the trigger of the learning process. The CBP approach is based on open problems, which are defined by faculty in context of Industry needs and current situation. The problems are assigned randomly to student teams.

4. The activities for each week will be assigned.

5. The Hands-On activities, along with short lectures, are included to facilitate learning key concepts, present the main aspects of the theory, and improve the background theory of students.

6. In the laboratory training, students carry out practices according to the project stages.

Assessment and Evaluation:

1. The Internal assessment is made on written reports, oral presentation and demonstration of project results with developed model in phase wise by Faculty in charge.

2. The external evaluation is made on written reports, oral presentation and demonstration of project results with developed model at the end of the semester by Examiner.

COURSE OVERVIEW:

Course Title	Environmental Science				Course Type	EC
Course Code	B20AS0303	Credits	2		Class	III Semester
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes	Assessment in

	Lecture	2	0	0	Per Semester		Weightage	
	Tutorial	-	-	-				
	Practical	-	-	-				
	-	-	-	-	Theory	Practical	IA	SEE
	Total	2	0	0	26	-	50%	50 %

COURSE OBJECTIVES:

The objectives of this course are:

1.Graduates will be familiar with current and emerging environmental engineering and global issues, and have an understanding of ethical and societal responsibilities.

2. Graduates will have the ability to obtain the knowledge, and will recognize the need for engaging in life-long learning.

3. Will find the need of various types of energy (conventional & non-conventional) resources and natural resources.

4. Acquire knowledge with respect to biodiversity, threats, conservation and appreciate the concept of ecosystem.

5. Acquire knowledge about sources, effects and control measures of environmental pollution, degradation and waste management

6. Explore the ways for protecting the environment

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand, analyse and execute favourable environmental conditions and the role of individual, government and NGO in environmental protection	6,7,9	1
CO2	List the causes, effects & remedial measures and find ways to overcome them by suggesting the pollution-controlled products.	6,7,9	1
CO3	Classify different wastes, sources of waste and their effect on population	6,7,9	1

CO4	Demonstrate various water conservation methods and suggest appropriate technique for conservation of water	6,7,9	1
CO5	Get motivation to find new renewable energy resources with high efficiency through active research and innovation.	6,7,9	1
C06	Critically analyse the ecological imbalances and provide recommendations to protect the environment.	6,7,9	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	□	□	□			
CO2	□	□	□			
CO3	□	□	□			
CO4	□	□	□			
CO5	□	□	□			
CO6	□	□	□			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2	3		1				1		
CO2						2	3		1				1		
CO3						2	3		1				1		
CO4						2	3		1				1		
CO5						2	3		1				1		
CO6						2	3		1				1		

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT – 1 Basics of environment: Introduction & definition to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment. 4 Hr Environmental protection: Role of Government - Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Environmental Legislations, Initiative and Role of Non-government organizations in India and world. 3 Hr Self study: Need for public awareness on the environment, Gaia Hypothesis

UNIT – 2

Environmental pollution, degradation & Waste management:

Environmental Pollution: Definition, sources and types, Pollutant-Definition & classification, Concepts of air pollution, water pollution, Soil pollution, Automobile Pollution-Causes, Effects & control measures. 3Hr

Environmental degradation: Introduction, Global warming and greenhouse effect,

Acid rain-formation & effects, Ozone depletion in stratosphere and its effect. 2 Hr

Waste management: Municipal solid waste, Biomedical waste and Electronic waste

(E-Waste). 2 Hr

Self study: Case studies of London smog, Bhopal gas tragedy, marine pollutions and study of different waste water treatment processes, Disaster management, early warning systems-bio indicators for Tsunami and other natural disasters.

UNIT – 3

Energy & Natural resources:

Energy: Definition, classification of energy resources, electromagnetic radiation-features and applications, Conventional/Non-renewable sources – Fossil fuels based (Coal, petroleum & natural gas), nuclear energy, Non-conventional/renewable sources – Solar, wind, hydro, biogas, biomass, geothermal, ocean thermal energy, Hydrogen as an alternative as a future source of energy. 4Hr

Natural resources:

Water resource - Global water resource distribution, Water conservation methods, Water quality parameters, Uses of water and its importance.

Mineral resources - Types of minerals, Methods of mining & impacts of mining activities.

Forest wealth - Importances, Deforestation-Causes, effects and controlling measures 3Hr

UNIT – 4

Ecology, ecosystem & field work:

Ecology-Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Characteristics of an Ecosystem - Ecosystem Resilience, Ecological succession and productivity, Balanced ecosystem, Components of ecosystem-abiotic and biotic, biological diversity.

3Hr

Biogeochemical cycles and its environmental significance – Carbon and nitrogen cycle, Energy flow in ecosystem, food chains –types, food web & Ecological Pyramids. 2Hr

Field work:

Visit to waste water treatment and biogas plant at REVA university campus, and/or

Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. 2Hr

TEXT BOOKS:

REFERENCE BOOK:

1.R.J. Ranjit Daniels and Jagadish Krishnaswamy, “Environmental Studies”,

Wiley India Private Ltd., New Delhi, Co-authored & Customised by Dr.MS Reddy & Chandrashekar, REVA University, 1st Edition, 2017.

2. R.J. Ranjit Daniels and Jagadish Krishnaswamy, “Environmental Studies”, Wiley India Private Ltd., New Delhi, 2nd Edition, 2014.

3. Benny Joseph, “Environmental Studies”, Tata McGraw – Hill Publishing

Company Limited, New Delhi, 2nd Edition, 2008.

4. Dr.S.M.Prakash, “Environmental Studies”, Elite Publishers, Mangalore, 2nd Edition, 2009.

5. Rajagopalan R, “Environmental Studies – from Crisis to cure”, Oxford University Press, New Delhi, 3rd Edition, 2016.

6. Anil Kumar Dey and Arnab Kumar Dey, “Environmental Studies”, New age international private limited publishers, New Delhi, 2nd Edition, 2007.

7. Michael Allaby, “Basics of environmental Science”, Routledge-Tayler & Francis

e-library, New York, 2nd Edition, 2002.

8. Dr.Y.K Singh, “Environmental Science”, New age international private limited publishers, New Delhi, 1st Edition, 2006.

COURSE OVERVIEW: Course	Management Science				Course Type			
Course Code	B20MG030	Credits	2		Class		III Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes		Assessment in	
	Lecture	2	0	0				
	Tutorial	-	-	-				
	Practical	-	-	-				
	-	-	-	-	Theory	Practical	IA	SEE
	Total	2	0	0	26	-	50%	50 %

COURSE OBJECTIVES:

The objectives of this course are:

The course intends to familiarize students to understand the management principles and applications, which lays a strong foundation for managers and leaders in critical thinking and decisions making process. The course emphasizes on giving an overview of the functional area of management

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs

CO1	Plan organizational structure for a given context in the organisation	1,2,3	1
CO2	Carry out production operations through Work-study.	1,2,3	1
CO3	Apply various principles in quality control.	1,2,3	1
CO4	Understand the market, customers and competition to fix better price for the given product appropriately.	1,2,3	1
CO5	Plan and control the HR function better.	1,2,3	1
C06	Evolve a strategy for a business or service organization.	1,2,3	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	□	□	□	□		
CO2	□	□	□	□		
CO3	□	□	□	□		
CO4	□	□	□	□		
CO5	□	□	□	□		
CO6	□	□	□	□		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									1	2	3		1		
CO2									1	2	3		1		
CO3									1	2	3		1		
CO4									1	2	3		1		
CO5									1	2	3		1		
CO6									1	2	3		1		

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT – 1 Introduction to Management and Organization: Concepts of Management and organization- nature, importance and Functions of Management. Systems Approach to Management - Taylor's Scientific Management Theory- Taylor's Principles of Management, Maslow's theory of Hierarchy of Human Needs- Douglas McGregor's Theory X and Theory - Hertzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management. Designing Organizational Structures: Basic concepts related to Organization Depart mentation and Decentralization.
UNIT – 2 Operations and Marketing Management: Principles and Types of Plant Layout-Methods of Production(Job, batch and Mass Production), Work Study --Basic procedure involved in Method Study and Work Measurement - Business Process Reengineering(BPR) Statistical Quality Control: control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality. Objectives of Inventory control, EOQ, ABC Analysis. Purchase Procedure, Stores Management and Store Records - JIT System, Supply Chain Management, Functions of Marketing, Marketing Mix. And Marketing Strategies based on Product Life Cycle. Channels of distribution.
UNIT – 3 Human Resources Management (HRM): Concepts of HRM. HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR.. Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development. Placement, Wage and Salary Administration, Promotion. Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating -Capability Maturity Model (CMM) Levels - Performance Management System.
UNIT - 4 Strategic Management and Contemporary strategic Issues: Mission, Goals, Objectives, Policy, Strategy. Programmes, Elements of Corporate Planning Process, Environmental Scanning. Value Chain Analysis, SWOT Analysis. Steps in Strategy Formulation and implementation, Generic. Strategy alternatives. Bench Marking and Balanced Score and as Contemporary Business Strategies.

EXT BOOKS:

REFERENCE BOOK:

I. Kotler Philip and Keller Kevin Lane, Marketing Management, Pearson, New York, 15th Edition, 2012.

2. Koontz and Weihrich: Essentials of management, McGraw Hill, New Delhi, 11th Edition, 2012.

3. Thomas N. Duening and John M. Ivancevich, Management - Principles and Guidelines, Dreamtech Press; 1st Edition, 2012.

4. Samuel C. Certo, Modern Management, Prentice Hall, New York, 9th Edition, 2012.

5. Schermerhorn, Capling, Poole and Wiesner, Management, Wiley, New York, 6th Edition, 2012.

6. John A. Parnell, Strategic Management – Theory and Practice, Cengage Publications, 2018.

7. Lawrence R Jauch, R. Gupta and William F. Glucek: Business Policy and Strategic Management Science, McGraw Hill, New York, 5th Edition, 2012.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

SWAYAM/NPTEL/MOOCs:

REVA UNIVERSITY
Bengaluru, India

ರುಕ್ಮಿಣಿ ಜ್ಞಾನವನ, ಕಟ್ಟಿಗೇನಹಳ್ಳಿ, ಯಲಹಂಕ, ಬೆಂಗಳೂರು – 560064

ಕನ್ನಡಿಗರಿಗೆ ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ಪಠ್ಯ

ಪರಿವಿಡಿ

ಘಟಕ – 1 : **ಕವಿತೆಗಳು**

1. ಬೆಳಗು – ದ ರಾ ಬೇಂದ್ರೆ
2. ಕಲ್ಕಿ – ಕುವೆಂಪು

ಘಟಕ – 2 : **ಕಥೆಗಳು**

3. ಗಾಂಧಿ – ಬೆಸಗರಹಳ್ಳಿ ರಾಮಣ್ಣ
4. ಸೆರೆ – ಯಶವಂತ ಚಿತ್ತಾಲ

ಘಟಕ – 3 : **ವಿಜ್ಞಾನ ಲೇಖನಗಳು**

5. ಆನೆಹಳ್ಳದಲ್ಲಿ ಹುಡುಗಿಯರು – ಬಿ ಜಿ ಎಲ್ ಸ್ವಾಮಿ
6. ವೃತ್ತಿಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಮಾಧ್ಯಮ – ಎಸ್ ಸುಂದರ್

ಘಟಕ – 4 : ಪರಿಸರ ಲೇಖನಗಳು

7. ಚೀಂಕ್ರ ಮೇಸ್ತ್ರಿ ಮತ್ತು ಅರಿಸ್ಟಾಟಲ್ – ಕೆ ಪಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ
8. ಗುಬ್ಬಚ್ಚಿಯ ಗೂಡು – ಪಿ ಲಂಕೇಶ್

- ಬಿ ಎಂ ಎಸ್ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು ಕನ್ನಡಿಗರಿಗೆ **'ಕನ್ನಡ ಕಲಿ'** ಪಠ್ಯ ಪುಸ್ತಕ
- ಕರ್ನಾಟಕ ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ವಿಭಾಗ ಕನ್ನಡಿಗರಿಗೆ **ಸಾಹಿತ್ಯ ಸಿಂಚನ'** ಪಠ್ಯ ಪುಸ್ತಕ
- ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ ಕನ್ನಡಿಗರಿಗೆ **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯ ಪುಸ್ತಕ

ಹಲವಾರು ಪಠ್ಯಪುಸ್ತಕಗಳು ಇಂಜಿನಿಯರಿಂಗ್ ವಿಭಾಗದಲ್ಲಿ ಕನ್ನಡ ಬೋಧನೆಗೆ ಬಳಕೆಯಲ್ಲಿದ್ದು ಜೊತೆಗೆ ಬಿಎಡ್ ಕನ್ನಡ ಕಲಿಕೆಯ ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ರೇವಾ ವಿಶ್ವವಿದ್ಯಾಲಯದ ತಾಂತ್ರಿಕ ವಿಭಾಗದ ಕನ್ನಡಿಗರು ಮತ್ತು ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಇಷ್ಟವಾಗುವ ಮತ್ತು ಪ್ರಯೋಜನಕಾರಿಯಾಗುವ ಪಠ್ಯ ಪುಸ್ತಕವನ್ನು ತರಗತಿಗಳು ಪ್ರಾರಂಭವಾಗುವುದರ ಒಳಗೆ ಸಿದ್ಧಪಡಿಸಲಾಗುವುದು.

- ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ ಕನ್ನಡೇತರರಿಗೆ **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯ ಪುಸ್ತಕ
- ಬಿ ಎಂ ಎಸ್ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು ಕನ್ನಡೇತರರಿಗೆ **'ಕನ್ನಡ ಮನಸ್ಸು'** ಪಠ್ಯ ಪುಸ್ತಕ
- ಕರ್ನಾಟಕ ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ವಿಭಾಗ ಇವರು **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯ ಪುಸ್ತಕ ತಂದಿದ್ದಾರೆ.

ಹಲವಾರು ಪಠ್ಯಪುಸ್ತಕಗಳು ಇಂಜಿನಿಯರಿಂಗ್ ವಿಭಾಗದಲ್ಲಿ ಕನ್ನಡ ಬೋಧನೆಗೆ ಬಳಕೆಯಲ್ಲಿದ್ದು ಜೊತೆಗೆ ಬಿಎಡ್ ಕನ್ನಡ ಕಲಿಕೆಯ ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ರೇವಾ ವಿಶ್ವವಿದ್ಯಾಲಯದ ತಾಂತ್ರಿಕ ವಿಭಾಗದ ಕನ್ನಡಿಗರು ಮತ್ತು ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಇಷ್ಟವಾಗುವ ಮತ್ತು ಪ್ರಯೋಜನಕಾರಿಯಾಗುವ ಪಠ್ಯ ಪುಸ್ತಕವನ್ನು ತರಗತಿಗಳು ಪ್ರಾರಂಭವಾಗುವುದರ ಒಳಗೆ ಸಿದ್ಧಪಡಿಸಲಾಗುವುದು.

IV SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20EP0401	Discrete Mathematics and Graph Theory	FC	3	1	0	4	5
2	B20EP0402	Relational Database Management Systems	HC	2	0	1	3	4
3	B20EP0403	Control Systems Engineering	HC	3	0	1	4	5
4	B20EN0403	Microcontroller and Applications	HC	3	0	1	4	5
5	B20EN0404	Object Oriented Programming and Data Structures using C++	HC	2	0	1	3	4
TOTAL				**13**	**1**	**4**	**18**	**23**
Practical /Term Work / Sessional								
6	B20EN0405	Course Based project on Microcontroller and Applications	HC	0	0	1	1	2
7	B20AH0301	Communication Skills	FC	2	0	0	2	2
8	B20LS0301	Indian Constitution and Professional Ethics	FC	2	0	0	2	2
9	B20AHM401	Universal Human Values	MC	0	0	0	0	1
TOTAL				**4**	**0**	**1**	**5**	**7**
TOTAL SEMESTER CREDITS					**23**			
TOTAL CUMULATIVE CREDITS					**85**			
TOTAL CONTACT HOURS					**30**			

Course Title	**Discrete Mathematics and Graph theory**				Course Type		Hard Core	
Course Code	**B20AS0402**	**Credits**	**3**		Class		IV Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	1	2	2				
	Practical	-	-	-	Theory	Practical	IA	SEE
	Total	4	5	5	52		50%	50 %

COURSE OVERVIEW:

This is an introductory course in discrete mathematics and graph theory. The goal of this course is to introduce students to ideas and techniques from discrete mathematics and elements of graph theory that are widely used in science and engineering. This course teaches the students techniques in how to think logically and mathematically and apply these techniques in solving problems. To achieve this goal, students will learn logic and proof, sets, functions, as well as algorithms and mathematical reasoning. Key topics involving relations, graphs, trees, and formal languages and computability are covered in this course.

COURSE OBJECTIVES:

The objectives of this course are to:

Provide information related to operations on discrete structures such as sets, relations and functions.

Illustrate the use of Algebraic structures and how to carry out operations on them.

Provide insights into induced subgraphs, cliques, matchings, covers in graphs

Illustrate the different types of graphs viz. Hamiltonian and/or Eulerian

Introduce the techniques or proofs and analysis.

Model real world problems in the form of algorithmic steps using graph theory.

Provide insights graph theory based tools in solving practical problems

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Discuss diagram strategies for potential proofs in logical sequential order without mathematical symbols (plain English). Construct mathematical arguments using logical connectives and quantifiers.	1,2,3,4	1,2,3
CO2	classify different types of relations and functions and be able to summarize their properties.	1,2,3,4	1,2,3
CO3	Use graphs as a tools to visualize and simplify situations.	1,2,3,4	1,2,3
CO4	Apply algorithm to solve problems, (Critical Thinking)	1,2,3,4	1,2,3
CO5	Translate real-world problems into probability mode	1,2,3,4	1,2,3
CO6	Apply Sampling distribution to solve Engineering problems	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√	√	
CO2	√	√	√	√	√	
CO3	√	√	√	√	√	
CO4	√	√	√	√	√	
CO5	√	√	√	√	√	
CO6	√	√	√	√	√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1									2	2	1
CO2	3	2	2	2									2	2	1
CO3	3	3	2	1									2	2	1
CO4	3	2	2	1									2	2	1
CO5	3	3	2	1									2	2	1

CO6	3	3	2	1									2	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1 Set Theory & Logic: Set theory fundamental operations ; propositions; negation; disjunction and conjunction; implication and equivalence; truth tables; laws of Logic; predicates; quantifiers; rules of Inference; methods of proofs.
UNIT - 2 Relations and Functions: representation of relations by graphs; properties of relations; equivalence relations and partitions; Functions, Composition, and Inverse Functions.
UNIT - 3 Introduction to Graph theory: Konigsberg's Bridge problem, Utilities problem, Seating Problems, graphs, Representation of graphs, Directed graphs, incidence, adjacency, degree, Indegree , out degree, regular graphs, complete graphs, Null graphs, Bipartite graphs, Isomorphism, Directed graphs, Sub graphs, Walk, Trail, Path, Cycle, Connected and Disconnected graphs, Weakly Connected and Strongly Connected, Components, Complement of Graph, Partition , Decomposition
UNIT - 4 Eulerian , Hamiltonian Graph and Graph coloring: Operation on graphs, Definition of Euler Trail, Euler graph, Standard theorems on Euler graphs Hamiltonian Path, Hamiltonian Cycle and Hamiltonian Graph, Standard theorems on Hamiltonian Graph, Planar graph, Detection of Planarity, Geometric dual, Euler formula, Graph coloring, Chromatic polynomial, Map coloring, Four color theorem, Five Color theorem,, Matching, Network flow and its applications, Cut set, Cut vertex, Chord, Properties of Cut set, Max flow Min cut theorem.

Self-learning component: Application of concepts to Data mining techniques like Classification, Association, Clustering, Regression Analysis.

Text Books:

1. Kenneth H Rosen , Discrete mathematics and its application, McGraw Hill, Sept. 2002

2. Englewood cliffs, Graph theory and its applications tp Engineering and computer science, Prentice Hall, 1974.

3. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall, 2014. 2. Ralph P Grimaldi, Discreteand Combinatorial mathematics, Pearson Education, 5th edition, 2014.

Reference Books:

1. V.Krishnamurthy, Combinatorics: Theory and Applications, East-West Press Pt. Ltd., Delhi, 1986.

2. J. Tremble, Manohar, Discrete Mathematical Structures with applications to computer Science McGraw Hill pub. 1975.

3. Richard Kohar, Basic Discrete Mathematics: Logic, Set Theory, and Probability, World Scientific

Publishing Company, 1st Edition, 2017

4. Oscar Levin, Discrete mathematics: An Open Introduction, CreateSpace Independent Publishing

Platform, 2nd edition, 2016

5. Springer Journal of Number Theory and Discrete Mathematics.

6. Frank Harary, "Graph Theory", Narosa, 2013. 2. J.A Bondy and U.S.R Murthy, Graph Theory with applications, Macmillan, 2013 3. GeirAgnarsson and Raymond Geenlaw ; Graph Theory modeling, Applications and algorithms, Pearson Education, 2007. 4. Douglas B, “Introduction to Graph Theory”, Prentice Hall of India, 2nd edition, 2015.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

http://pfister.ee.duke.edu/courses/ece586/notes_ch1.pdf

https://www.researchgate.net/publication/332254891_Relations_and_Functions

https://www.researchgate.net/publication/314062405_Discrete_Mathematics_Sets_Relations_and_Functions

https://dgtstudy.com/media/media/study_material/2020-04-06/DGT_Sets_Relations_and_Functions.pdf

https://www.maths.ed.ac.uk/~v1ranick/papers/wilsongraph.pdf

https://www.researchgate.net/publication/317895972_Introduction_to_Graph_Theory

https://www.math.utah.edu/mathcircle/notes/MC_Graph_Theory.pdf

http://faculty.nps.edu/rgera/MA4027/A%20First%20Course%20in%20Graph%20Theory%20-%20Gary%20Chartrand.pdf

SWAYAM/NPTEL/MOOCs:

https://www.youtube.com/watch?v=xlUFkMKSB3Y

https://www.youtube.com/watch?v=0uTE24o3q-o https://www.youtube.com/watch?v=E40r8DWgG40&list=PLEAYkSg4uSQ2fXcfrTGZdPuTmv98bnFY

https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862D1A947252D20

https://www.youtube.com/watch?v=0wfLKljzatA&list=PLYrahs7hsYIQiSNxTfZndQz7jWPXsA1ur

Course Title	Relational Database Management Systems (RDBMS)				Course Type			
Course Code	B20EP0402	Credits	4		Class		IV Semester	
	TLP	Credits	Contact Hours	Work Load	Total Number of Classes		Assessment in	
	Theory	2	2	2				
	Tutorial	-	-	-				
	Practice	1	2	2				
	-							
	Total	3	4	4	26	26	50%	50 %

COURSE OVERVIEW:

This course introduces topics such as conceptual data modeling, relational data model, relational query languages, and relational database design. It helps the students to gain fundamental concepts, techniques and applications in database.

COURSE OBJECTIVES:

The objectives of this course are:

To provide a knowledge of Database architecture

To provide students to understand and use a relational database system

To introduction to Databases, Conceptual design using ERD, Functional dependencies and Normalization, Relational Algebra.

To introduce about concepts of creating a good database and use various SQL operations

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs

CO1	Define and understand basic terminologies of DBMS.	1,2,3	1,2,3
CO2	Differentiate between File and Database and identify Database users, Administrators & Designers	1,2,3	1,2
CO3	Explain DBMS architecture and ER Model	1,2,3	1,2
CO4	Distinguish Attributes and Entity	1,2	1,2
CO5	Draw ER diagram for the given example and identify the constraints used in ER diagram	1,2,3,4	1,2,3
CO6	Explain Hashing techniques, Index structures, Relational Model & Joint operations	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create(L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓		✓		
CO3	✓				✓	
CO4	✓			✓		
CO5	✓	✓		✓		
CO6	✓					✓

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1									1	2	
CO2	3	1	1	1									3	1	
CO3	3	2		1									3	3	2
CO4	3	2		1									3	2	
CO5	3	2	1	1									3	2	
CO6	3	1	2	1									3	1	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1 Introduction to databases and Conceptual Modelling Introduction, characteristics of the database approach, data models, schemas, instances, database languages and interfaces, Using high-level conceptual data models for database design, a sample database application, entity types, attributes, keys, relationship types, weak entity types, ER diagrams, naming conventions, design issues.
UNIT - 2 Relational Data Model and Relational algebra Relational model concepts, relational model constraints and relational database schemas, update operations, transactions, dealing with constraint violations, unary relational operations, select and project, relational algebra operations from set theory, binary relational operations, join and division, additional relational
UNIT - 3 SQL SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, insert, delete, update statements in SQL, additional features of SQL, schema change statements in SQL, retrieving data using the SQL Select Statement, Restricting and sorting data, Using Single row functions, Joins, More complex SQL retrieval queries, views in SQL.
UNIT - 4 Database Design Theory and Normalization Informal design guidelines for relation schemas, Functional dependencies, Normal forms based on primary keys, General definitions of second and third normal forms, Other Normal forms. Transactions and Recovery: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions. Introduction to recovery, Recovery Concepts, Shadow Paging, The Aries Recovery Algorithm

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Creation of COMPANY database	MySQL software	Familiarization of SQL Commands
2	Creation of INSURANCE database	MySQL software	Familiarization of SQL Commands
3	Craetion of BANK database	MySQL software	Familiarization of SQL Commands
4	Creation of Order Processing database	MySQL software	Familiarization of SQL Commands
5	Creation of STUDENT database	MySQL software	Familiarization of SQL Commands

TEXT BOOKS:

Elmasri and Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2007.

Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2003

Phill Pratt, "Concepts of Database Management, Cengage Learning", 8th Edition, 2014.

Jeffrey A Hoffer, "Modern Database Management, Pearson", 12th Edition, 2015.

REFERENCE BOOK:

Abraham Silberschatz, Henry F. Korth, S. Sudarshan: "Database System Concepts", 6th Edition, McGraw Hill, 2010.

C J Date, "Database Design and Relational Theory: Normal Forms and All that Jazz", O 'Reilly, April 2012.

James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi

IEEE Transactions on Knowledge and Data Engineering

Elsevier Data and Knowledge Engineering

ACM Transactions on Database Systems

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

https://ieeexplore.ieee.org/document/1456366

https://ieeexplore.ieee.org/abstract/document/1054507

https://onlinelibrary.wiley.com/toc/10991131a/4/1

https://www.youtube.com/watch?v=00ZbuhPruJw

https://www.youtube.com/watch?v=beFoCZ7oMyY

https://www.youtube.com/watch?v=A6BRXPqxya0

SWAYAM/NPTEL/MOOCs:

Course Title	Control Systems Engineering				Course Type		UG	
Course Code	B20EP0403	Credits	4		Class		IV Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Tutorial	-	-	-				
	Practice	1	2	2				
	-	-	-	-				
	Total	4	5	5	39	26	50%	50 %

COURSE OVERVIEW:

In this course covers the transfer function modelling and state space modelling of electrical and mechanical system. The dynamic and steady state time domain response system is discussed. This course also covers stability criteria and stability analysis of system by root locus, RH criteria, Bode plot and Nyquist plot. The state space modelling methods in different canonical form and transformation from transfer function model to state space and vice versa and different methods of calculating state variable and calculating output variable is covered. The concept of controllability and observability and control system design using state space is briefly discussed.

COURSE OBJECTIVES:

The objectives of this course are:

To provide an understanding of system modeling.

To provide and understanding on the system response with and without feedback.

To provide a detailed understanding of time domain and frequency domain behavior of a system

To have an understanding of stability analysis of the system and its significance

To introduce the state variable approach for linear invariant system in both continuous time and discrete time for the analysis and design of system.

To design stable system in state space by pole placement method.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the concept of modeling of systems for simple mechanical and electrical system.	1,2,4,10	1, 2
CO2	Write the Transfer function using various techniques like using differential equations, Block diagrams, signal flow graphs.	1,2,3,4,10	1
CO3	Apply time domain and frequency domain analyses technique to determine stability of system.	1,2,4,10	1,2
CO4	Design and verify the stability of a system	1,2,3,4,10	1, 3
CO5	Model a system in state space and solve state space equation.	1,2,4,10	1, 3
CO6	Identify the control solution possibility by applying controllability test and observability test.	1,2,4,10	1, 3

BLOOM’S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom’s Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓			
CO2	✓					
CO3			✓			
CO4			✓			
CO5			✓			

CO6		✓				

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		2						1			3		2
CO2	3	3	3	1						1			3		
CO3	2	3		2						1			3		2
CO4	3	3	2	3									3	3	
CO5	3	3		3						1			3		2
CO6	2	1		2						1			1		2

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1 Modeling of Systems: Modeling and writing Transfer function (Both Electrical & Mechanical), Block Diagram reduction, Signal flow graph.
UNIT - 2 Stability of linear feedback system: Concept of stability, RH Criteria, Relative Stability, RH Application. Case study Root locus: Introduction to root locus, Procedure and problems, Effect of addition of pole zero to open loop systems. Case study
UNIT - 3 Frequency Response method: Introduction to Bode plots Performance measurement from Bode plots, problems on Bode plots case study. Introduction to Nyquist criteria, Relative Stability, Comparison (Time domain & frequency domain), Problems on Time domain & frequency domain, case study

UNIT - 4

State space analysis: Introduction, concept of state variable and state model, state model for linear continuous time systems, state variable and linear discrete-time systems, Diagonalization, solution of state equation, concept of controllability and observability, pole placement by state feedback, problems.

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Time response of first order system	MATLAB Software	Apply and test concepts of control system
2	Time response of second order system	MATLAB Software	Apply and test concepts of control system
3	Steady-state Error	MATLAB Software	Apply and test concepts of control system
4	Stability of system based on pole position	MATLAB Software	Apply and test concepts of control system
5	Root Locus Analysis.	MATLAB Software	Apply and test concepts of control system
6	Stability analysis of a system based using Bode Plot	MATLAB Software	Apply and test concepts of control system
7	Time response of PID controller.	MATLAB Software	Apply and test concepts of control system
8	Stability analysis of a system using Nyquist Plot	MATLAB Software	Apply and test concepts of control system
9	Design of control system in state space using pole placement.	MATLAB Software	Apply and test concepts of control system

TEXTBOOKS:

J. Nagarath and M.Gopal, “Control Systems Engineering”, New Age International (P) Limited, Publishers, Fourth edition – 2005

K. Ogata, “Modern Control Engineering “, Pearson Education Asia/ PHI, 4thEdition, 2002

REFERENCE BOOK:

W.Bolton, “Instrumentation and control Systems”, Addison Wesley Publishing, ISBN: 0 2 -0 1997.

Richard Dorf& Robert H Bishop, “Modern Control Systems”, Addison Wesley Publishing; ISBN: 0-201-32677-9, 2008.

Benjamin C. Kuo and Farid Golnaagi, “Automatic Control Systems”, Wiley Student 8th Edition, 2009.

Joseph J Distefano III et al., Schaum’sOutlines, “Feedback and Control System”, TMH, 2nd Edition 2007.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

https://www.controleng.com/magazine/

https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=37

http://ieeecss.org/publication/ieee-control-systems-magazine

https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=87

http://ieeecss.org/publication/transactions-control-systems-technology

SWAYAM/NPTEL/MOOCs:

https://nptel.ac.in/courses/107/106/107106081/

https://nptel.ac.in/courses/108/106/108106098/

https://www.udemy.com/course/control-systems-engineering/

Course Title	Microcontrollers and Applications				Course Type			
Course Code	B20EN0403	Credits	4		Class		IV Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practice	1	2	2				
	-	-	-	-				
	Total	4	5	5	39	26	50%	50 %

COURSE OVERVIEW:

This course introduces 8051 microcontroller to provide basic understanding of architecture, instruction set, assembly level programming, interfacing to various sensors, relays, motors, actuators through various types of serial and parallel communication. Timers and interrupt functions are illustrated through the selection and control activities using suitable programming platforms such as Assemblers, C compilers, Kiel, , etc. This fundamental knowledge on microcontrollers lead to explore large number of controller families like ATMEGA, TI and PIC that are used in industrial and automation applications.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce Microcontroller 8051 Architecture.

2. Give an insight into instruction set of microcontroller 8051.

3. Introduce assembly and C programming for 8051.

4. Provide insight into timer, serial communication and interrupts modules of 8051.

5. Interface a microcontroller with peripheral devices.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the Architecture of 8051 microcontroller.	1,2,4	1,3
CO2	Describe Instruction Set of 8051	1,2,4	1,3
CO3	Write Assembly and C Programs for 8051.	1,2,4,5	1,2,3
CO4	Design Timer applications	1,2,3,4	1,2,3
CO5	Implement serial communication applications	1,2,3,4	1,2,3
CO6	Interface various peripherals.	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓	✓				
CO3	✓		✓	✓		
CO4			✓	✓		

CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		2									3		2
CO2	3	3		2									3		2
CO3	3	3		2									3	2	2
CO4	3	3	1	1									3	2	2
CO5	3	3	1	1									3	2	2
CO6	3	3	1	1									3	2	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT – 1 8051 Architecture, Addressing Modes and Instruction Set: Introduction to Microprocessors and Microcontrollers, the 8051 Architecture, Memory organization, Addressing Modes, Data transfer Instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instruction. Assembler Directives, Stack, Assembly language
UNIT – 2 Timers/Counters, Serial Communication, and Interrupts: Basics of interrupts, 8051 interrupt structure. Timers and Counters, Timer delay calculations. Serial Communication, connections to RS-232, UART, Programming in
UNIT – 3 Interfacing and Applications : 8051 Memory Interfacing, Interfacing 8051 to LCD, parallel and serial ADC, DAC, Stepper motor and DC Motor,MAX232, Interfacing Programming in C Language.

UNIT – 4
Advanced microcontrollers: Architecture and memory organization: PIC16F877A, MSP430, ARM Cortex-3, AtMega32

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Data Transfer Instructions: Block Data Transfer without overlap, Sorting	Keil uvision3	Writing programs for a given task
2	Arithmetic Instructions: 32-bit multi-precision Addition, Subtraction, square and cube of 8-bit number and 8-bit Division.	Keil uvision3	Writing programs for a given task
3	Logical Instructions: ASCII to packed BCD and Vice versa, Implementation of Boolean expressions (Bit Manipulation).	Keil uvision3	Writing programs for a given task
4	Timers: Wave form generation with varying Duty Cycle using Interrupt and Polling Techniques.	Keil uvision3	Writing programs for a given task
5	Serial Communication: Serial data transmission with Polling and Interrupt technique (Regular and Look up table).	Keil uvision3	Writing programs for a given task
6	Interfacing DAC to generate various waveforms with output voltage varying between -12V to 12V with Amplitude and Frequency control.	Keil uvision3	Writing programs for a given task
7	DC Motor speed control using external interrupt.	Keil uvision3	Writing programs for a given task
8	Stepper motor interfacing by controlling the steps and direction.	Keil uvision3	Writing programs for a given task
9	Display the ASCII value of Key pressed on LCD.	Keil uvision3	Writing programs for a given task

TEXT BOOKS:

Kenneth J. Ayala, “The 8051 microcontroller architecture, programming and applications” Thomson publication, 3rd edition, 2007

Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D, McKinlay “The 8051 Microcontroller and Embedded Systems using assembly and C” PHI, 2006/Pearson 2006.

Sandhu, Harprit singh. “Making PIC microcontroller instruments and controllers / Harprit Singh Sandhu.” McGraw-Hill (2009).

https://e2echina.ti.com/group/c8df485b47/m/msp430/11060/download

https://www.arm.com/zh/files/word/Yiu_Ch1.pdf

http://ce.sharif.edu/~pourmohammadi/AVR%20Microcontroller%20and%20Embedded%20Systems/AVR%20Microcontroller%20and%20Embedded%20Systems.pdf

Course Title	**Object Oriented Programming and Data Structures using C++**				Course Type		UG(Integrated)	
Course Code	**B20EN0404**	**Credits**	**3**		Class		IV Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	2	2	2				
	Tutorial	-	-	-				
	Practice	1	2	2				
	-	-	-	-				
	Total	3	4	4	28	28	50%	50 %

COURSE OVERVIEW:

The purpose of this course is to provide the solid foundations in the basic concepts of data structures algorithms and C++ programming language. The Data Structures and C++ Programming Language are a very important to develop Application Software, System Software, Operating Systems, and Network Simulators as it employees Object Oriented Programming (OOP) aspect. This course has important features of OOP like Polymorphism, Inheritance which are not present in C Programming Language. Survey of fundamental data structures (array, linked lists, queue, stack) and how to use them in C++. This course then delves deeper into the design, analysis and implementation of such data structures.

COURSE OBJECTIVES:

The objectives of this course are:

1. Provide insights into the role of programming Languages like C and C++ in design and development.
2. Provide a concise but through introduction to the fundamental concepts of Classes, Objects, Inheritance and polymorphism in C++.
3. Discuss insights into the basic concepts of data structures and algorithms.
4. Implement basic concepts about arrays, stacks, queues and linked lists.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain C++ data types and operators	1,2,3,5	1,2,3
CO2	Explain object-oriented software engineering and Use concept of classes and objects in writing object-based programs	1,2,3,5	1,2,3
CO3	Use the concept of inheritance in writing object-oriented programs. Apply the concept of run time polymorphism	1,2,3,5	1,2,3
CO4	Identify and classify various types of data structures	1,2,3,,5	1,2,3
CO5	Write C++ programs to implement data structures like array, stack, queue and linked list.	1,2,3,5	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1		√	√			
CO2		√	√			
CO3		√	√			
CO4			√			

CO5			√	√		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2								2	2	1
CO2	4	3	2		3								3	2	
CO3	3	3	2		3								3	3	2
CO4	3	4	3		3								3	3	2
CO5	3	3	4		2								3	2	3

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1 The Basic C++ Language, Concepts of Object Oriented Programming: The General Form of a C++ Program, Datatypes, Operators, Branching and Looping Statements, Dynamic Memory Allocation.. OOP Concepts: Procedure Oriented vs Object-Oriented Programming, Features of Object-Oriented Programming, Class, Object, Data Member, Member Functions.
UNIT - 2 OOP Concepts and Features: Constructors and its Types, Destructors. Inheritance: Different types of Inheritances, Single Inheritance – Public, Private and Protected. Multiple Inheritance. Polymorphism: Introduction, Compile Time Polymorphism (function overloading) and Run Time Polymorphism (Virtual Functions). Operator Overloading: + operator

UNIT - 3
Introduction and Linear Data Structures: Stack & Queues: Introduction to Data Structure: Types of Data Structure, Arrays: Single Dimensional Array and its operations, Stack: Concept, operations, Array Representation of Stack, Applications; Queues: Concept, Operations, Array Representation of Simple Queue, Circular Queue, Applications;
UNIT - 4
Linear Data Structure: Linked List Array Vs Linked List, Linked List concept, Operations on Linked List, Types of Linked List, Application of Linked List. Concept of Files.

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	a. Write a C++ program to generate all the prime numbers between 1 to 20. b. Write a C++ program to find both the largest and smallest number in an array of size 10. c. Write a Program to illustrate New and Delete Keywords for dynamic memory allocation.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with conditional & looping statements.
2	Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with declaring & defining 'Class, Data Members, & Member Functions'.
3	Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with member function all.

4	Write a C++ Program to illustrate default constructor, parameterized constructor and copy constructors.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with constructors.
5	a. Write C++ program to illustrate single Inheritance. b. Write C++ program to illustrate single Inheritance.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with class inheritance.
5	a. Write C++ program to implement compile-time polymorphism. b. a. Write C++ program to implement run-time polymorphism.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with polymorphism.
6	Write C++ program to implement Stack and perform push, pop, & display operation on it.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with Stack.
7	Write C++ program to implement Queue and perform enqueue, dequeue, & display operation on it.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with Queue.
8	Write C++ program to implement Singly Linked List and perform operation 'adding new node at the beginning of Linked List' & display node values.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with Linked List.
9	Write C++ program to implement Singly Linked List and perform operation 'adding new node at the end of Linked List' & display node values.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with Linked List.
10	a. Write C++ program to implement Singly Linked List and perform operation 'deleting a last node from the Linked List' & display node values. b. Write C++ program to implement Singly Linked List and perform	Algorithm, Flowchart, & C++ compiler.	Writing program skills with Linked List.

	operation 'deleting a first node from the Linked List' & display node values.		

TEXT BOOKS:

Stanley B. Lippmann, Josee Lajore: "C++ Primer", 4th Edition, Pearson Education, 2005

Langsam, Augenstein, Tenenbaum, "Data Structures Using C and C+", 2nd edition, Pearson Education India, 2015.

REFERENCE BOOK:

Herbert Schildt , "The Complete Reference C++", Fourth Edition, McGraw-Hill, 2003.

Bjarne Stroustrup, " The C++ Programming Language", 4th Edition, Pearson Education, 2003

. Seymour Lipschutz, "Data Structure with C", TMH.

G. A. V. Pai, "Data Structures and Algorithms", TMH, 2008

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

Web: https://www.tutorialspoint.com/cplusplus/index.htm

Journal: "A Study of Course Assessment on C++ Programming", by Spinger;

link: https://link.springer.com/chapter/10.1007/978-3-642-35452-6_39

SWAYAM/NPTEL/MOOCs:

SWAYAM/NPTEL: "Programming in C++ and Data Structures";

link: https://onlinecourses.nptel.ac.in/noc21_cs02/preview

link: https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs25/

MOOC: Programming in C++ and Data Structures.

link: https://www.coursera.org/specializations/hands-on-cpp

link: https://www.coursera.org/learn/cs-fundamentals-1

Course Title	**Course based project on Microcontrollers and Applications**				Course Type		UC	
Course Code	**B20EN0405**	**Credits**	**1**		Class		IV Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Tutorial	-	-	-				
	Practice	1	2	2				
	-	-	-	-				
	Total	1	2	2		26	50%	50 %

Course Based Project/Project Based Learning has been considered a good approach in improving education in Engineering, because, this approach facilitates learning difficult subjects, encourages active learning, and allows developing both the Engineering skills and transversal skills by using a 'learning environment that simulates a real professional challenge'.

Execution:

1. The project is carried out by team of two or three students (student team).

2. Each Student team is guided and monitored by Faculty, the Course coordinator for Microcontrollers and Applications will be the Coordinator for Course based Project(CBP) Course.

3. The problem is the trigger of the learning process. The CBP approach is based on open problems, which are defined by faculty in context of Industry needs and current situation. The problems are assigned randomly to student teams.

4. The activities for each week will be assigned.

5. The Hands-On activities, along with short lectures, are included to facilitate learning key concepts, present the main aspects of the theory, and improve the background theory of students.

6. In the laboratory training, students carry out practices according to the project stages.

Assessment and Evaluation:

1. The Internal assessment is made on written reports, oral presentation and demonstration of project results with developed model in phase wise by Faculty in charge.

2. The external evaluation is made on written reports, oral presentation and demonstration of project results with developed model at the end of the semester by Examiner.

Course Title	Communication Skills				Course Type		FC	
Course Code	B20AH0401	Credits	2		Class		IV Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	2	2	2				
	Tutorial	-	-	-				
	Practice	-	-	-				
	-	-	-	-				
	Total	2	2	2	26		50%	50 %

COURSE OVERVIEW:

This course is aimed to develop basic communication skills in English in the learners, to prioritize listening and reading skills among learners, to simplify writing skills needed for academic as well as workplace context, to examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

COURSE OBJECTIVES:

The objectives of this course are to:

Develop basic communication skills in English.

Emphasize on the development of speaking skills amongst learners of Engineering and Technology

Impart the knowledge about use of electronic media such as internet and supplement the learning materials used in the classroom.

Inculcate the habit of reading and writing leading to effective and efficient communication.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs

CO1	Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using appropriate communicative strategies (Speaking Skills).		
CO2	Build inferences from the text		
CO3	Make use of accurate writing skills using different components of academic writing.		
CO4	Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas		

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1						
CO2						
CO3						
CO4						
CO5						

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT – 1 Functional English: Grammar: Prepositions; Modal Auxiliaries, Reading Comprehension, Active and passive voice, Giving Instructions.
UNIT – 2 Interpersonal Skills: Grammar: Tenses; Wh-questions, Compound words; Phrasal verbs, Recommendations
UNIT - 3 Multitasking Skills Grammar: Conditional Sentences, Homonyms; homophones, Subject-verb agreement.
UNIT – 4 Communication Skills Grammar: Direct and indirect speech, Interpreting visual materials (line graphs, pie charts etc.), Single word substitutes

TEXT BOOKS:

Green, David. Contemporary English Grammar Structures and Composition. New Delhi: MacMillan Publishers, 20l0.

Thorpe, Edgar and Showick Thorpe. Basic Vocabulary. Pearson Education India, 20l2. 3.Leech, Geoffrey and Jan Svartvik. A Communicative Grammar of English. Longman, 2003.

REFERENCE BOOK:

Murphy, Raymond. Murphy's English Grammar with CD. Cambridge University Press, 2004.

Rizvi, M. Ashraf. Effective Technical Communication. New Delhi: Tata McGraw-Hill, 2005.

Riordan, Daniel. Technical Communication. New Delhi: Cengage Publications, 20ll.

Sen et al. Communication and Language Skills. Cambridge University Press, 20l5.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

SWAYAM/NPTEL/MOOCs:

TEXT BOOKS:

REFERENCE BOOK:

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

SWAYAM/NPTEL/MOOCs:

<table>
<tr><td>Course Title</td><td colspan="3">Indian Constitution and Professional Ethics</td><td colspan="2">Course Type</td><td colspan="2">FC</td></tr>
<tr><td>Course Code</td><td>B20LS0301</td><td>Credits</td><td colspan="2">2</td><td>Class</td><td colspan="2">IV Semester</td></tr>
<tr><td rowspan="6"></td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="3">Total Number of Classes Per Semester</td><td colspan="2" rowspan="3">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>2</td><td>2</td><td>2</td><td>26</td><td></td><td>50 %</td><td>50 %</td></tr>
</table>

COURSE OVERVIEW:

COURSE OBJECTIVES:

The objectives of this course are:

The objectives of this course are to:

1. Explain basic knowledge required to understand Constitution of India.
2. Describe the Fundamental Rights, Duties and other Rights.
3. Discuss different types of ethics.
4. Explore ethical standards followed by different companies.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the Fundamental Rights, Duties and other Rights protected under Indian Constitution.	8,9,12	1
CO2	Demonstrate the practicality of Constitution perspective and make them face the world as a bonafide citizen.	8,9,12	1
CO3	Analyse human rights at different levels	8,9,12	1
CO4	Apply ethics in society	8,9,12	1
CO5	Discuss the ethical issues related to engineering	8,9,12	1
CO6	Realize the responsibilities and rights in the society.	8,9,12	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			
CO6	√	√	√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	2			2	1		
CO2								3	2			2	1		
CO3								3	2			2	1		
CO4								3	2			2	1		
CO5								3	2			2	1		
CO6								3	2			2	1		

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT1: Indian constitution Salient features, fundamental rights and duties (Directive principle and statepolicy), Legislature (Loka Sabha &Rajya Sabha), Executive (President& Governor) and Judiciary (Supreme court & high court), Composition and function of parliament, Council of ministers, prime minister, Speaker, Passing of bills.
UNIT2: Human Rights: Nature and Scope of human rights, Universal protection of human rights (UDHR),Regional protection of human rights, National level protection of human rights, Human rights and vulnerable groups (children, women & old-age). Human values: Truth, Honesty, Loyalty, Love, Peace with examples, Difference between ethics, beliefs and morals.

UNIT3: ENGINEERING ETHICS
Senses of Engineering Ethics, Variety of moral issues, Types of inquiry, Moral dilemmas, Moral Autonomy, Consensus and Controversy, Models of professional roles, Theories about right action, Self-interest , Customs and Religion, Uses of Ethical Theories.
UNIT4: GLOBAL ISSUES
Multinational Corporations, Environmental Ethics, Computer Ethics ,Weapons Development Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors Moral Leadership ,Code of Conduct , Corporate Social Responsibility.

TEXT BOOKS:

1.Kapoor, S.K., “Human rights under International Law and Indian Law”, Prentice Hall of India, New Delhi, 2002.

2. Basu, D.D., “Indian Constitution”, Oxford University Press, New Delhi, 2002. 3. Chakraborty, S.K., “Values and ethics for Organizations and Theory Practice”, Oxford University Press, New Delhi, 2001.

3. Mike W. Martin and Roland Schinzinger, Ethics in Engineering, Tata McGraw Hill, New Delhi,2003.

4. Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOK:

1. Meron Theodor, “Human Rights and International Law Legal Policy Issues”, Vol. 1 and 2, Oxford University, Press, New Delhi, 2000.

2. M V Pylee, “An Introduction to Constitution of India”, S Chand & Company, 5th Edition

3. Durga Das Basu, “Introduction to constitution of India”, LexisNexis, 23rd Edition.

4. Edmund G Seebauer and Robert L Barry, —Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.

5.Laura P. Hartman and Joe Desjardins, —Business Ethics: Decision Making for Personal Integrity and Social Responsibility Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.

6. World Community Service Centre, Value Education‘, Vethathiri publications, Erode, 2011.

Course Title	**Universal Human Values**				**Course Type**		**MC**	
Course Code	B20AHM401	**Credits**	**0**		**Class**		**IV Semester**	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	1	1				
	Tutorial	-	-	-				
	Practice	-	-	-				
	-	-	1	1	13 Theory	- Practical	- **IA**	- **SEE**
	Total	**2**	**2**	**2**	**26**		**50 %**	**50 %**

COURSE OVERVIEW:

COURSE OBJECTIVES:

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act

The objectives of this course are:

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	6,9,10	1
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc	6,9,10	1
CO3	Understand the role of a human being in ensuring harmony in society and nature	6,9,10	1
CO4	Demonstrate the role of human being in the abetment of pollution	6,9,10	1

CO5	Describe appropriate technologies for the safety and security of the society as responsible human being	6,9,10	1
CO6	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	6,9,10	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			
CO6	√	√	√			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						3			1	1			1		
CO2						3			1	1			1		
CO3						3			1	1			1		
CO4						3			1	1			1		
CO5						3			1	1			1		
CO6						3			1	1			1		

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents

UNIT – 1 Happiness and Prosperity

A look at basic Human Aspirations. Right understanding, Relationship, basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly, Method to fulfil human aspirations: understanding and living in harmony at various levels, Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seeker and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health;

UNIT - 2 Understanding values in human-human relationship

meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal

UNIT – 3 Understanding the harmony in the Nature

Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT – 4 Natural acceptance of human values

Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically

TEXT BOOKS:

1. R R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010
2. A.N Tripathy, Human Values, New Age Intl. Publishers, New Delhi, 2004.
3. R.R. Gaur, R. Sangal and G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2010
4.Bertrand Russell, Human Society in Ethics & Politics, Routledge Publishers, London, 1992

REFERENCE BOOK:

1.Corliss Lamont, Philosophy of Humanism, Humanist Press, London, 1997
2. I.C. Sharma, Ethical Philosophy of India Nagin & co Julundhar, 1970
3. Mohandas Karamchand Gandhi, The Story of My Experiments with Truth, Navajivan Mudranalaya, Ahmadabad, 1993
4. William Lilly, Introduction to Ethics, Allied Publisher, London, 1955

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

SWAYAM/NPTEL/MOOCs:

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20EP0501	Embedded Systems	HC	3	0	0	3	3
2	B20EP0502	Machine Learning	HC	3	0	0	3	3
3	B20EP0503	Unix Shell Programing	HC	1	1	1	3	5
4	B20EP0504	Java Programming	HC	1	1	0	2	3
5	B20EPS5XX	Professional Elective-1	SC	3	0	0	3	3
6	B20EPS5XX	Professional Elective-2	SC	3	0	0	3	3
7	B20XXO5XX	Open Elective-1	OE	3	0	0	3	3
TOTAL				**17**	**2**	**1**	**20**	**23**
Practical /Term Work / Sessional								
8	B20EP0505	Embedded Systems Lab	HC	0	0	1	1	2
9	B20EP0506	Machine Learning Lab	HC	0	0	1	1	2
10	B20EP0507	Java Programming Lab	HC	0	0	1	1	2
11	B20EP0508	Technical Documentation	FC	1	0	0	1	1
12	B20EP0509	Research based project	HC	0	0	2	2	4
TOTAL				**1**	**0**	**5**	**6**	**11**
TOTAL SEMESTER CREDITS					**26**			
TOTAL CUMULATIVE CREDITS					**111**			
TOTAL CONTACT HOURS					**34**			

<table>
<tr><td>Course Title</td><td colspan="4">Embedded Systems</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EP0501</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Embedded Systems</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number Of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

Embedded systems have become the next inevitable wave of technology, finding application in diverse fields of engineering. Microprocessors, together with sensors and actuators, have become embeddable in almost everything. The purpose of the course is to provide the students with the detailed information about embedded systems which can be defined as a control system or computer system designed to perform a specific task. The course prerequisites are Microprocessor/Microcontrollers, C Programming language, Digital Electronics.

COURSE OBJECTIVES:

The objectives of this course are:

1. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
2. Describe the hardware software co-design and firmware design approaches
3. Learn the internals of RTOS and the fundamentals of RTOS based ES design.
4. Illustrate the different scheduling algorithms and synchronization techniques.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand, analyze and explain the basic building blocks of Embedded System hardware.	1,2,3	1,2,3
CO2	Acquire knowledge and understand fundamental embedded system paradigms, characteristics, and attributes.	1,2,3	1,2,3
CO3	Make use of the Hardware/ Software Co-Design techniques for ES design.	1,2,3	1,2,3
CO4	Understand about the RTOS based ES concepts and the goal of ES in real time applications.	1,2,3	1,2,3

CO5	Able to practically apply gained theoretical knowledge in order to design, analyse and implement embedded systems, e.g. integrating embedded subsystems and applications in building a simple fully functional embedded system.	1,2,3	1,2,3
CO6	Understand and interpret the different scheduling algorithms and synchronization techniques.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3		✓	✓			
CO4	✓	✓	✓			
CO5	✓	✓	✓	✓		✓
CO6	✓	✓	✓			

COURSE ARTICULATION MATRIX

CO/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3										2	2	
CO2	3	3	3										2	2	1
CO3	3	3	3										2	2	1
CO4	3	3	3										2	2	1
CO5	3	3	3										2	2	1
CO6	3	3	3										2	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents

UNIT – 1
Introduction To Embedded Systems: What is an Embedded System? Embedded vs General computing system, classification, application, and purpose of ES. Typical Embedded Systems: Core of an Embedded System, Memory, Sensors, Actuators, LED, Opto-Coupler, Communication Interface, Reset circuits, RTC, WDT, Application and Domain Specific ES examples.
UNIT – 2
Characteristics, Attributes, Hardware Software Co-Design and Program Modelling: Characteristics and Quality Attributes of Embedded Systems. Hardware Software Co-Design Introduction, Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to UML, Hardware Software Tradeoffs.
UNIT – 3
Real Time Basics and Real Time Operating System: Real time systems definition and Types of the Real Time Systems, Operating Systems Basics: The Kernel, Monolithic Kernel and Microkernel, Types of Operating Systems, General Purpose OS, Real-Time OS: The Real-Time Kernel, Hard Real-Time, Soft Real-Time. Tasks, Process and Threads: Process, Structure of Process, Process State and State Transitions, Process Management, Threads: Concept, Concept of Multithreading, Thread Standards: POSIX threads, Win32 Threads, Java Threads, Thread Pre-Emption, Types of Threads, Thread Binding, Thread vs Process.
UNIT - 4
Real Time Operating System Concepts: Multiprocessing and Multitasking: Types of Multitasking. Task Scheduling: Concepts, Non-Preemptive Scheduling: FCFS/FIFO Scheduling, LCFS/LIFO Scheduling, Shortest Job First Scheduling, Priority Based Scheduling. Preemptive Scheduling: Shortest Remaining Time Scheduling, Round Robin Scheduling, Priority based Preemptive scheduling. Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS(Self Study/Case Study).

TEXTBOOKS:

1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009.

REFERENCE BOOKS

1. Frank Vahid, Tony D. Givargis, Embedded System Design – A Unified Hardware/Software Introduction, John Wiley, 2002.
2. Jonathan W. Valvano, Embedded Microcomputer Systems, 3rd. edition, Cengage Learning, 2011.
3. David E. Simon, An Embedded Software Primer, Pearson Ed., 2005.
4. Raj Kamal, Introduction to Embedded Systems, TMH, 2002.
5. KVKK Prasad, Embedded / Real Time Systems, Dreamtech Press, 2005.

6. Peter M, Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems, and Internet of Things, Springer, 3rd Edition, 2018
7. James K Peckol, "**Embedded Systems**", A contemporary Design Tool - John Weily, 2008

Course Title	Machine Learning				Course Type		HC	
Course Code	B20EP0502	Credits	3		Class		V Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	0	0	0				
	Total	**3**	**3**	**3**	**45**	**0**	**50%**	**50 %**

COURSE OVERVIEW:

The course provides students with some knowledge on the basic principles of machine learning which is the study of computer algorithms that can improve automatically through experience and using data. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

COURSE OBJECTIVES:

The objectives of this course are:

1. Discuss the basic theory underlying machine learning.
2. To become familiar with regression methods, classification methods, clustering methods.
3. To become familiar with Dimensionality reduction Techniques
4. Discuss the implementation of Machine learning algorithms and modules.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Comprehend statistical methods as basis of machine learning domain	1,2,3,4	1,2,3
CO2	Apply variety of learning algorithms for appropriate applications	1,2,3,4	1,2,3
CO3	Implement machine learning techniques to solve problems in applicable domains	1,2,3,4	1,2,3
CO4	Evaluate and compare algorithms based on different metrics and parameters.	1,2,3,4	1,2,3
CO5	Design application using machine learning techniques	1,2,3,4	1,2,3
CO6	Apply Dimensionality reduction techniques.	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2									3	2	1
CO2	3	3	2	2									3	2	1
CO3	3	3	2	2									3	2	
CO4	3	3	2	2									2	2	1
CO5	3	3	2	2									3	2	1
CO6	3	3	2	2									3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT – 1 **Introduction to Machine Learning Machine Learning**, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing a Machine Learning Application. Importance of Data Visualization, Basics of Supervised and Unsupervised Learning

UNIT – 2

Regression Techniques: Linear Regression, Logistic Regression. Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART). Hyperparameters tuning, Loss Functions, Evaluation Measures for Regression Technique.

UNIT – 3

Classification: Rule based classification, classification by Bayesian Belief networks, Hidden Markov Models. Support Vector Machine: Maximum Margin Linear Separators, Quadratic Programming solution to finding maximum margin separators, Kernels for learning non-linear functions.

Clustering: K-means Algorithms, Supervised learning after clustering, Radial Basis functions. Dimensionality Reduction Techniques, Principal Component Analysis.

UNIT – 4

Artificial Neural Networks: Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, Multilayer Perceptrons, Back-propagation Neural Networks, Competitive Neural Networks

Textbooks:

1. Tom Mitchell: In Tom Mitchell, Machine Learning, TMH
2. C. Bishop, Pattern Recognition and Machine Learning, Springer
3. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification and Scene Analysis, Wiley
4. Kishan Mehrotra, Chilukuri Mohan and Sanjay Ranka, Elements of Artificial NeuralNetworks, Penram International
5. Rajjan Shinghal, Pattern Recognition, Techniques and Applications, OXFORD
6. Ethem alpaydin, Introduction to Machine Learning, PHI

Reference Books:

1. EthemAlpaydin: Introduction to Machine Learning, Second edition MIT press, 20l0. Chapters l, 2, 6, 7, l9.
2. Yoshua Bengio and Aaron Courville, Deep Learning -Ian Good fellow, MIT Press book,20l6
3. Richard O. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc., 200l
4. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, l995

<table>
<tr><td>Course Title</td><td colspan="4">UNIX Shell Programming</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EP0503</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">UNIX Shell Programming</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>3</td><td>5</td><td>5</td><td>26</td><td>26</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

The course is aims to present the UNIX environment and to provide the most basic commands to students with UNIX knowledge. The course covers UNIX system and use different commands, UNIX directories and files, File attributes and permissions, changing file permissions. Course also provides basic knowledge about Vi Editor-Input mode commands. Command mode commands, the ex-mode commands, use of editors and regular expressions, Filters, File links – hard and soft links, the shells interpretive cycle, illustrating the mechanism of process creation and writing simple shell scripts.

COURSE OBJECTIVES:

The objectives of this course are:

1. Illustrate the UNIX system architecture and use of basic Commands.
2. Categorize and compare different UNIX files.
3. Demonstrate the use of UNIX Directories.
4. Use of editors and different commands in Vi editor.
5. Demonstrate the writing of shell scripts.
6. Categorize, compare and make use of UNIX system calls.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe UNIX system and use of different commands.	1,2,3	1,2,3
CO2	Apprehend the organization of UNIX file system.	1,2,3	1,2,3
CO3	Explore the use of different files and directories.	1,2,3	1,2,3
CO4	Apply the usage of different commands in Vi editor.	1,2,3	1,2,3
CO5	Explore the File inodes, File links and pattern matching.	1,2,3	1,2,3

CO6	Design the shell scripts for various functions.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓				
CO2	✓	✓				
CO3			✓			
CO4			✓			
CO5		✓	✓			
CO6		✓	✓			

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2										2	1	1
CO2	3	2	2										2	1	1
CO3	3	2	2										2	1	1
CO4	3	2	2										2	1	1
CO5	3	2	2										2	1	1
CO6	3	2	2										2	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1 **Introduction, UNIX Architecture:** Introduction, Brief history. UNIX Components/Architecture. Features of UNIX. Posix and Single Unix specification. Opensource licensing - History of Linux - Unix Vs Linux - Flavors of Linux - Benefits and characteristics of Linux, The login prompt. General features of Linux commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. Man command.
UNIT – 2 **UNIX Files and Directories:** Files, Naming files, Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands, pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.
UNIT - 3 **The Vi Editor:** The vi editor, Basics, Different modes of vi. Input mode commands. Command mode commands. The ex-mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. Simple examples using these commands. The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution.
UNIT - 4 **Shell Programming:** Shell programming. Ordinary and environment variables. The .profile. Read and read only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options.

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill/Ability
1	Getting Familiar with UNIX	UNIX OS/ Any Flavor of Linux	C Programming
2	Practice session on basic Unix Utilities, Practice Session on File related Utilities	UNIX OS/ Any Flavor of Linux	C Programming
3	Execution of various file/directory handling commands.	UNIX OS/ Any Flavor of Linux	C Programming
4	Execution of various Vi Mode editor input, command, and ex mode commands.	UNIX OS/ Any Flavor of Linux	C Programming
5	Demonstration of process, shell, kill commands.	UNIX OS/Any Flavor of Linux	C Programming
6	Demonstrating the regular expressions and filters.	UNIX OS/ Any Flavor of Linux	C Programming
7	Simple shell script for basic arithmetic and logical calculations.	UNIX OS/ Any Flavor of Linux	C Programming
8	Shell script to find factorial of a given integer.	UNIX OS/ Any Flavor of Linux	C Programming
9	C program to emulate the Unix ls -l command and program to list for every file in a directory, its inode number and file name.	UNIX OS/ Any Flavor of Linux	C Programming
10	C program to count the number of words, lines and characters of a given text file.	UNIX OS/ Any Flavor of Linux	C Programming

Textbooks and References:

1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill
2. Behrouz A. Forouzan, Richard F. Gilberg: UNIX and Shell Programming- Cengage Learning – India Edition. 2009
3. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
4. Richard Blum, Christine Bresnahan: Linux Command Line and Shell Scripting Bible, 2nd Edition, Wiley,2014

<table>
<tr><td>Course Title</td><td colspan="4">Java Programming</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EP0504</td><td>Credits</td><td colspan="2">2</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td><td>0</td></tr>
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</table>

COURSE OVERVIEW:

Java is an object-oriented language that enables learners to create real-world applications. Java technology-based software works just about everywhere from the smallest devices to super computers! Java technology components are not impacted by the kind of computer, phone, smart device, or operating systems they are running on. The architecture-neutral nature of Java technology is important in a networked world where one cannot predict the kind of devices that partners, suppliers and employees use to connect to their organizations. The Java Programming in course is the first step for developing such applications. This course introduces object-oriented concepts and its implementation in Java technology programs. In addition, it covers syntax and semantics of the Java programming language.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Illustrate the creation of classes and objects in Java
2. Demonstrate concept reusing of code using inheritance and interfaces
3. Use proper program handling mechanism to write robust programs
4. Familiarize advance java concepts like threads, JDBC, Servlets, JSP

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Develop simple programs using Java language concepts such as variables, conditional, methods and constructure	1,3,5	1,2
CO2	Apply program structure like inheritance, interface to develop programs.	1,2,3	1,2
CO3	Build application using the concept of packages	1,2,3,4	2,3
CO4	Demonstrate the programs using concepts of exception handling and file handling	1,2,3	1,2
CO5	Create programs using thread concepts	1,2,3	1,2
CO6	Discuss the concepts like JDBC, Servlets, JSP	1,2,10,11	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓	✓		
CO2			✓	✓		
CO3			✓			
CO4			✓			
CO5			✓			
CO6		✓				

COURSE ARTICULATION MATRIX:

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1		2								1	2	
CO2	2	3	2										3	2	
CO3	2	2	3	1										2	1
CO4	2	3	2										3	2	
CO5	2	3	2										3	2	
CO6	2	2	3	1										2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:
THEORY:

Contents
UNIT - 1
Java Revolution: Revolutionary programming language; **Object -Oriented Fundamentals:** Object oriented programming, how java is better than C++; **Java Language Introduction:** Hello World, Step by step, Variables; Types; Operators; Flow Control, Java User input, Input types. **Class:** Object references, Instance variables, the new operator, The Dot operator, Method declaration, Method calling, this, Constructors
UNIT - 2
Inheritance: Super, Method overloading, Method Overriding, Dynamic method dispatch; final, finalize, static, Abstract class and method.

Interfaces: The interface statement, The implement statement, Variables in interfaces. **String Handling:** String constructors, Special string syntax, Character extraction, Comparison, String copy modification.
UNIT - 3 **Package:** The package statement, Compiling classes in packages, the import statement, Access protection. **Exception Handling:** Fundamentals, Exception types, try and catch, Multiple catch clauses, Nested try statements. **Input/output:** Files, Input Stream, Output Stream, File streams. IO streams
UNIT – 4 **Threads:** Single threaded event loop, The java thread model, Thread, Runnable, Thread priorities, Thread Synchronization. **Introduction to Advance Java:** JDBC – Introduction, Architecture, Steps to create JDBC application, Java Servlets – Introduction, life cycle, Steps to create servlet, JSP – Introduction, Life cycle.

TEXTBOOKS:

1. Patrick Naughton, "The Java Handbook", Tata McGraw-Hill, 2006
2. Herbert Schildt, Java™: The Complete Reference, McGraw-Hill, Tenth Edition, 2018.

REFERENCE BOOKS

1. Bruce Eckel, "Thinking in Java", III Edition, Pearson 2004.
2. Y. Daniel Liang, Introduction to Java programming-comprehensive version-Tenth Edition, Pearson ltd 2015
3. Paul Deitel Harvey Deitel ,Java, How to Program, Prentice Hall; 9th edition , 2011
4. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

<table>
<tr><td>Course Title</td><td colspan="4">Embedded Systems Lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EP0505</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Embedded Systems</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
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<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>0</td><td>26</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

Embedded systems have become the next inevitable wave of technology, finding application in diverse fields of engineering. Microprocessors, together with sensors and actuators, have become embeddable in almost everything. The purpose of the course is to provide the students with the detailed information about embedded systems which can be defined as a control system or computer system designed to perform a specific task. The course prerequisites are Microprocessor/Microcontrollers, C Programming language, Digital Electronics.

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide insights into the basics of unix OS based GCC compiler
2. To teach hardware software co-design and firmware design approaches
3. To introduce the concepts POSIX thread libraries
4. Illustrate the different scheduling algorithms and synchronization techniques.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Implement required thread creations using Unix OS based GCC Compiler	1,2,3,5	1,2,3
CO2	Acquire knowledge and understand fundamental embedded system paradigms, characteristics, and attributes.	1,2,3,5	1,2,3
CO3	Design and execute a program using POSIX thread libraries	1,2,3,5	1,2,3
CO4	Understand about the RTOS based ES concepts and the goal of ES in real time applications.	1,2,3,5	1,2,3
CO5	Conduct the experiment for the given design parameters individually (and in a team) within the stipulated time	5,9,10,12	

CO6	Analyze the results, make relevant observations and measurements, and document the results in a form of report/journal.	5,9,10,12	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO/ PO	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3		✓	✓			
CO4	✓	✓	✓			
CO5	✓	✓	✓	✓		✓
CO6	✓	✓	✓			

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1		2							1	1	2	1
CO2	3	2	1		2							1	1	2	1
CO3	3	2	1		2							1	1	2	1
CO4	3	2	1		2							1	1	2	1
CO5					3				3	2		1			
CO6					3				3	2		1			

Note:1-Low,2-Medium,3-High

COURSE CONTENT

Sl. No.	Name of the Experiment	Tools and Techniques	Expected Skill /Ability
1	Write a program for singly Thread Creation and Termination using POSIX threads.	Unix OS based GCC Compiler	C programming language.

2	a) Write a program for creating independent threads each of which will execute some random function and use concept of Mutual Exclusion (Task Synchronization). b) Write a program to create N number of threads and to count how many threads are being executed. Use concept of Mutual Exclusion.	Unix OS based GCC Compiler	C programming language.
3	Write a program to create independent threads each of which will execute some function and wait till threads are complete before main continues. Unless we wait run the risk of executing an exit which will terminate the process and all threads before the threads have completed.	Unix OS based GCC Compiler	C programming language.
4	Write a program to create the N number of threads and find the how many threads are executed. Use concept of Mutual Execution.	Unix OS based GCC Compiler	C programming language.
5	Write a program to create two threads T1 and T2. Thread T1 should count numbers between 1-3 and 8-10 by calling the function FunctionCount1 and thread T2 should count numbers between 4-7 by calling the function FunctionCount2. Program should print the final count value.	Unix OS based GCC Compiler	C programming language.
6	Design and execute a program using POSIX thread library to create the number of threads specified by the user, each thread independently generates a random integer as an upper limit and then computes and prints the number of primes less than or equal to that upper limit, along with the upper limit.	Unix OS based GCC Compiler	C programming language.
7	Write a program to implement a process with a producer thread and a consumer thread which make use of a bounded buffer (Size can be prefixed at suitable value) for communication. Use any suitable synchronization construct.	Unix OS based GCC Compiler	C programming language.
8	Write a program to implement the usage of an Anonymous Pipe with size of 512bytes for data sharing between parent and child process using Inheritance Handling mechanism.	Unix OS based GCC Compiler	C programming language.

TEXTBOOKS:

1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009.

REFERENCE BOOKS

1. Frank Vahid, Tony D. Givargis, Embedded System Design – A Unified Hardware/Software Introduction, John Wiley, 2002.
2. Jonathan W. Valvano, Embedded Microcomputer Systems, 3rd. edition, Cengage Learning, 2011.
3. David E. Simon, An Embedded Software Primer, Pearson Ed., 2005.
4. Raj Kamal, Introduction to Embedded Systems, TMH, 2002.
5. KVKK Prasad, Embedded / Real Time Systems, Dreamtech Press, 2005.
6. Peter M, Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems, and Internet of Things, Springer, 3rd Edition, 2018

<table>
<tr><td>Course Title</td><td colspan="4">Machine Learning Lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EP0506</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
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</table>

COURSE OVERVIEW:

The course provides students with some knowledge on the basic principles of machine learning which is the study of computer algorithms that can improve automatically through experience and using data. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

COURSE OBJECTIVES:

The objectives of this course are:

1. Discuss the basic theory underlying machine learning.
2. Explain machine learning algorithms to solve problems of moderate complexity for data analysis.
3. Illustrate the concept of Genetic Programming and Artificial Neural Network.
4. Discuss the implementation of Machine learning algorithms and modules.

COURSE OUTCOMES (COs):
On successful completion of this course; the student shall be able to:

CO/ PO	Course Outcomes	POs	PSOs
CO1	Explain the basics of machine learning concepts	1,2,3,5	1,2,3
CO2	Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory	1,2,3,5	1,2,3
CO3	Apprehend how to perform evaluation of learning algorithms and model selection	1,2,3,5	1,2,3
CO4	Implement machine learning applications.	1,2,3,5	1,2,3

CO5	Conduct the experiment for the given design parameters individually (and in a team) within the stipulated time	5,9,10,12	---
CO6	Analyze the results, make relevant observations and measurements, and document the results in a form of report/journal.	5,9,10,12	---

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2		2							1	3	2	1
CO2	3	3	3		2							1	3	2	1
CO3	3	3	2		2							1	3	2	1
CO4	3	3	3		2							1	2	2	1
CO5					3				3	3		1			
CO6					3				3	3		1			

Note:1-Low,2-Medium,3-High

Sl. No.	**Name of the Experiment**	**Tools and Techniques**	**Expected Skill /Ability**

1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file	Python	ML Usage for real time
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples	Python	ML Usage for real time
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	Python	ML Usage for real time
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets	Python	ML Usage for real time
5	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	Python	ML Usage for real time
6	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task, - the program. Calculate the accuracy, precision, and recall for your data set.	Python	ML Usage for real time
7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.	Python	ML Usage for real time
8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.	Python	ML Usage for real time
9	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.	Python	ML Usage for real time
10	Implement the non-parametric Locally Weighted Regression algorithm to fit data points. Select appropriate data set for your experiment and draw graphs.	Python	ML Usage for real time

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<tr><td>Course Title</td><td colspan="4">Java Programming Lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EP0507</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
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<tr><td>Practical</td><td>1</td><td>22</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>26</td><td>50%</td><td>50 %</td></tr>
</table>

COURSE OVERVIEW:

Java is an object-oriented language that enables learners to create real-world applications. Java technology-based software works just about everywhere from the smallest devices to super computers! Java technology components are not impacted by the kind of computer, phone, smart device, or operating systems they are running on. The architecture-neutral nature of Java technology is important in a networked world where one cannot predict the kind of devices that partners, suppliers and employees use to connect to their organizations. The Java Programming in course is the first step for developing such applications. This course introduces object-oriented concepts and its implementation in Java technology programs. In addition, it covers syntax and semantics of the Java programming language.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Illustrate the creation of classes and objects in Java
2. Demonstrate concept reusing of code using inheritance and interfaces
3. Use proper program handling mechanism to write robust programs
4. Familiarize advance java concepts like threads, JDBC, Servlets, JSP

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Implement simple programs using Java language concepts such as variables, conditional, methods and constructure	1,3,5	1,2
CO2	Apply program structure like inheritance, interface to develop programs.	1,2,3	1,2
CO3	Build application using the concept of packages,	1,2,3,4	2,3
CO4	Demonstrate the programs using concepts exception handling and file handling	1,2,3	1,2
CO5	Conduct the software coding for the given design parameters individually (and in a team) within the stipulated time	5,9,10,12	1,2

CO6	Analyze the results, make relevant observations and measurements, and document the results in a form of report/journal.	5,9,10,12	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1			✓			
CO2				✓		
CO3			✓			
CO4			✓			
CO5			✓			
CO6		✓				

COURSE ARTICULATION MATRIX:

CO / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1		2								1	2	
CO2	2	3	2		2								3	2	
CO3	2	2	3		2									2	1
CO4	2	3	2		2								3	2	
CO5					3				3	3		1			
CO6					3				3	3		1			

Note:1-Low,2-Medium,3-High

Couse Contents:

Sl. No.	**Name of the Practice Session**	**Tools and Techniques**	**Expected Skill/Ability**
1	a) Introduction to Compiling and Executing a Java Program using command prompt. b) Program to illustrate Data Types and Variables c) Write a program to create three variables and find the number of distinct values using branching statements	Command Prompt/ Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs

<table>
<tr><td>2</td><td>a) Write a program to find the zodiac sign for the entered date & month using a branching statement
b) Write a program to create the following pattern using the looping structures.



</td><td>Command Prompt/ Eclipse IDE / BlueJ</td><td>Apply Java Programming concepts to write programs</td></tr>
<tr><td>3</td><td>a) Write a program to create a BMI calculator that reads the user’s weight in kilograms and height in meters, then calculates and displays the user’s body mass index. Formula: BMI = weight (kg) / [height(m)]^2
[Reference Values: Underweight: less than 18.5, Normal: between 18.5 and 24.9, Overweight: between 25 and 29.9, Obese: 30 or greater]
b) Write a program to calculate the value of π from the infinite series
$\pi = 4 - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \frac{4}{9} - \frac{4}{11} + \ldots$
Print a table that shows the value of π approximated by computing the first 200,000 terms of this series. How many terms do you have to use before you first get a value that begins with 3.14159?</td><td>Eclipse IDE / BlueJ</td><td>Apply Java Programming concepts to write programs</td></tr>
<tr><td>4</td><td>a) Write a java program to find the area and perimeter of a rectangle using the concept of class and objects.
b) Write a java program to demonstrate copy constructor and constructor overloading
c) Write a java program to demonstrate function overloading and overriding</td><td>Eclipse IDE / BlueJ</td><td>Apply Java Programming concepts to write programs</td></tr>
<tr><td>5</td><td>Write a java program to create a program to superclass MotorVehicle with instance variable modelName, modelNumber, modelPrice, parameterized constructor, and display () method. Create a sub-class that inherits the features of the superclass and has its instance variable discountRate, parameterized constructor, and display (), discount () methods. Create an object for the car class and invoke all the methods using the object of that class. (Hint: Single Inheritance)</td><td>Eclipse IDE / BlueJ</td><td>Apply Java Programming concepts to write programs</td></tr>
</table>

6	Write a java program to create an abstract class **Shape** which contains the abstract method **numberOfSides().** Create different sub-classes by the name **Trapezoid, Triangle, and Hexagon**, which extends the shape class. Develop a class **ShapeDemo** which contains the main method. Create the object for different subclasses with the main method and invoke the method **numberOfSides()** using the objects of classes. (Hint: Abstract Class)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
7	Write a program to create an interface **Calculator** which contains **add(), sub(), multiply(), divide(), remainder ()** abstract methods with two-parameter x and y. Develop a class **CalculatorDemo** which inherits the features of the interface. Create an object for the CalculatorDemo class and invoke all the methods of this class. (Hint: implementing interfaces/ multiple inheritances	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
8	Write a program to demonstrate the function on string like **toLowerCase(), toUpperCase(), length(), startsWith(), endsWith(),s ubstring(),** and string conversion using **String.valueOf()** (Hint: String Handling)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
9	Write a java program using the concept of packages. Create a class Trignometry which contain static method **sine (), cos (), tan (), cosec (), tan (), cosec (), sec (), cot ().** Print the value of a given angle in degree by calling these methods. (Hint: Implementing packages)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
10	a) Write a java class to demonstrate **ArithematicException**, **NullPointerException**, **ArrayIndexOutOfBoundsException** (Hint: Handling predefined exceptions) b) Write a java program to demonstrate working with files (Hint: Files & Exception)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
11	Write a Java Program using **the Runnable** interface to demonstrate the concepts of thread priorities. (Hint: Threads)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
12	Write a java program to demonstrate the multithread and thread synchronization (Hint: Multithreading)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs

TEXTBOOKS:

1. Patrick Naughton, “The Java Handbook”, Tata McGraw-Hill, 2006
2. Herbert Schildt, Java™: The Complete Reference, McGraw-Hill, Tenth Edition, 2018.

REFERENCE BOOKS

1. Bruce Eckel, “Thinking in Java”, III Edition, Pearson 2004.
2. Y. Daniel Liang, Introduction to Java programming-comprehensive version-Tenth Edition, Pearson ltd 2015
3. Paul Deitel Harvey Deitel ,Java, How to Program, Prentice Hall; 9th edition , 2011
4. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

Course Title	Technical Documentation				Course Type		FC	
Course Code	**B20EP0508**	**Credits**	**1**		**Class**		**V Semester**	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-	Theory	Practical	**CIE**	**SEE**
	Practical	-	-	-				
	Total	**1**	**1**	**1**	**13**	**-**	**50%**	**50 %**

COURSE OVERVIEW:

COURSE OBJECTIVES:

The objectives of this course are to:

1. Acquire language skills
2. Develop linguistic and communicative competencies
3. Study academic subjects more effectively using the theoretical and practical components of English syllabus, and hence will develop study skills and communication skills in formal and informal situations.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Produce effective engineering documents that enable readers to access relevant information.	6, 9,10,12	1
CO2	Learn to avoid communication problems that distract the readers, causing confusions, distrust, or misunderstanding.	6, 9,10,12	1
CO3	Learn to the practice of various verbal reasoning and grammar practice.	6, 9,10,12	1
CO4	To search engineering information, both in traditional ways and online.	6, 9,10,12	1
CO5	Write research/design reports with special emphasis on content and style.	6, 9,10,12	1
CO6	learn strategies for preparing and delivering presentations, single or in team	6, 9,10,12	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

	Bloom's Level					
CO#	**Remember (L1)**	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√					
CO2	√					

CO3		√				
CO4		√				
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX:

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1			2	2		2	1		
CO2						1			2	2		2	1		
CO3						1			2	2		2	1		
CO4						1			2	2		2	1		
CO5						1			2	2		2	1		
CO6						1			2	2		2	1		

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
Unit 1 **Information Design and Development-** Different kinds of technical documents, Information development life cycle, factors affecting information and document design, Technical Writing, Grammar, and Editing- Technical writing process, forms of discourse, writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style.
Unit 2 Introduction to advanced technical communication, Usability, managing technical communication projects, time estimation, Single sourcing, Localization, Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

TEXTBOOKS:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.

5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002. 7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213).

<table>
<tr><td>Course Title</td><td colspan="3">Research Based Project</td><td>Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EP0509</td><td>Credits</td><td colspan="2">2</td><td>Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Embedded Systems</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td rowspan="2">Total Number of Classes Per Semester</td><td rowspan="2" colspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>2</td><td>4</td><td>4</td></tr>
<tr><td>-</td><td>2</td><td>4</td><td>4</td><td>52</td><td>50%</td><td>50%</td></tr>
</table>

Mini-project course will prepare the students to take up Capstone projects in final year. It is an activity of a group of students with the intention to work on a "Specific Topic" of common interest which will give an experience of problem-solving along with group members, by using knowledge, facilities available and under the guidance of a faculty. Mini projects help students in different ways like the formation of groups, understanding group behavior, improving communication skills, learning in-depth with minimum time, interaction with the guide and outside world.

COURSE OBJECTIVES:

The objectives of this course are:

1. Integrate knowledge and skills learnt from theory concepts to build projects
2. Design solution to Engineering/real time problems

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Practice and strengthen the required knowledge in the chosen area of technology for project development.	1,2,3,4,5,9, 10,11,12	1,2,3
CO2	Identify, discuss, and justify the technical aspects of the chosen project with a systematic approach.	1,2,3,4,5,9, 10,11,12	1,2,3
CO3	Reproduce the technical features for Engineering projects.	1,2,3,4,5,9, 10,11,12	1,2,3
CO4	Work in a team in development of technical projects to solve real time problems	1,2,3,4,5,9, 10,11,12	1,2,3
CO5	Communicate and report effectively project related activities and findings.	1,2,3,4,5,9, 10,11,12	1,2,3
CO6	Inculcate innovative thinking and thereby preparing students for main project	1,2,3,4,5,9, 10,11,12	1,2,3

BLOOM’S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom’s Level

	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√	√	
CO2	√	√	√	√	√	
CO3	√	√	√	√	√	
CO4	√	√	√	√	√	
CO5	√	√	√	√	√	
CO6	√	√	√	√	√	

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2				3	3	1	1	2	2	1
CO2	3	3	3	3	2				3	3	1	1	3	2	1
CO3	3	3	3	3	2				3	3	1	1	3	3	2
CO4	3	3	3	3	2				3	3	1	1	3	3	2
CO5	3	3	3	3	2				3	3	1	1	3	3	2
CO6	3	3	3	3	2				3	3	1	1	3	3	2

Note:1-Low,2-Medium,3-High

Execution:

1. The project is carried out by team of two or three students (student team).
2. Each Student team is guided and monitored by Faculty.
3. Identification of problem and plan of implementation of the project will be submitted by the team
4. The progress of the project activities will be monitored on weekly basis
5. Students carry out practices according to the project stages.

Assessment and Evaluation:

1. The Internal assessment is made in phase1 and phase2 stages based on written reports, oral presentation, and demonstration of project results with developed model by Faculty in charge.
2. The external evaluation is made on written reports, oral presentation, and demonstration of project results with developed model at the end of the semester by Examiner.

5th Semester
PROFESSIONAL ELECTIVE-1

<table>
<tr><td>Course Title</td><td colspan="4">Sensors and Instrumentation</td><td colspan="2">Course Type</td><td colspan="2">Hardcore</td></tr>
<tr><td>Course Code</td><td>B20EPS511</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Sensors and Instrumentation</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes
Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

COURSE OBJECTIVES:

The objectives of this course are:

1. Present an outline in the measurement of different physical quantities.
2. Provide an understanding of measuring instruments and different types of sensors.
3. Provide an understanding of virtual instrumentation.
4. Illustrate the different methods of data acquisition.
5. Provide an understanding into the concepts of intelligent instrumentation.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the use of sensors for measurement of displacement, force, and pressure.	1,2,3	1,2,3
CO2	Employ commonly used sensors in industry for measurement of temperature, position, accelerometer, and vibration sensor	1,2,3	1,2
CO3	Demonstrate measurement of flow and level.	1,2,3	1,2
CO4	Demonstrate the use of virtual instrumentation in automation industries.	1,2,3	1,2
CO5	Identify and use data acquisition methods.	1,2,3	1,2
CO6	Comprehend intelligent instrumentation in industrial automation.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓		✓			
CO3	✓					
CO4	✓		✓			
CO5	✓		✓			
CO6	✓					

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										1	2	1
CO2	3	3	3										3	2	1
CO3	3	3	2										3	3	2
CO4	3	3											3	3	
CO5	3	3											3	3	
CO6	3	3	2										3	3	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
UNIT - 1
Sensors & Transducer: Definition, Classification & selection of sensors, Measurement of displacement using Potentiometer, LVDT & Optical Encoder, Measurement of force using strain gauge, Measurement of pressure using LVDT based diaphragm & piezoelectric sensor.
UNIT - 2
Measurement and Sensing: Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging, Measurement of position using Hall effect sensors, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.
UNIT - 3

Virtual Instrumentation and data acquisition: Introduction: Graphical programming techniques, Data types, Advantage of Virtual Instrumentation techniques, Concept of WHILE & FOR loops, Arrays, Clusters & graphs, Structures: Case, Sequence & Formula nodes. Basic block diagram of data acquisition, successive approximation ADC, Use of Data Sockets for Networked Communication.
UNIT - 4
Intelligent Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control.

TEXTBOOKS:

1. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
2. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
3. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.
4. Gary Johnson / Lab VIEW Graphical Programing II Edition / McGraw Hill 1997.

REFERENCE BOOK:

1. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
2. A.D. Helfrick and W.D. cooper,Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001
3. Hermann K.P. Neubert, “Instrument Transducers” 2nd Edition 2012, Oxford University Press.

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108/105/108105064/
2. https://nptel.ac.in/courses/108/108/108108147/
3. https://onlinecourses.nptel.ac.in/noc19_ee44/preview

<table>
<tr><td>Course Title</td><td colspan="4">Computer Organization and Operating Systems</td><td colspan="2">Course Type</td><td colspan="2">Hardcore</td></tr>
<tr><td>Course Code</td><td>B20EPS512</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Computer Organization and Operating Systems</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

This course is descriptive in nature, which is designed to provide knowledge of the core concepts of computer architecture and operating systems. The conceptual skills gained by the subject serves as the basic platform for communication, networks, embedded systems, real time systems domains.

COURSE OBJECTIVES:

The objectives of this course are:

1. Present an outline in the fundamental concepts of computer system architecture.
2. Provide an understanding of memories in computer, basic structure, I/O organization.
3. Provide an understanding of interrupts, direct memory access and other aspects.
4. Illustrate the different components and functions related to design of operating systems.
5. Illustrate the different components and methodology related to memory management.
6. Provide an understanding into the concepts and types of virtual memories.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Define and describe the role of an operating system and issues in the management of resources like processor, memory, and input-output.	1,2,3	1,2,3
CO2	Distinguish between the different components and functions related to design of operating systems	1,2,3	1,2
CO3	Analyze with examples the various operations and types related to processes.	1,2,3,4	1,2
CO4	Distinguish the different components and methodology related to memory management, scheduling, and page replacement policies	1,2,3,4	1,2
CO5	Define & describe the I/O concepts, machine instructions, sequencing etc.	1,2,3	1,2
CO6	Analyze the complete concept of binary addition, subtraction, multiplication, floating point numbers, numbering sequences etc.	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓			✓		
CO3	✓					
CO4	✓			✓		
CO5	✓			✓		
CO6	✓					

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										1	2	1
CO2	3	3	3										3	2	1
CO3	3	3	2										3	3	2
CO4	3	3											3	3	
CO5	3	3											3	3	
CO6	3	3	2										3	3	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Basic Structure of Computers: Computer types, Functional units, Basic operational concepts, Bus structures, Performance-processor clock, Basic performance equation, clock rate, performance measurement. Machine Instructions and Programs: Numbers, arithmetic operations and characters, Memory location and Addresses, Memory operations, Instructions, and instruction sequencing, Addressing modes, Assembly language, Stack and Queues and Subroutines.

UNIT - 2
Input/ Output Organization: Accessing I/O Devices; Interrupts; enabling and disabling interrupts, Handling multiple devices, Device requests, Exceptions, Direct Memory Accesses; Buses; Interface Circuits, standard I/O interface.
UNIT - 3
Introduction to Operating Systems and System Structures : Introduction: Computer-System Organization, Computer System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Distributed Systems, Special-Purpose Systems, Computing Environments; System Structures: Operating System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating System Structure, Virtual machines.
UNIT - 4
Memory Management: Memory-Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Structure of the page table, Segmentation. Virtual Memory Management: Demand Paging, Page Replacement policies, Allocation of frames, Fundamentals of Scheduling policies.

TEXTBOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Principles", Seventh Edition, John Wiley and Sons 2006.
2. Roger L Tokheim, "Digital Electronics Principles and Applications", Sixth Edition, McGraw Hill, 2004.
3. Carl Hamacher, Z Varnesic and S Zaky, "Computer Organization", Fifth Edition, McGraw Hill 2002.

REFERENCE BOOK:

1. Milan Milenkovic, "Operating Systems - Concepts and Design", Second Edition, Tata McGraw-Hill.
2. Harvey M. Deitel, "Operating Systems", Addison Wesley
3. D.M. Dhamdhere : Operating Systems- A Concept-based Approach, Tata McGraw Hill
4. Morris Mano, "Digital Logic and Computer Design", Pearson Education Asia.
5. Morris Mano and Charles R Kime, "Logic and Computer Design Fundamentals", Second Edition, Pearson Education Asia.

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs37/preview
3. https://onlinecourses.swayam2.ac.in/cec20_cs06/preview
4. https://onlinecourses.nptel.ac.in/noc19_cs50/preview

<table>
<tr><td>Course Title</td><td colspan="4">Mechatronics</td><td colspan="2">Course Type</td><td colspan="2">Professional Elective</td></tr>
<tr><td>Course Code</td><td>B20EPS513</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Mechatronics</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

The course consists of foundations of interdisciplinary domain of mechatronics. The course gives a brief roundup of Sensors and Transducers, actuation systems, System Models and Controllers and programmable logic controllers.

COURSE OBJECTIVES:

The objectives of this course are:

1. To understand the requirements of Mechatronics systems and recognize its various elements.
2. To understand the actuation systems and signal conditioning circuits.
3. To understand the concepts of system models and controllers
4. To understand the implementation of programmable logic controllers for Mechanical drives.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Define Mechatronics systems and recognize its various elements.	1,2,3	1,2
CO2	Compile the key elements of electrical actuation systems and signal conditioning circuits.	1,2,3	1,2
CO3	Demonstrate the concepts of system models and controllers.	1,2,3	1,2
CO4	Analyze the processing of logic controllers.	1,2,3	1,2
CO5	Design the programmable logic controller for applications	1,2,3	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓				
CO2	✓		✓			

CO3	✓					
CO4	✓		✓			
CO5	✓		✓			
CO6	✓					

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										1	2	
CO2	3	3	3										3	2	
CO3	3	3	2										3	3	
CO4	3	3											3	3	
CO5	3	3											3	3	

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
Unit-1
Sensors and Transducers: Introduction to Mechatronics Systems, Measurement Systems, control Syste ms, Microprocessor basd Controllers. Sensors and Transducers, Performance, Terminology, Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors Selection of Sensors.
Unit-2
Actuation System: Rotary Actuators, Mechanical Actuation Systems, Cams, Gear Trains, Ratchet and pawl Beltand Chain Drives, Bearings. Electrical Actuation Systems, Mechanical Switches Solid State Switches, Solenoids Construction and working principle of DC and AC Motors, speed control of AC and DC drives, Stepper Motors switching circuitries for stepper motor, AC & DC Servo motors
Unit-3
System Models and Controllers: Building blocks of Mechanical, Electrical, Fluid and Thermal systems, Rotational, Translation systems, electromechanical systems, Hydraulic Mechanical Systems. Continuous and discrete process Controllers, Control Mode, Step mode, Proportional Mode, Derivative Mode, Integral Mode, PID Controllers, Digital Controllers, Velocity Control, Adaptive Control, Digital logic control, Microprocessors control.
Unit-4:

Programming Logic Controllers: Programmable Logic Controllers, Basic Structure, Input / Output Processing, Programming, Mnemonics, Timers, Internal relays and counters, Shift Registers, Master and Jump Controls, Data Handling, Analogs Input / Output, Selection of a PLC.

TEXTBOOKS:

1. Mechatronics- W. Bolton, Longman, 2nd Pearson Publications, 2007
2. Microprocessor Architecture, programming and applications with 8085.8085A- R.S. Ganokar, Wiley Eastern

REFERENCE BOOK:

1. Mechatronics Principles & applications by Godfrey C. Canwerbolu, Butterworth- Heinemann 2006.
2. Mechatronics- danNecsulescu, Pearson Publication, 2007
3. Introduction Mechatronics & Measurement systems, David. G. Aliciatore & Michael B. Bihistand, tata McGraw Hill, 2000.
4. Mechatronics: Sabricentinkunt, John wiley & sons Inc. 2007

5th Semester
PROFESSIONAL ELECTIVE-2

<table>
<tr><td>Course Title</td><td colspan="4">Networks and Signals</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>B20EPS521</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Networks and Signals</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>0</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>-</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

The course covers the fundamentals of signal and system analysis tackling both continuous-time (CT) and discrete-time (DT) systems. Fourier analysis in the course includes Fourier series for periodic continuous-time signals, the continuous-time Fourier transform (CTFT) and the discrete-time Fourier transform (DTFT). This course introduces the concepts to determine voltage, current and power in branches of any circuits excited by dc and ac voltages and current sources by simplifying techniques to solve dc circuit problems using basic circuit theorems and structured methods like node voltage and mesh current analysis. The goal also includes derivation of the transient responses of RC, RL and RLC circuits, steady state response of circuits and application of Laplace transform in network theory.

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide insight into fundamentals of Continuous and Discrete-time signals and systems, their properties and representations.
2. To provide understanding of signal representation in Fourier domain such as Fourier series, Fourier transform, discrete time Fourier transform.
3. Introduce the fundamental concepts of electrical circuit analysis with active and passive energy sources,
4. Study and analyse circuit using network theorems, transforms, and circuit resonance,
5. Select an analysis strategy to determine a response

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Illustrate the operations on Signals	1,2,3,4	2,3
CO2	Classify the signals into even-odd, energy-power signals	1,2,3,4	3
CO3	Represent continuous time periodic signals in frequency domain using Fourier technique.	1,2,3,9,10	1,2,3
CO4	Analyze the concepts of super mesh, super node, and network		

CO5	Analyze transient behavior of RLC Circuits by applying Laplace Transforms.	1,2,3,9,10, 11	1,2,3
CO6	Calculate the impulse response of the series and parallel RLC circuits		

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓		✓	✓	
CO2	✓			✓	✓	
CO3	✓		✓	✓	✓	
CO4	✓		✓	✓	✓	

COURSE ARTICULATION MATRIX

CO/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**1**	**1**										**2**	**3**
CO2	**3**	**2**	**1**	**1**											**3**
CO3	**3**	**3**	**3**						**3**	**1**			**1**	**1**	**2**
CO4	**3**	**3**	**3**						**3**	**1**	**1**		**1**	**1**	**2**

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Introduction to Signals and Systems: Definitions of a signal and system, Elementary signals, Basic operations on signals, Classification of signals, Properties of systems.
UNIT - 2
Fourier Representation for Aperiodic signals: FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance, Inverse Fourier Transform. FT representation of aperiodic discrete signals-DTFT, definition, DTFT of standard discrete signals.
UNIT - 3
Circuit Analysis Techniques: Practical sources, Source transformations, Concepts of super node and super mesh, Network Theorems: Superposition theorem, Thevenin's & Norton's theorem, Maximum power transfer theorem.

UNIT - 4

Applications of LT technique in circuit analysis: A procedure for evaluating initial conditions, Initial & Final State of a network element. Time-domain to s-domain transformation of R-L-C circuits, step response of series R-L & series R-C circuit, impulse response of series R-L & series R-C network.

TEXTBOOKS:

1. Simon Haykins, “Signals and Systems”, John Wiley, India Pvt Ltd, Second Edition, 2008
2. W H Hayt, J E Kemmerly, S M Durbin, “Engineering Circuit Analysis”, 6th Edition, Tata McGraw-Hill Publication.

REFERENCE BOOK:

1. Allan V. Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson Education, Second Edition, 1997.
2. Nahvi and Edminister, “Electric Circuits” Schaum’s Outline Series, McGraw Hill, 2003.
3. J. David Irwin and R. Mark Nelms, “Basic Engineering Circuit Analysis”, 8th Edition, John Wiley, 2006.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

- https://www.tutorialspoint.com/signals_and_systems/index.htm
- https://www.tutorialspoint.com/network_theory/index.htm

SWAYAM/NPTEL/MOOCs:

- https://www.udemy.com/course/signals-and-systems-from-basics-to-advance/
- https://nptel.ac.in/courses/108/105/108105159/

Course Title	Cloud Computing				Course Type		Softcore	
Course Code	B20EPS522	Credits	3		Class		V Semester	
Theory of Computation	TLP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practical	0	0	0	Theory	Practical	IA	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**-**	**50%**	**50%**

COURSE OVERVIEW:

The course is designed to provide a wide knowledge and deep understanding of installing, configuring, and managing cloud infrastructure for an organization

COURSE OBJECTIVES:

The objectives of this course are:

1. learning the principles of virtualization technologies and cloud computing
2. Introduce the concepts how virtual machines, hypervisors, virtual networks and virtual storage work together.
3. Emphasizes on how to apply and build cloud infrastructure in practice.
4. Introduce actual approaches in virtual machine management and troubleshooting.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	The fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability, benefits, as well as current and future challenges	1,2,3,5	1
CO2	Explain the economics of outsourcing IT to the cloud software deployment considerations	1,2,3,5	1,2
CO3	Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model	1,2,3,5	1,2
CO4	Demonstrate how to build secure networks in the cloud	1,2,3,5	1,2
CO5	Discover a variety of managed big data services in the cloud	1,2,3,5	1,2
CO6	Explain what machine learning is, the terminology used, and its value proposition	1,2,3,5	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**

CO1		✓	✓	✓		
CO2			✓			✓
CO3		✓				✓
CO4		✓				
CO5		✓	✓			✓
CO6		✓	✓			✓

COURSE ARTICULATION MATRIX

CO/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2		2								3	2	1
CO2	3	3	3		2								3	2	1
CO3	3	3	2		2								3	2	
CO4	3	3	3		2								2	2	1
C05	3	3	2		3								3	2	1
CO6	3	3	3		3								3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Cloud Computing: Cloud versus traditional architecture, IaaS, PaaS, and SaaS. Google Cloud architecture, Cloud computing characteristics, IT infrastructure, Cloud Versus Traditional Architecture. Creating a Virtual Machine, Compute Engine: Qwik Start – Windows, Getting Started with Cloud Shell and gcloud, Kubernetes Engine: Qwik Start, Set Up Network and HTTP Load Balancers
UNIT - 2
Networking in the Cloud: Introduction to networking in the cloud, defining a Virtual Private Cloud, Public and private IP address basics, Google's network architecture, Routes and firewall rules in the cloud, User Authentication: Identity-Aware Proxy, Multiple VPC networks, VPC Networks - Controlling Access, HTTP Load Balancer with Cloud Armor, Create an Internal Load Balancer, Google Cloud Packet Mirroring with Opensource IDS
UNIT - 3
Infrastructure as Code: Cloud Deployment Manager, Public and private IP address basics, Monitoring and managing your services, applications, and infrastructure.

Google Cloud’s operations suite: Cloud Storage: Qwik Start - Cloud Console, Cloud IAM: Qwik Start, Cloud Monitoring: Qwik Start, Cloud Functions: Qwik Start – Console, Google Cloud Pub/Sub: Qwik Start – Console,
UNIT – 4 **Big Data and Machine Learning Fundamentals in Cloud:** Big data managed services in the cloud. Leverage big data operations with Dataproc. Build Extract, Transform, and Load pipelines using Dataflow.BigQuery, Google’s Enterprise Data Warehouse Introduction to machine learning in the cloud. Building bespoke machine learning models with Vertex AI. AutoML.Google’s pre-trained machine learning APIs

TEXTBOOKS:

1. Cloud Computing Bible by Barrie Sosinsky John Wiley & Sons 2011 ISBN13: 9780470903568

REFERENCE BOOK:

1. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS) Michael J. Kavis John Wiley & Sons 2014 978-1-118- 61761-8
2. Mastering VMware vSphere 6.7: Effectively deploy, manage, and monitor your virtual datacenter with VMware vSphere 6.7, 2nd Edition by Martin Gavanda(Author), Andrea Mauro(Author), Paolo Valsecchi(Author), Karel NovakPackt Publishing 2019 978-1-78961-337

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. Google Cloud -GCP Course-Google Cloud for Education - Curriculum

<table>
<tr><td>Course Title</td><td colspan="4">Research Methodology & IPR</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>B20EPS523</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">V Semester</td></tr>
<tr><td rowspan="5">Research Methodology & IPR</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>-</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

COURSE OBJECTIVES:

This course objective is:

1. To provide insights into research methodology for their research studies, irrespective of their discipline.
2. Enhance the research skills and equip them to carry out individual or team research work according to scientific/technology requirements.
3. Introduce different IPR Legislations and IPR filing procedures.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Formulate research problem.	1,2,3,8,10	1,2,3
CO2	Develop the most appropriate methodology for their research studies, irrespective of their discipline.	1,2,3,8,10	1,2,3
CO3	Analyze literature review and find research gaps to finalize research objectives	1,2,3,8,10	1,2,3
CO4	Identify the need of ethics in research	1,2,3,8,10	1,2,3
CO5	Identify the need of IPR of research projects for economic growth and social benefits	1,2,3,8,10	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level					
CO#	**Remember (L1)**	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓			
CO2	✓					
CO3	✓		✓			

CO4	✓		✓			
CO5		✓	✓			

COURSE ARTICULATION MATRIX

CO / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2					3		1					
CO2	2	2	2					3		1					
CO3	2	2	2					3		1					
CO4	2	2	2					3		1					
CO5	2	2	2					3		1					
CO6	2	2	2					3		1					

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
Unit-1 **Research and Types of research** Meaning of Research- Objectives of Research- Motivation in Research. Research methods v/s Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Research Process. Criteria of good Research. Defining the Research Problem - Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem, Technique Involved in Defining a Problem, Research design – Basic Principles- Need of research design –– Features of good design – Important concepts relating to research design, Different Research Designs.
Unit-2 **Tthesis writing and Ethics.** Structure and components of scientific reports - Types of report – Technical reports and thesis, Significance –Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables - Bibliography, referencing and footnotes - Oral presentation – Planning – Preparation – Practice – Making presentation – Use of visual aids - Importance of effective communication. **LATEX**: Introduction to LATEX and it's usage in documentation, preparation of thesis, technical papers, and articles.
Unit- 3 **Intellectual Property Rights**

Intellectual Property Rights: Introduction, Legislations covering IPR in INDIA; Patents: Conditions to be satisfied by an invention to be patentable, Patentable inventions under patent Act 1970,Types of patents which are not patentable in INDIA, Term of patent in INDIAN system, Essential patent documents to be submitted, Criteria for naming inventors in an application of patent, Where to apply ?How to apply?, Why provisional specification, Complete specification, Hierarchy of officers in patent office, Register of patents ,working of patents and company licensing, Revocation of patents, Term of patents, Patent of addition
Unit-4 **Other Intellectual Property Rights** Copy Right; Trademarks; Geographical Indications; Industrial Designs; Layout Design of Integrated designs; Plant verity; International Patenting; Case studies

TEXTBOOKS:

1. Kothari, C. R. **“**Research methodology: Methods & techniques”. New Delhi: New Age International (P) Ltd, 2004.

REFERENCE BOOK:

1. “LATEX Documentation” available at http://www.latex-project.org/
2. “Patent Manual”, available at http://www.bits-pilani.ac.in/uploads/Patent_ManualOct_25th _07.pdf

VI SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20EP0601	UI/UX Design	HC	1	1	1	3	5
2	B20EP0602	Web Technologies	HC	1	1	0	2	3
3	B20EN0603	Computer Networks	HC	3	0	0	3	3
4	B20EP0604	Basic VLSI Design	HC	3	0	0	3	3
5	B20EPS6XX	Professional Elective-3	SC	3	0	0	3	3
6	B20XXO6XX	Open Elective-2	OE	3	0	0	3	3
TOTAL				**14**	**2**	**1**	**17**	**20**
Practical /Term Work / Sessional								
7	B20EP0605	Web Technologies Lab	HC	0	0	1	1	2
8	B20EN0606	Computer Networks Lab	HC	0	0	1	1	2
9	B20EP0606	Basic VLSI Design Lab	HC	0	0	1	1	2
10	B20EP0607	Mini Project/Internship	HC	0	0	2	2	4
11	B20PA0501	Indian Tradition and Culture	FC	1	0	0	1	2
TOTAL				**1**	**0**	**5**	**6**	**12**
TOTAL SEMESTER CREDITS					**23**			
TOTAL CUMULATIVE CREDITS					**134**			
TOTAL CONTACT HOURS					**32**			

Course Title	**UI/UX Design**				**Course Type**		**HC**	
Course Code	**B20EP0601**	**Credits**	**3**		**Class**		**V Semester**	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	1	2	2	Theory	Practical	**CIE**	**SEE**
	Practical	1	2	2				
	Total	**3**	**5**	**5**	**39**	**26**	**50%**	**50%**

COURSE OVERVIEW:

The course is organized around a practical project with iterative design of a graphical user interface to organize information about users into useful summaries with affinity diagrams, to convey user research findings with personas and scenarios and to learn the skill of sketching as a process for user experience design. The students will be given exposure to wireframing and Prototyping software in the various UI/UX Design tools.

COURSE OBJECTIVES:

The objectives of this course are:

1. The aim of the UI/UX course is to provide students with the knowledge of user- centered design,
2. User -centered methods in design, graphic design on screens, simulation and prototyping techniques, usability testing methods, interface technologies and
3. User centered design in corporate perspective

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand iterative user-centered design of graphical user interfaces	1,2,3,5,9	1,2,3
CO2	Apply the user Interfaces to different devices and requirements	1,2,3,5,9	1,2,3
CO3	Create high quality professional documents and artifacts related to the design process.	1,2,3,5,9	1,2,3
CO4	Develop the complete design process.	1,2,3,5,9	1,2,3
CO5	Apply implementation of GUI to different devices.	1,2,3,5,9	1,2
CO6	Create Graphically User Interface for applications	1,2,3,5,9	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

	Bloom's Level					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**

CO#	(L1)	(L2)	(L3)	(L4)	(L5)	(L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2				1				3	2	1
CO2	3	3	3		2				1				3	2	1
CO3	3	3	2		2				1				3	2	
CO4	3	3	3		2				1				2	2	1
CO5	3	3	2		3				1				3	2	1
CO6	3	3	3		3				1				3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS

THEORY:

Contents
UNIT – 1
Introduction to the UI: What is User Interface Design (UI) -The Relationship Between UI and UX, Roles in UI/UX, A Brief Historical Overview of Interface Design, Interface Conventions, Approaches to Screen Based UI, Template vs Content, Formal Elements of Interface Design, Active Elements of Interface Design, Composing the Elements of Interface Design, UI Design Process, Visual Communication design component in Interface Design
UNIT-2
Introduction to UX: UX Basics- Foundation of UX design, Good and poor design, Understanding Your Users, Designing the Experience, Elements of user Experience, Visual Design Principles, Functional Layout, Interaction design, Introduction to the Interface, Navigation Design, User Testing, Developing and Releasing Your Design

UNIT – 3
UI/ UX Design Tools: User Study- Interviews, writing personas: user and device personas, User Context, Building Low Fidelity Wireframe and High-Fidelity Polished Wireframe Using wireframing Tools, Creating the working Prototype using Prototyping tools, Sharing and Exporting Design
UNIT - 4
Web Design: Wireframes to Prototypes: Responsive web design and mobile web challenges: Mobile-first approach, Web typography, The relationship between design and programming and whether it is important to know how to code the different web technologies that make the web work, such as HTML, CSS, JavaScript, server-side coding, and databases.

Practice Sessions

Contents
1. Introduction to Figma Design tools (All basic Componets) 2.Design backgrounds in Figma and Blending Modes 3.Incoroprate Google Fonts and Gradients Colors 4.Design Layout Grids and Responsive Design 5.Create Apple Watch Ring Using Figma 6.To create simple Blob background in Figma 7.Desiging using UIKits in Figma 8.Design an Icons using Tools provided 9.Publishing Design styles and components 10.3D Mock-ups to design

TEXTBOOKS:

1. A Project Guide to UX Design: For user experience designers in the field or in the making (2nd. ed.). Russ Unger and Carolyn Chandler. New Riders Publishing,USA, 2012.
2. The Elements of User Experience: User-Centered Design for the Web and Beyond, Second Edition Jesse James Garrett, Pearson Education. 2011.
3. The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Third Edition Wilbert O. Galitz , Wiley Publishing, 2007.
5. The UX Book Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson and Pardha S. Pyla, Elsevier, 2012

<table>
<tr><td>Course Title</td><td colspan="4">Web Technologies</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EP0602</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">VI Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>2</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50%</td><td>50 %</td></tr>
</table>

COURSE OVERVIEW:

Web Technologies. Enable the students to know techniques involved to support real-time Software development. To highlight the features of different technologies involved in Web Technology and various Scripting Languages.

COURSE OBJECTIVES:

The objectives of this course are:

1. Illustrate the Semantic Structure of HTML and CSS.
2. Compose forms and tables using HTML and CSS.
3. Design Client-Side programs using JavaScript.
4. To impart skills required to develop web applications and services.
5. To provide students with conceptual and practical knowledge of web applications.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply XHTML and CSS syntax and semantics to build web pages.	1,2,3	1,2,3
CO2	Identify tools and technologies for Web applications.	1,2,3	1,2,3
CO3	Apply appropriate user experience and interactive design concepts to custom websites.	1,2,3	1,2,3
CO4	Demonstrate HTML5 integration with JavaScript scripting skills in a variety of student-designed projects.	1,2,3	1,2,3
CO5	Design and build applications using Android and or iOS UI Paradigms	1,2,3	1,2
CO6	Apply Reactive and Functional programming concepts	1,2,3	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level

	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2										3	2	1
CO2	3	3	3										3	2	1
CO3	3	3	2										3	2	
CO4	3	3	3										2	2	1
CO5	3	3	2										3	2	1
CO6	3	3	3										3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT – 1   **Introduction HTML and XHTML:** WWW architecture, Fundamentals of HTML Introduction to Computers and Internet, World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, MIME, Hypertext Transfer Protocol. Text formatting tags, marquee, inserting images, Links, Lists, creating tables, Frames, Working with form elements. Syntactic differences between HTML and XHTML.
UNIT – 2

Cascading Style Sheets: : Introduction, Levels of Style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, The Box Model, Background Images, The <span> and <div> tags
UNIT – 3 **JavaScript:** Overview of JavaScript, Object Orientation and JavaScript, General Syntactic characteristics, Screen output and keyboard input, Control statements, Functions, Arrays in JavaScript, Constructors, Pattern Matching using Regular Expressions, Events and Event handling.
UNIT - 4 **React Native:** React, JSX ,Components ,Props,State, Style,Components, Views, User Input, Debugging, Data, Navigation, Expo Components, Creating Custom Cards, Touchable Opacity, Reusing Components, Communicating with child from parent, Handling Text Inputs,Working with Scroll View,App Build

TEXTBOOKS:

1. Robert W. Sebesta, “Programming the World Wide Web”, 7th Edition. Addison-Wesley, 2012.
2. Kogent Learning Solutions Inc., “Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML Black Book”, Dream tech Press, ISBN-13: 978-9351192510, Paperback – 19 Dec 2013
3. Bonnie Eisenman “Learning React Native: Building Native Mobile Apps with JavaScript” : O'Reilly Media, Inc. ISBN: 9781491989142

REFERENCE BOOKS

1. Gi Houssein Djirdeh , Anthony Accomazzo , Sophia Shoemaker-“ Fullstack React Native: Create beautiful mobile apps with JavaScript and React Native”
2. Eric Ladd, Jim O’ Donnel, “Using HTML 4, XML and JAVA”, Prentice Hall of India – QUE, 1999.
3. Aferganatel, “Web Programming: Desktop Management”, PHI, 2004.
4. Rajkamal, “Web Technology”, Tata McGraw-Hill, 2001.

<table>
<tr><td>Course Title</td><td colspan="4">Computer Networks</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EN0603</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">VI Semester</td></tr>
<tr><td rowspan="5">Embedded Systems</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
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<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>-</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

The main objective of this course is to provide a foundational view of communication networks: the principles upon which the Internet and other computer networks are built; how those principles translate into deployed protocols and hands-on experience on solving challenging problems with network protocols. Computer communication networks course will include topics such as link-layer technology, switching, routing protocols, the Internet Protocol, reliability, flow control, congestion control, and their embodiment in TCP and UDP, Quality of Service and application layer protocols such as HTTP, etc. The course will involve a significant amount of network simulator tool to design the basic network topologies and protocols.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the basics of data communication and networking.
2. Classify multiple access methods and identify different LANs.
3. Illustrate functions of network layer and demonstrate different routing protocols
4. Discuss transport layer and application layer protocols

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the fundamental concepts of basic networking, Protocols, Standards and Layered models	1,2,3	1,2,3
CO2	Compare OSI Model & TCP/IP Suite	1,2,3	1,2,3
CO3	Differentiate multiple access methods and LANs	1,2,3	1,2,3
CO4	Demonstrate the concepts of network layer and build sub-nets and routing mechanism.	1,2,3,5	1,2,3
CO5	Evaluate different transport layer protocols	1,2,3,5	1,2,3
CO6	Evaluate different application layer protocols	1,2,3,5	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	
CO6	✓	✓	✓	✓	✓	

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										1	2	1
CO2	3	2	1										1	2	1
CO3	3	2	1		3								3	2	1
CO4	3	2	1		3								3	2	1
CO5	3	2	1		3								3	2	1
CO6	3	2	1		3								3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
UNIT - 1 **Introduction to Data Communication and Networking:** Layered tasks, OSI Model, TCP/IP Suite, and Comparison of OSI Model & TCP/IP Suite. Addressing of TCP/IP Model. Framing, Flow and Error Control, Protocols: Noiseless channels and noisy channels, HDLC
UNIT - 2 **Multiple Access &LANs:** Random access, Controlled access, Channelization. Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11
UNIT - 3 **Network Layer:** Logical addressing, Ipv4 addresses, Ipv6 addresses, Internetworking, Ipv4 Header Format and Ipv6 Header Format, Transition from Ipv4 to Ipv6. Distance vector routing, link state routing.
UNIT - 4

Transport layer & Application Layer: Process to Process Delivery, UDP, TCP, SCTP, Domain Name System, Resolution

TEXTBOOKS:

1. B Forouzan "Data Communication and Networking", 4th Ed, TMH 2006.

REFERENCE BOOK:

1. James F. Kurose, Keith W. Ross "Computer Networks", Pearson Education, 2nd Edition, 2003.
2. Wayne Tomasi "Introduction to Data communication and Networking" Pearson Education 2007
3. S. Keshav, "An Engineering Approach to Computer Networking", Pearson Education

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch01.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch02.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch11.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch12.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch13.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch14.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch19.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch20.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch22.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch23.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch25.ppt

<table>
<tr><td>Course Title</td><td colspan="4">Basic VLSI Design</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EP0604</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">VI Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

This course provides fundamental concepts, basic theory, and design methodologies of VLSI design technology. Furthermore, the structures of designing VLSI systems include MOS devices and circuits, fabrication process, MOS design rules, physical design of MOS circuits. Development of arithmetic building blocks and memories using MOS circuits.

COURSE OBJECTIVES:

The objectives of this course are:

1. To acquire the knowledge of different types of MOSFETS, electrical properties of MOS circuits, and Fabrication process.
2. To introduce the physical design of MOS circuits.
3. To present the fundamental concept of CMOS logic gates design techniques.
4. To illustrate the arithmetic building blocks and memories using MOS circuits.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Differentiate the Enhance type MOSFET and Depletion type MOSFET	1,2,3,4	1,2,3
CO2	Analyze the various types of MOS circuits, design equations, and Fabrication processes	1,2,3,4	1,2,3
CO3	Sketch the stick diagram and physical design of MOS circuits	1,2,3,4	1,2,3
CO4	Design and analyze the CMOS logic circuits, and CMOS Pass transistor logic	1,2,3,4	1,2,3
CO5	Design and development of arithmetic building blocks	1,2,3,4	1,2
CO6	Differentiate SRAM and DRAM semiconductor memory technologies	1,2,3,4	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2										2	1
CO2	3	3	2	2										2	1
CO3	3	3	2	2										2	
CO4	3	3	2	2										2	1
CO5	3	3	2	2										2	1
CO6	3	3	2	2										2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
Unit 1
Introduction to MOS Circuits: Introduction to Integrated circuit Technology, Basic IC design flow chart, Basic MOS transistors: Enhancement mode transistor action, Depletion mode transistor action, Basic steps of fabrication process of NMOS, PMOS, CMOS. Introduction to BiCMOS Technology. **MOS Device Design Equations:** Ids versus V_{ds}, Non-Saturated Region, Saturated Region, MOS Transistor threshold voltage, Tansconductance g_m and output conductance g_{ds}, nMOS Inverter, CMOS Inverter.
Unit 2
VLSI Circuit Design Processes: Stick diagrams, Stick diagrams of standard gates, Design Rules, Physical Design (Layout) of Logic gates and Logic Functions.
Unit 3

CMOS Logic Gates Design: NAND and NOR gates, Complex Logic gates, CMOS Full Adder Circuit, Pass transistors transmission Gate, CMOS Transmission Gates, Complementary Pass Transistor Logic (CPL).
Unit 4
Arithmetic Building Blocks and Memories: Design of arithmetic building blocks: Adders, Multipliers, shifters, Semiconductor Memories: SRAM, and DRAM.

TEXTBOOKS:

1. Douglas A. Pucknell and Kamran Eshraghian, “Basic VLSI Design”, 3rd Edition, PHI, 2017.
2. Sung-Mo Kang and Yusif Leblebici, “CMOS Digital Integrated Circuits: Analysis and Design”, Tata McGraw-Hill, 3rd Edition, 2007.
3. Neil H. E Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson Education, 4th Edition, 2011.

REFERENCE BOOKS

1. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, “Digital Integrated Circuits: A Design Perspective”, 2nd Edition, Pearson, 2016.
2. John. P. Uyemura, “Introduction to VLSI Circuits and Systems”, John Wiley, 1st Edition, 2009.

<table>
<tr><td>Course Title</td><td colspan="4">Web Technologies Lab</td><td colspan="2">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EP0605</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">VI Semester</td></tr>
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<tr><td>Lecture</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Tutorial</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
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</table>

COURSE OVERVIEW:

Web Technologies. Enable the students to know techniques involved to support real-time Software development. To highlight the features of different technologies involved in Web Technology and various Scripting Languages.

COURSE OBJECTIVES:

The objectives of this course are:

1. Illustrate the Semantic Structure of HTML and CSS.
2. Compose forms and tables using HTML and CSS.
3. Design Client-Side programs using JavaScript.
4. 4.To impart skills required to develop web applications and services.
5. To provide students with conceptual and practical knowledge of web applications.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply XHTML and CSS syntax and semantics to build web pages.	1,2,3,5	1,2,3
CO2	Identify tools and technologies for Web applications.	1,2,3,5	1,2,3
CO3	Apply appropriate user experience and interactive design concepts to custom websites.	1,2,3,5	1,2,3
CO4	Demonstrate HTML5 integration with JavaScript scripting skills in a variety of student-designed projects.	1,2,3,5	1,2,3
CO5	Design and build applications using Android and or iOS UI Paradigms	1,2,3,5	1,2
CO6	Apply Reactive and Functional programming concepts	1,2,3,5	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2								3	2	1
CO2	3	3	3		2								3	2	1
CO3	3	3	2		2								3	2	
CO4	3	3	3		2								2	2	1
CO5	3	3	2		3								3	2	1
CO6	3	3	3		3								3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

LAB EXPERIMENTS

Contents

1. Write a javascript to design a simple calculator to perform the following operations:sum, product, difference and quotient.

2. Write a javascript that calculates the squares and cubes of the numbers from 0 to 10 and outputs html text that displays the resulting values in an html table format.

3. Write a javascript code that displays text "text-growing" with increasing font size in the interval of 100ms in red color, when the font size reaches 50pt it displays "text-shrinking" in blue color. Then the font size decreases to 5pt.

4. Develop and demonstrate a html5 file that includes javascript script that uses functions for the following problems:
   a. Parameter: a string
   b. Output: the position in the string of the left-most vowel
   c. Parameter: a number
   d. Output: the number with its digits in the reverse order

5. Create the google logo using text attributes using react native.

6. Create a mobile applications connecting components to the stylesheet using react native.

7. To recreate the snapchat login page using the design layout practices.

8. Create an iphone call app navbar using react native.

9. Create an app that provides some information on one of your role models.

10. Create app that will take a monetary value in united states dollar (usd) from a user and convert it to various currencies

TEXTBOOKS:

1. Robert W. Sebesta, "Programming the World Wide Web", 7th Edition. Addison-Wesley, 2012.
2. Kogent Learning Solutions Inc., "Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML Black Book", Dream tech Press, ISBN-13: 978-9351192510, Paperback – 19 Dec 2013
3. Bonnie Eisenman "Learning React Native: Building Native Mobile Apps with JavaScript" : O'Reilly Media, Inc. ISBN: 9781491989142

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1. Gi Houssein Djirdeh , Anthony Accomazzo , Sophia Shoemaker-" Fullstack React Native: Create beautiful mobile apps with JavaScript and React Native"
2. Eric Ladd, Jim O' Donnel, "Using HTML 4, XML and JAVA", Prentice Hall of India – QUE, 1999

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4. Rajkamal, “Web Technology”, Tata McGraw-Hill, 2001.

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<tr><td>Lecture</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tutorial</td><td>-</td><td></td><td></td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>26</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

COURSE OBJECTIVES:

The objectives of this course are:

1. Identify the necessary software and hardware to constitute a designed computer network
2. Implement a simple LAN Network
3. Describe, Analyze and evaluate a number of datalink, network, and transport layer protocols
4. Describe routing protocols

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Write and debug the code for various error detection, Congestion Control Techniques		
CO2	Write and test the code using different security techniques to secure the messages,		
CO3	Write the program and evaluate different network layer and transport layer protocols		
CO4	Write the code for different wired and wireless network scenarios and test the performance using simulators		
CO5	Evaluate various design parameters such as latency, error rate, throughput, and their influence on node/link utilization and performance		

BLOOM'S LEVEL OF THE COURSE OUTCOMES

<table>
<tr><td rowspan="2">CO#</td><td colspan="6">Bloom's Level</td></tr>
<tr><td>Remember (L1)</td><td>Understand (L2)</td><td>Apply (L3)</td><td>Analyze (L4)</td><td>Evaluate (L5)</td><td>Create (L6)</td></tr>
</table>

CO1	✓	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	

COURSE ARTICULATION MATRIX

CO/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2		3				2	2			1	2	3
CO2	2	2	2		3				2	2			1	2	3
CO3	2	2	2		3				2	2			1	2	3
CO4	2	2	2		3				2	2			1	2	3
CO5	2	2	2		3				2	2			1	2	3

Note:1-Low,2-Medium,3-High

PRACTICE SESSION:

Sl. No.	**Name of the Practice Session**	**Tools and Techniques**	**Expected Skill /Ability**
1	Write a program for bit stuffing & de-stuffing using HDLC.	C/C++ Software	Identify bit stuffing and destuffing
2	Write a program for character stuffing & de-stuffing using HDLC.	C/C++ Software	Identify byte stuffing and destuffing
3	Perform the Encryption and Decryption of a given message using substitution method.	C/C++ Software	Analyze the Encryption and Decryption of a given message using substitution method.
4	Choose the two prime numbers, p=17 and q=11.Write a program for public key encryption system using RSA algorithm to encrypt and decrypt the message.	C/C++ Software	Understand the key concept of public key encryption system using RSA algorithm to encrypt and decrypt the message.
5	Write a program to implement the congestion control b using the leaky bucket algorithm. Examine node transmitting/receiving packets to/from other nodes. Using a random function; vary the packet size.	C/C++ Software	Analyze the leaky bucket algorithm for congestion control

6	Write a program for distance vector algorithm to find the shortest path for transmission.	C/C++ Software	Analyze to find the shortest path using the distance vector algorithm
7	Create a three node network topology and connect the duplex links between them. Tcl script to observe the packet flow for the given network in network animator (NAM)	NS2 Simulator Software	Understand the concept of duplex link in a given three node topology, and analyze the packet flow.
8	Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3, n1-n3. Apply relevant applications over TCP agents by changing the parameters and hence determine the number of packets transmitted.	NS2 Simulator Software	Analyze the concept of TCP agent for a given four node network and determine the number of packets transmitted
9	Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply UDP agent between n0-n3, n1-n3. Apply relevant applications over UDP agents by changing the parameters and hence determine the number of packets transmitted.	NS2 Simulator Software	Analyze the concept of UDP agent for a given four node network and determine the number of packets transmitted
10	Simulate a three nodes point-to point network and connect the duplex links between them. Set the queue size, vary the transmission speeds (bandwidth)and find the number of packets dropped.	NS2 Simulator Software	Evaluate the concept of duplex link in a given three node topology, and analyze queue size, the transmission speeds (bandwidth)and the number of packets dropped.
11	Simulate an Ethernet LAN using N-nodes (6-10) with UDP/TCP connection. Apply relevant applications over UDP/TCP agents by changing the parameters and hence determine the number of packets transmitted.	NS2 Simulator Software	Analyze packet transmission in 802.3 Ethernet using UDP/TCP
12	Simulate a wireless network for n nodes. For a wireless network consisting of three mobile nodes (n0-n2), Nodes are configured with the specific parameters of a wireless node. Initial location of the node is fixed. Nodes are given mobility with fixed speed and fixed destination location. TCP agent is attached to node0 and TCP sink agent is attached to node1. Both the agents are connected and FTP application is attached to TCP agent. Write a Tcl script and make an ad-hoc simulation to analyze the output in the trace file. Use the routing protocol as Adhoc on demand distance vector (AODV).	NS2 Simulator Software	Design and analyze AODV protocol for wireless networks.

TEXTBOOKS:

1. B Forouzan “Data Communication and Networking”, 4th Ed, TMH 2006.

REFERENCE BOOK:

1. James F. Kurose, Keith W. Ross “Computer Networks”, Pearson Education, 2nd Edition, 2003.
2. Wayne Tomasi ”Introduction to Data communication and Networking” Pearson Education 2007
3. S. Keshav, “An Engineering Approach to Computer Networking”, Pearson Education

Course Title	Basic VLSI Design Lab				Course Type		HC	
Course Code	**B20EP0606**	**Credits**	**3**		**Class**		**VI Semester**	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	0	0	0				
	Tutorial	-	-	-	Theory	Practical	**CIE**	**SEE**
	Practical	1	2	2				
	Total	**1**	**2**	**2**	**0**	**26**	**50%**	**50 %**

COURSE OVERVIEW:

This course provides fundamental concepts, basic theory, and design methodologies of VLSI design technology. Furthermore, the structures of designing VLSI systems include MOS devices and circuits, fabrication process, MOS design rules, physical design of MOS circuits. Development of arithmetic building blocks and memories using MOS circuits.

COURSE OBJECTIVES:

The objectives of this course are:

1. To acquire the knowledge of different types of MOSFETS, electrical properties of MOS circuits, and Fabrication process.
2. To introduce the physical design of MOS circuits.
3. To present the fundamental concept of CMOS logic gates design techniques.
4. To illustrate the arithmetic building blocks and memories using MOS circuits.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate a clear Understanding in hardware design language Verilog HDL	1,2,3,5	1,2,3
CO2	Model a Combinational circuit using hardware description language Verilog HDL and validate its functionality	1,2,3,5	1,2,3
CO3	Implement various combinational and sequential circuits using Verilog	1,2,3,5	1,2,3
CO4	Describe the physical design process of Digital Integrated Circuits	1,2,3,5	1,2,3
CO5	Demonstrate the ability to use various EDA tools for digital system design	1,2,3,5	1,2

CO6	Implement schematic and layout of various digital CMOS logic circuits using EDA tools.	1,2,3,5	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2		2							1	3	2	1
CO2	3	3	3		2							1	3	2	1
CO3	3	3	2		2							1	3	2	
CO4	3	3	3		2							1	2	2	1
CO5	3	3	2		3							1	3	2	1
CO6	3	3	3		3							1	3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

Sl. No.	**Name of the Practice Session**	**Tools and Techniques**	**Expected Skill /Ability**
1	Write a Verilog HDL program with a suitable test bench to simulate an Inverter and buffer using switch level description	HDL Switch level modelling, Test bench verification, Cadence NCSim	HDL Programming skills/Design and Analysis of MOSFET circuits
2	Write a Verilog HDL program with a suitable	HDL Switch level	HDL Programming

	test bench to simulate a CMOS Transmission gate and basic logic gates using switch level description	modelling, Test bench verification, Cadence NCSim	skills/Design and Analysis of MOSFET circuits
3	Write a Verilog HDL program with a suitable test bench to simulate a 32-bit ALU using behavioural description. Four logical and arithmetic operations need to be considered.	HDL behavioural level modelling, Test bench verification, Cadence NCSim	HDL Programming skills/Design and Analysis of ALU
4	Write a Verilog HDL program with a suitable test bench to simulate a SR and JK Flip-flops using behavioural description. Synthesize the design with the given constraints and generate the synthesis report	HDL behavioural level modelling, Test bench verification, Cadence NCSim, RTL compliier	HDL Programming skills/Design and Analysis of sequential circuits
5	Write a Verilog HDL program with a suitable test bench to simulate a D and T Flip-flops using behavioural description. Synthesize the design with the given constraints and generate the synthesis report	HDL behavioural level modelling, Test bench verification, Cadence NCSim, RTL compliier	HDL Programming skills/Design and Analysis of sequential circuits
6	Draw the CMOS Inverter schematic and perform the transient analysis, and DC analysis. Draw the layout and verify the design	CMOS logic circuits design, analysis, and verification of layout, Cadence virtuoso	Design, analysis, and verification of digital MOS circuits
7	Draw the CMOS NAND gate schematic and perform the transient analysis. Draw the layout and verify the design	CMOS logic circuits design, analysis, and verification of layout, Cadence virtuoso	Design, analysis, and verification of digital MOS circuits
8	Draw the CMOS NOR gate schematic and perform the transient analysis. Draw the layout and verify the design	CMOS logic circuits design, analysis, and verification of layout, Cadence virtuoso	Design, analysis, and verification of digital MOS circuits
9	Draw the CMOS schematic of 2:1 Multiplexer and perform the transient analysis. Draw the layout and verify the design	CMOS logic circuits design, analysis, and verification of layout, Cadence virtuoso	Design, analysis, and verification of digital MOS circuits
10	Draw the CMOS schematic of Half-Adder and perform the transient analysis. Draw the layout and verify the design	CMOS logic circuits design, analysis, and verification of layout, Cadence virtuoso	Design, analysis, and verification of digital MOS circuits

TEXTBOOKS:

1. Douglas A. Pucknell and Kamran Eshraghian, “Basic VLSI Design”, 3rd Edition, PHI, 2017.
2. Sung-Mo Kang and Yusif Leblebici, “CMOS Digital Integrated Circuits: Analysis and Design”, Tata McGraw-Hill, 3rd Edition, 2007.

3. Neil H. E Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson Education, 4th Edition, 2011.

REFERENCE BOOKS

1. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, “Digital Integrated Circuits: A Design Perspective”, 2nd Edition, Pearson, 2016.
2. John. P. Uyemura, “Introduction to VLSI Circuits and Systems”, John Wiley, 1st Edition, 2009.

<table>
<tr><th>Course Title</th><th colspan="4">Mini Project/ Internship</th><th colspan="2">Course Type</th><th colspan="2">FC</th></tr>
<tr><th>Course Code</th><th>B20EN0605</th><th>Credits</th><th colspan="2">2</th><th colspan="2">Class</th><th colspan="2">VI Semester</th></tr>
<tr><td rowspan="5">Research based project</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Tutorial</td><td>0</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>2</td><td>4</td><td>4</td></tr>
<tr><td>Total</td><td>2</td><td>4</td><td>4</td><td>0</td><td>52</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW

Research-based project course targets to promote and develop student competencies related to research practice and to benefit students through activities linked to research. This course denotes the application of learning and teaching strategies that link research with teaching. One of the main advantages would be to awaken student's interest in knowledge and the main problems that society faces in order that students may broaden their perspectives and focus their study areas.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Make students to observe research in the real world
3. Make a presentation of research methods and approaches
4. Show experimental procedures and real exercises of computational issues in scientific disciplines.
5. Ask students to read and perform searches from the bibliography of a research paper, analyzing figures, diagrams, tables and simulators presented in the paper
6. Introduce students to a peer review of a research process

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Observe students research in the real world	7,8,9,10,11,12	1,2,3,
CO2	Present research methods and approaches	7,8,9,10,11,12	1,2,3,
CO3	Show experimental procedures and real exercises of computational issues in scientific disciplines.	7,8,9,10,11,12	1,2,3,
CO4	Perform searches from the bibliography of a research paper, analyzing figures, diagrams, tables and simulators presented in the paper	7,8,9,10,11,12	1,2,3,
CO5	Describe a peer review of a research process	7,8,9,10,11,12	1,2,3,
CO6	Relate the current result with the literature	7,8,9,10,11,12	1,2,3,

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1							1	2	3	3	3	3	1	1	
CO2							1	2	3	3	3	3	1	1	
CO3							1	2	3	3	3	3	1	1	
CO4							1	2	3	3	3	3	1	1	
CO5							1	2	3	3	3	3	1	1	
CO6							1	2	3	3	3	3	1	1	

Note:1-Low,2-Medium,3-High

<table>
<tr><td>Course Title</td><td colspan="4">Indian Traditions and Culture</td><td colspan="2">Course Type</td><td colspan="2">FC</td></tr>
<tr><td>Course Code</td><td>B20PA0501</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">VI Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>1</td><td>1</td><td>1</td><td>13</td><td>-</td><td>50%</td><td>50 %</td></tr>
</table>

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide conceptual knowledge of Indian culture and traditions
2. Introduce students to the science and technological advancements related to Indian culture
3. Help students understand the Indian spiritual aspects of Indian culture
4. Help learners understand the factors which unite the diverse cultures of India

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Gain conceptual understanding of Indian culture and traditions.		
CO2	Describe various ancient theories in treatment of any disease.		
CO3	Appreciate the science and technological advancements in ancient India		
CO4	Comprehend the Indian spiritual aspects of Indian culture like yoga, meditation and nirvana.		
CO5	Demonstrate the theory behind celebrating Hindu festivals and concept of making varieties of food		
CO6	Understand India as a land united by cultural diversity.		

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓	✓				

CO3	✓	✓				
CO4	✓	✓				
CO5	✓	✓				
CO6	✓	✓				

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								2	2	2					
CO2								2	2	2					
CO3								2	2	2					
CO4								2	2	2					
CO5								2	2	2					
CO6								2	2	2					

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
Unit 1
Indian Tradition Culture – Indus Valley Civilization and early cultural practices, The Vedic culture, Influence of Buddhism and Jainism on Indian Culture, Influence of Islam and Christianity, Indian Cultural Renaissance of the 19th Century Religion – Pre-vedic and Vedic religion, Jainism, Buddhism, Hinduism, Religious Reform Movements, Advent of Christianity Art – Introduction to Natyashastra, classical and contemporary art forms (dance and music), regional art forms (dance and music), Folk art, puppetry Architecture – Engineering and Architecture in Ancient India; Evolution of Hindu Temple Structures, Sculptures, Coins and Pottery from Ancient India Literature- Vedas, Upanishads, Ramayana, Mahabharata & Bhagavat Gita.
Unit 2
Contribution of ancient India to Science and Maths i. Development of Science in Ancient India- Astronomy, Mathematics, Medicine, Metallurgy.

ii. Scientists of Ancient India - Mathematics and Astronomy- Baudhayan, Aryabhata, Brahmagupta, Bhaskaracharya, Mahaviracharya Science- Kanad, Varahamihira, Nagarjuna Medical Sciences (Ayurveda and Yoga)- Susruta, Charaka, Yoga and Patanjali iii. Science and Scientists in Medieval India- Mathematics, Biology, Chemistry, Astronomy, Medicine, Agriculture. iv. Scientists in Modern India- Srinivas Ramanujan, Chandrasekhara V Raman, Jagadish Chandra Bose, Homi Jehangir Bhabha, Dr, Vikram Ambalal Sarabhai, Dr. APJ Abdul Kalam
Unit 3 **Indian Spiritual Aspects** I. Hindu Spirituality based on shruti and smriti- Hinduism in General, Basic notions of Vedas, Upanishads, Ramayana, Mahabharata & Bhagavat Gita. ii. Hata Yoga and Pranayama- Main Features, Basics of Yoga –Different kinds of Yoga; Raja Yoga (Ashtanga yoga); Karma yoga; Bhakti Yoga – yoga of Loving Devotion; Jnana yoga – Yoga of Knowledge; Hatha Yoga (Asana/ Pranayamas); Kundalini Yoga; Nada Yoga; Sannyasa Yoga iii. Buddhist, Jaina Spiritualities- Main Doctrines of Buddhism: Four Noble Truths (Arya Satya), Concept of Nirvana - Ashtanga Marga
Unit 4 **Unity in Diversity** Commensality and the Significance of Food – Eating Together as Family and as a Society, Food at Rituals; annaprasan, marriage and funeral, Kitchen as Shared Space for Women, Food and Nationalist Response of Indian Community, Visibility of Indian Cuisine in the World Celebrating Diverse Festivals – Festival Types: Religious and Seasonal, Religious - Holi, Diwali, Ganesh Chaturthi, Janmashtami, Mahavir Jayanthi, Ramadan, Christmas, Buddha Purnima; Seasonal (harvest festivals) - Baisakhi, Pongal, Sankranti Attire - Indus Valley Civilization, Vedic period, Modern India

TEXTBOOKS

1. Sundararajan K.R., “Hindu Spirituality - Vedas through Vedanta, Cross Road Publications”, New York, 1997.
2. Griffiths Bede, “Yoga and the Jesus Prayer Tradition, Asian Trading Corporation”, Bangalore, 1992
3. Ansh Mishra, Science in Ancient India, Indian Corporation, New Delhi, 1998
2. Sen Taylor, Collen. Feasts and Fasts: A History of Food in India. Reaktion Books, New Delhi, 2014.
3. Thapar, Romila, Readings in Early Indian History. Oxford University Press. New Delhi, 2018

6^{th} Semester

PROFESSIONAL ELECTIVE-3

<table>
<tr><td>Course Title</td><td colspan="4">Fundamentals of Analog and Digital Communication</td><td colspan="2">Course Type</td><td colspan="2">Softcore</td></tr>
<tr><td>Course Code</td><td>B20EPS631</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">6 Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes
Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>45</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

To study about the various modulation techniques like amplitude and angle modulation, that is used for data transmission and reception of analog signals and to understand about the modulation techniques used for digital transmission along with spread spectrum and multiple access techniques.

COURSE OBJECTIVES:

The objectives of this course are:

1. To develop ability to analyze system requirements of analog and digital communication systems.
2. To understand the generation, detection of various analog and digital modulation techniques.
3. To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
4. To understand the concepts of baseband transmissions.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze and design of various continuous wave and angle modulation and demodulation techniques	1,2,3	1,2,3
CO2	Understand the effect of noise present in continuous wave and angle modulation techniques.	1,2,3	1,2,3
CO3	Attain the knowledge about AM, FM Transmitters and Receivers	1,2,3	1,2,3
CO4	Analyze and design the various Pulse Modulation Techniques.	1,2,3	1,2,3
CO5	Understand the concepts of Digital Modulation Techniques and Baseband transmission.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level

	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓			
CO2		✓				
CO3			✓			
CO4			✓			

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1										1	1	1
CO2	2	2	3										1	2	2
CO3	2	2	3										1	2	2
CO4	1	2	1										1	1	1
CO5	2	2	2										1	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Introduction to Communication Systems: Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).
UNIT - 2
Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM). Data Communication: History of Data Communication – Standards Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Data communication Hardware – serial and parallel interfaces.
UNIT - 3
Shift Keying: Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

UNIT - 4

Access Schemes: Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Handover Techniques – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.

TEXTBOOKS:

1. Analog and Digital Communications – Simon Haykin, John Wiley, 2005.
2. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, 2009, PHI.

REFERENCE BOOKS:

1. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.
2. Martin S.Roden, "Analog and Digital Communication System", 3rd Edition, PHI, 2002.

Course Title	Agile Software Development and Devops				Course Type		Softcore	
Course Code	**B20EPS632**	**Credits**	**3**		**Class**		**5 Semester**	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	**IA**	**SEE**
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

The course provides students with a knowledge on the basic principles of software development life cycle, activities involved in software requirements engineering, software development, testing, evolution and maintenance. It introduces concepts such as software processes and agile methods, and essential software development activities

COURSE OBJECTIVES:

The objectives of this course are:

1. Discuss the importance of the software development process.
2. Explain the workflow of Automating process.
3. Illustrate with case study, the importance of DevOps.
4. To provide insights Describe the software life cycle using a case study.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline the importance of the software development process.	1,2,3	1,2,3
CO2	Design the workflow of Automating process.	1,2,3	1,2,3
CO3	Make use of DevOps.	1,2,3	1,2,3
CO4	Describe the software life cycle	1,2,3	1,2,3
CO5	Develop an application using software life cycle.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**

CO1			✓			
CO2		✓				
CO3			✓			
CO4			✓			

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1										1	1	1
CO2	2	2	3										1	2	3
CO3	2	2	3										1	1	3
CO4	1	2	1										1	1	1
CO5	1	2	1										1	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Defining the Software Development Process: Goals of Defining the Software Development Process , Why Is Defining the Software Development Process Important? , Where Do I Start?, Explaining the Software Development Lifecycle , Systems versus Software Development Lifecycle, Defining Requirements, Managing Complexity and Change, Validity of Requirements, Testing Requirements ,Functional Requirements, Nonfunctional Requirements, Epics and Stories, Planning for Changing Requirements , Workflow for Defining Requirements ,Test-Driven Development , Designing Systems ,Software Development ,Testing , Testing the Application ,Testing the Process Itself , Continuous Integration , Continuous Delivery and Deployment , Defining Phases of the Lifecycle ,Documentation Required , DevOps , Communicating with All Stakeholders, Production Support ,Maintenance and Bugfixes, Lifecycle in the Beginning ,Maintenance of the Lifecycle, Creating the Knowledge Base.
UNIT - 2
Agile Application Lifecycle Management: Goals of Agile Application Lifecycle Management, Why Is Agile ALM Important? Where Do I Start? Understanding the Paradigm Shift, Rapid Iterative Development, Remember RAD? , Focus on 12 Agile Principles, Agile Manifesto, Fixed Timebox Sprints, Customer Collaboration, Requirements, and Documentation.

UNIT - 3
Automating the Agile ALM: Goals of Automating the Agile ALM, Why Automating the ALM Is Important, Where Do I Start? Tools, Do Tools Matter? Process over Tools, Understanding Tools in the Scope of ALM, Staying Tools Agnostic, Commercial versus Open Source, What Do I Do Today? ,Automating the Workflow , Process Modeling Automation ,Managing the Lifecycle with ALM, Broad Scope of ALM Tools ,Achieving Seamless Integration ,Managing Requirements of the ALM, Creating Epics and Stories, Systems and +Driven Development ,Environment Management ,Gold Copies ,Supporting the CMDB, Driving DevOps ,Supporting Operations ,Help Desk ,Service Desk ,Incident Management , Problem Escalation ,Project Management, Planning the PMO ,Planning for Implementation, Evaluating and Selecting the Right Tools ,Defining the Use Case ,Training Is Essential, Vendor Relationships, Keeping Tools Current.
UNIT - 4
DevOps: Goals of DevOps, Why Is DevOps Important? Where Do I Start? How Do I Implement DevOps? Developers and Operations Conflicts, Developers and Operations Collaboration, Need for Rapid Change, Knowledge Management, the Cross-Functional Team, Is DevOps Agile? The DevOps Ecosystem, Moving the Process Upstream, Left-Shift, Right-Shift, DevOps in Dev, DevOps as Development, Deployment Pipeline, Dependency Control, Configuration Control, Configuration Audits, QA and DevOps, Information Security, Infrastructure as Code, Taming Complexity, Automate Everything, Disaster Recovery and Business Continuity, Continuous Process Improvement.

TEXTBOOKS:

3. Bob Aiello and Leslie Sachs, "Agile Application Lifecycle Management Using DevOps to Drive Process Improvement", Addison Wesly, First printing, June 2016.

REFERENCE BOOK:

1. Roger S, "Software Engineering – A Practitioner's Approach", seventh edition, Pressman, 2010.
2. Roger Pressman, Ian Summerville, "Software Engineering", 9th edition, 2010.
3. Hans Van Vliet, "Software Engineering: Principles and Practices", 2008.
4. Richard Fairley, "Software Engineering Concepts", 2008.
5. ACM Transactions on Software Engineering and Methodology (TOSEM).
6. IEEE Transactions on Software Engineering.

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/101/106101061/
2. https://nptel.ac.in/courses/106/105/106105182/
3. https://www.coursera.org/specializations/agile-development
4. https://www.coursera.org/courses?languages=en&query=agile%20development

<table>
<tr><th>Course Title</th><th colspan="4">Robotics and Automation</th><th colspan="2">Course Type</th><th colspan="2">Softcore</th></tr>
<tr><th>Course Code</th><th>B20EPS633</th><th>Credits</th><th colspan="2">3</th><th colspan="2">Class</th><th colspan="2">6 Semester</th></tr>
<tr><th rowspan="5">Course Structure</th><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><th rowspan="2">IA</th><th rowspan="2">SEE</th></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><th>Total</th><th>3</th><th>3</th><th>3</th><th>45</th><th>0</th><th>50%</th><th>50%</th></tr>
</table>

COURSE OVERVIEW:

Robotics is the interdisciplinary branch of engineering and science that includes mechanical engineering, electrical engineering, computer science, and others. Robotics deals with the design, construction, operation, and use of robots as well as computer systems for their control, sensory feedback, and information processing. Automation and Robotics are two closely related technologies. Automation as the technology that is concerned with the use of mechanical, electronic, and computer-based systems in the operation and control of production. The course provides robot classification and anatomy, Robot kinematics, Trajectory Planning and control, Sensors and vision systems used in robots and Robot Programming

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide insights into Robots and anatomy.
2. To Understand Robot kinematics
3. To introduce the concepts of Sensors and vision systems used in robots.
4. To give details of writing Robot Program.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the basic applications and advantages of using robots in the industry.	1,2,3	1,2,3
CO2	Do the robot motion analysis.	1,2,3	1,2,3
CO3	Relate mathematical modeling and trajectory planning scheme in robots.	1,2,3	1,2,3
CO4	Recognize the different types of sensors and cameras used in the field of robotics.	1,2,3	1,2,3
CO5	Write robot programs and upgrade knowledge on different types of cell layout applicable in robotics.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓			
CO2		✓				
CO3			✓			
CO4			✓			
CO5			✓			

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1										1	1	1
CO2	2	2	3										1	2	2
CO3	2	2	3										1	2	2
CO4	1	2	1										1	1	1
CO5	2	2	2										1	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Introduction to robotics: Definition, anatomy of robot, classification configurations, robot links and joints, robot specifications, resolution accuracy and repeatability, simple numerical problems, robot drive systems, hydraulic, pneumatic and electric drive systems, wrist and its motions, end effectors, types of end effectors, mechanical grippers, methods of constraining parts in grippers, types of gripper mechanisms, simple numerical problems, vacuum cups, magnetic grippers, adhesive grippers, hooks, scoops and other gripper devices, tool as end effectors, examples.
UNIT - 2
Robot motion analysis & Robot control: Direct kinematics and inverse kinematics, 3D homogeneous transformations, rotation, translation and displacement matrix, composite rotation matrix, rotation matrix about an arbitrary axis, links, joints and

their parameters, Denavit-Hertenberg (D-H) representation, application of D-H matrices to different robot configurations. Basic control systems and models, transfer function with examples, transfer function for spring-mass-damper system, transient response of a second order system, transfer function of a robot joint, different types of controllers, proportional (P) controller, integral (I) controller, derivative (D) controller, PID controller, simple numerical problems
UNIT - 3 **Robot trajectory planning & Robot sensors:** Trajectory planning, definition, steps in trajectory planning, joint space techniques, use of a p-degree polynomial as interpolation function, cubic polynomial trajectories, linear function with parabolic blends, joint space verses Cartesian space trajectory planning, simple numerical problems on joint space trajectory planning. Classification of robot sensors and their functions, touch sensor, tactile sensor, binary sensor, analog sensor, proximity sensor, range sensor, force, and torque sensor
UNIT - 4 **Robot sensors and Machine Vision & Robot programming** Machine vision, functions of machine vision system, sensing and digitizing, imaging devices, analog to digital signal conversion, quantization and encoding, simple numerical problems, image storage, image processing and analysis, image data reduction, segmentation, feature extraction, object recognition, robotic machine vision applications, inspection, identification, visual serving, and navigation. Introduction to robot programming, robot cell layout, work cell control and interlocks, manual programming, lead through and walkthrough programming, off-line programming, VAL programming language, example, AML and VAL-II robot programming languages, examples, Programming with graphics, example.

TEXTBOOKS:

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey: Industrial Robotics, McGraw-Hill Publications, International Edition, 2008.
2. James G. Keramas: Robot Technology Fundamentals, Cengage Learning, International Edition 1999.

Reference Books:

1. Fu K. S., Gonzelez R. C., Lee C. S. G: Robotics: Control, Sensing, Vision, IntelligenceMcGraw Hill Book Co., International edition, 2008.
2. Yorem Koren,: Robotics for Engineers, McGraw-Hill Publication, International edition, 1987
3. Craig, J. J: Introduction to Robotics: Mechanics and Control, Pearson Prentice-Hall Publications, 3rd edition, 2005.
4. Schilling R. J: Fundamentals of Robotics, Analysis and Control, Prentice-Hall Publications, Eastern Economy edition, 2007
5. Appu Kuttan K. K: Robotics, International Publications, First Edition, 2007
6. R. K. Mittal, I. J. Nagrath: Robotics and Control Tata-McGraw-Hill Publications, 2007.

IV Year Syllabus

VII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20EP0701	Data Analytics using R	HC	1	1	1	3	5
2	B20EP0702	Cyber Security and Blockchain	HC	1	1	1	3	5
3	B20EPS7XX	Professional Elective-4	SC	3	0	0	3	3
4	B20EPS7XX	Professional Elective-5	SC	3	0	0	3	3
5	B20XXO7XX	Open Elective-3	OE	3	0	0	3	3
TOTAL				**11**	**2**	**2**	**15**	**19**
Practical /Term Work / Sessional								
6	B20EN0703	Major Project Phase – 1	HC	0	0	1	1	2
TOTAL				**0**	**0**	**1**	**1**	**2**
TOTAL SEMESTER CREDITS					**16**			
TOTAL CUMULATIVE CREDITS					**150**			
TOTAL CONTACT HOURS					**21**			

Course Title	**Data Analytics using R**				**Course Type**		**HC**	
Course Code	**B20EP0701**	**Credits**	**3**		**Class**		**VII Semester**	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	1	2	2	Theory	Practical	**CIE**	**SEE**
	Practical	1	2	2				
	Total	**3**	**5**	**5**	**39**	**26**	**50%**	**50 %**

COURSE OVERVIEW:

The course provides students with some knowledge on the basic principles of machine learning, which is the study of computer algorithms that can improve automatically through experience and using data. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

COURSE OBJECTIVES:

The objectives of this course are:

1.To introduce different functions in R, how to read data into R, accessing R packages,

2.writing R functions, debugging, and organizing data using R functions.

3.Cover the Basics of statistical data analysis with examples.

4.To introduce the concepts involving collecting, compiling and visualize data using statistical functions.

5. To give insight into exploratory data analysis using R

6. To introduce regression and perspective analysis

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Solve the analytical problems using R	1,2,3,4,5	1,2,3
CO2	Develop competency in the R programming language and several data related R libraries	1,2,3,4,5,10	1,2,3
CO3	Analyze real time data effectively using visualizations in R	1,2,3,4,5,10	1,2,3
CO4	Import, export and manipulate data and produce statistical summaries of continuous and categorical data in R	1,2,3,4,5,10	1,2,3
CO5	Perform exploratory data analysis using R	1,2,3,4,5	1,2,3
CO6	Develop data visualizations with the ggplot package.	1,2,3,4,5	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

POS / COs	PO 1	P 2	PO 3	PO 4	PO 5	PO 6	P 7	PO 8	PO 9	P O 10	P O 11	P O 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1	2								3	2	1
CO2	3	3	3	1	2								3	2	1
CO3	3	3	2	1	2								3	2	1
CO4	3	3	3	1	2								2	2	1
CO5	3	3	2	1	3								3	2	1

CO6	3	3	3	1	3								3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT – 1 **Introduction to Data Analysis:** Overview of Data Analytics, Need of Data Analytics, Nature of Data, Classification of Data: Structured, Semi-Structured, Unstructured, Characteristics of Data, Applications of Data Analytics.
UNIT-2: **R Programming Basics** Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages
UNIT – 3 **Data Visualization using R.** Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files. Working with R Charts and Graphs: Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts
UNIT – 4 **Statistics with R:** Random Forest, Decision Tree, Normal and Binomial distributions, Time Series Analysis, Linear and Multiple Regression, Logistic Regression. **Prescriptive Analytics**: Creating data for analytics through designed experiments, creating data for analytics through active learning, Creating data for analytics through reinforcement learning.

PRACTICE:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	**R AS CALCULATOR APPLICATION** a. Using with and without R objects on console b. Using mathematical functions on console c. Write an R script, to create R objects for calculator application and save in a specified location in disk.	R version 4.3.0	Understand basics of R scripting
2	**DESCRIPTIVE STATISTICS IN R** a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars & cars datasets. b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.	R version 4.3.0	Understand basics of R scripting
3	**READING AND WRITING DIFFERENT TYPES OF DATASETS** a. Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location. b. Reading Excel data sheet in R. Reading XML dataset in R.	R version 4.3.0	Understand basics of R scripting
4	**VISUALIZATIONS** a. Find the data distributions using box and scatter plot. b. Find the outliers using plot. c. Plot the histogram, bar chart and pie chart on sample data.	R version 4.3.0	Understand data visualization using R
5	**CORRELATION AND COVARIANCE** a. Find the correlation matrix. b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data. c. Analysis of covariance: variance (ANOVA) if data have categorical variables on iris data.	R version 4.3.0	Understand plot correlation
6	**REGRESSION MODEL** Import data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in an institute based on his or her GRE score, GPA obtained and rank of the student. Also check if the model is fit or not. require (foreign), require (MASS).	R version 4.3.0	Understand regression techniques
7	**MULTIPLE REGRESSION MODEL** Apply multiple regressions if data have a continuous independent variable. Apply on above dataset.	R version 4.3.0	Understand multiple regression
8	**REGRESSION MODEL FOR PREDICTION** Apply regression Model techniques to predict the data on above dataset.	R version 4.3.0	Understand Proof of work algorithm
9	**CLASSIFICATION MODEL** a. Install relevant package for classification. b. Choose classifier for classification problem. c. Evaluate the performance of classifier.	R version 4.3.0	Understand bitcoin mining
10	**CLUSTERING MODEL** a. Clustering algorithms for unsupervised classification. b. Plot the cluster data using R visualizations.	R version 4.3.0	Understand Consensus algorithm

Textbooks:

1. W. N. Venables, D.M. Smith and the R Development Core Team, “An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics” , 2008

Reference Books:

1. Hastie, Trevor, et al., “The elements of statistical learning”, Vol. 2. No. 1. New York: springer, 2009.
2. Montgomery, Douglas C., and George C. Runger. “Applied statistics and probability for engineers”, John Wiley &Sons, 2010
3. Joseph F Hair, William C Black et al, “Multivariate Data Analysis”, Pearson Education, 7th edition, 2013.
4. Mark Gardener, “Beginning R - The Statistical Programming Language”, John Wiley & Sons, Inc., 2012.

Course Title	**Cyber Security and Blockchain**				**Course Type**		**HC**	
Course Code	**B20EP0702**	**Credits**	**3**		**Class**		**VII Semester**	
Cyber Security and Blockchain	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	1	1				
	Tutorial	1	2	2	Theory	Practical	**IA**	**SEE**
	Practice	1	2	2				
	Total	**3**	**5**	**5**	**39**	**26**	**50 %**	**50 %**

COURSE OVERVIEW:

The Cyber Security and Blockchain typically deals with the study of Need to understand cyber security, its objectives, Infrastructure and Architecture, Job roles in cyber security, Cyber Insurance, Future of Cyber security are explained. We also take a dive into Rise of blockchain with study of basic cryptography, De-Centralised networks, Introduction to Bitcoin, characteristics and architecture, Types of Blockchain, Job roles and its Future. We also analyse the working of blockchain with an example of a Bitcoin transaction, Bitcoin Mining, Consensus algorithm, Types of consensuses, Applications of blockchain other than cryptocurrency, NFTs. The concepts of Cyber Security and Blockchain are applied to analyse the complex problems arise in the cyber networks. Through this course Students will get extensive exposure to basics of blockchain and cyber security.

COURSE OBJECTIVES:

The objectives of this course are:

7. Make the students to understand basics of cyber security and blockchain.
8. Study the working principle and details of blockchain transaction.
9. Understand the basics of cryptography and its applications.
10. Understand the consequences and effects of cyber-attacks.
11. Familiarize the students with the consensus algorithms.
12. Carry out Jobs in Cyber security and Blockchain fields.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe basic operations of blockchains.	1,2,3	1,2,3
CO2	Analyze the cyber-attacks by the type of business	1,2,3,5	1,2
CO3	Assess the outcomes of cyber defense techniques.	1,2,3,5	1,2
CO4	Analyze working principle and characteristics of Blockchain	1,2,3,5	1,2
CO5	Analyse career path in Cyber security and Blockchain.	1,2,3,5	1,2
CO6	Design a cryptocurrency using principles of Blockchain	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓				
CO2	✓			✓		
CO3	✓	✓	✓		✓	
CO4	✓			✓		
CO5	✓	✓	✓	✓		
CO6	✓					✓

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1		2								1	2	1
CO2	3	3	3		2								3	2	
CO3	3	3	2		2								3	3	
CO4	3	3	2		2								3	3	

CO5	3	3	2		2								3	3	
CO6	3	3	2		2								3	3	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
UNIT - 1 **Introduction to Cyber Security:** Basics of CCN, History of Internet, DNS, World wide web, Introduction to cyber security, Need of Cyber security, Objectives of cyber security, Cyber security Infrastructure and Architecture (NIST), Job Roles in Cyber security, Cyber Insurance, The INDIAN Cyberspace, National Cyber Security Policy, Future of Cyber security.
UNIT - 2 **Cyber Attacks and defenses:** Attacks on E-businesses: Introduction to E-Businesses and their advantages. Malwares, Phishing, Cross site scripting (XSS), Spyware, Worms, Trojan Horse, DoS, Salami attack, Data diddling, Email Spoofing. Attacks in E-commerce: Introduction to E-Commerce, Advantages and disadvantages, Client level attacks, DDos, SQL Injection, Price manipulation, Session hijacking. Cyber Defense techniques, Case study: Hack of Maharashtra govt website.
UNIT - 3 **Introduction and Rise of Blockchain:** Banking system, Architecture, Types of networks, Rise of Bitcoin (History), Cryptocurrency, Blockchain introduction, characteristics, Types of blockchain, Architecture of Blockchain, Job roles in Blockchain, Risks in adopting blockchain, Future of Blockchain.
UNIT - 4 **Working and Applications of blockchain:** Basics of Cryptography, Explanation of overall working of blockchain using a bitcoin transaction as example, Bitcoin mining, Consensus algorithm, Proof of Work, Applications of Blockchain other than cryptocurrencies, NFTs introduction. Case study: Health record management using blockchain technology.

PRACTICE SESSION:

Sl. No.	**Name of the Practice Session**	**Tools and Techniques**	**Expected Skill /Ability**
1	Understanding IP address, DNS in a computer	General browser	Understand IP address
2	Implementing firewall and other security tools	Windows firewall, defender	Understand firewall security
3	Implementation of Steganography.	Steganography tools	Understand steganography

4	Implementation to identify web vulnerabilities, using OWASP project.	Zap proxy (OWASP)	Understand OWASP project
5	Implementation of Mobile Audit and generate the report of the existing Artifacts	Win Audit	Understand Mobile audit.
6	Implementation of Symmetric and Asymmetric cryptography.	Python IDE	Understand cryptography techniques
7	Implementation of blockchain	Python IDE	Understand basic blockchain building
8	Implementation of Proof of Work	Python IDE	Understand Proof of work algorithm
9	Implement Mining algorithm.	Python IDE	Understand bitcoin mining
10	Implement consensus algorithm	Python IDE	Understand Consensus algorithm

TEXTBOOKS:

4. Dr. Jeetendra Pande, "Introduction to Cyber security" Uttarakhand Open University, 2017.

REFERENCE BOOK:

2. Dac-Nhuong Le and Raghvendra Kumar, "CYBERSECURITY IN PARALLEL AND DISTRIBUTED COMPUTING Concept, Techniques, Applications and Case studies" Wiley education, 2018

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

11. https://uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf
12. https://mrcet.com/pdf/Lab%20Manuals/IT/CYBER%20SECURITY%20(R18A0521).pdf
13. https://ccl.yale.edu/sites/default/files/files/A%20Brief%20Introduction%20to%20Blockchain%20(Final%20without%20Notes).pdf
14. https://cnx.org/contents/FOAgj46E@1.1:CF55C3SF@1/chapter-1-Magnetic-Circuits-and-Magnetic-Materials
15. https://scet.berkeley.edu/wp-content/uploads/BlockchainPaper.pdf
16. https://iabtechlab.com/wp-content/uploads/2018/07/Blockchain-Technology-Primer.pdf
17. https://www.skillsforcare.org.uk/Documents/Topics/Digital-working/An-Introduction-to-Cyber-Security.pdf
18. https://www.activestate.com/blog/how-to-build-a-blockchain-in-python/
19. https://medium.com/coinmonks/python-tutorial-build-a-blockchain-713c706f6531
20. https://github.com/dvf/blockchain/blob/master/blockchain.py

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
2. https://onlinecourses.swayam2.ac.in/cec20_cs09/preview
3. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
4. https://nptel.ac.in/courses/106/105/106105184/

LAB Reference:

1. https://hackernoon.com/learn-blockchains-by-building-one-117428612f46
2. https://andersbrownworth.com/blockchain/hash

7th Semester

PROFESSIONAL ELECTIVE-4

<table>
<tr><td>Course Title</td><td colspan="4">Computer Vision and Image Processing</td><td colspan="2">Course Type</td><td colspan="2">Professional Elective</td></tr>
<tr><td>Course Code:</td><td>B20EPS711</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">VII Semester</td></tr>
<tr><td rowspan="5">Computer Vision and Image Processing</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td>0</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

This course introduces the fundamental concepts and techniques of computer vision and image processing. It covers the basics of digital image representation, manipulation, and analysis, as well as more advanced topics such as feature detection and matching, object and scene recognition, and 3D computer vision. The course will emphasize practical applications of computer vision and image processing, and students will gain experience with real-world examples. By the end of the course, students will have a solid understanding of the fundamentals of computer vision and image processing and be able to apply these skills to solve real-world problems in a variety of fields, including robotics, autonomous vehicles, medical imaging, and more.

COURSE OBJECTIVES:

The objectives of this course are:

1. To Understand the fundamental principles of digital image representation, manipulation, and analysis, including techniques for image filtering, enhancement, and segmentation.
2. To Gain a working knowledge of image features and matching, including feature detection, extraction, and matching, and understand the theory behind these techniques.
3. To Learn about object and scene recognition, including object detection, neural networks for object recognition, and scene recognition, and understand the theoretical concepts behind these techniques.
4. To provide an understanding of 3D computer vision, including structure from motion, dense 3D reconstruction, visual SLAM, and stereo vision, and understand the theoretical foundations of these techniques.
5. To provide an understanding of the limitations and challenges in applying computer vision and image processing techniques to real-world problems, and the ethical implications of such applications.
6. To give insights into critical thinking and problem-solving skills by analyzing case studies and research papers related to computer vision and image processing and evaluating the effectiveness and limitations of various techniques.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand and explain the fundamental principles of digital image representation, manipulation, and analysis, including techniques for image filtering, enhancement, and segmentation.	1,2,3,12	2,3
CO2	Understand and explain the theory behind image features and matching, including feature detection, extraction, and matching.	1,2,3,4,5,6, 12	2,3
CO3	Understand and explain the theoretical concepts behind object and scene recognition, including object detection, neural networks for object recognition, and scene recognition.	1,2,3	2,3
CO4	Understand and explain the theoretical foundations of 3D computer vision, including structure from motion, dense 3D reconstruction, visual SLAM.	1,2,3,4,12	2,3
CO5	Analyze and evaluate the effectiveness and limitations of various computer vision and image processing techniques in real-world applications and understand the ethical implications of such applications.	1,2,3,4,12	2,3
CO6	Develop critical thinking and problem-solving skills by analyzing case studies and research papers related to computer vision and image processing and applying theoretical concepts to evaluate the effectiveness and limitations of various techniques.	1,2,3,4,12	2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓				
CO2	✓		✓	✓		
CO3	✓				✓	✓
CO4	✓	✓		✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX

POs/ COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**P7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	2	2										1	2	1

CO2	2	1	2										1	2	1
CO3	3	1	2										1	2	1
CO4	2	1	2	1									1	2	1
CO5	3	2	2										1	1	1
CO6	3	2	2										1	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
UNIT – 1 **Introduction to Computer Vision and Image Processing** What is computer vision? Image Formation: Geometric primitives and transformations, Photometric image formation, The digital camera, Image Filtering and Enhancement: Point operators, Linear filtering, More neighborhood operations, Fourier transforms, Pyramids and wavelets, Geometric transformations.
UNIT – 2 **Image Features and Matching** Feature Detection and Matching: Points and patch, Edges, Lines. Image stitching: Motion models, Global alignmen Compositing. Object detection: Face detection, Pedestrian detection, General object detection.
UNIT - 3 **Object and Scene Recognition** Instance recognition, Image classification, Semantic segmentation, Deep neural networks for Object and scen recognition.
UNIT – 4 **3D Computer Vision** Motion estimation: Translational alignment, Parametric motion, Optical flow, Layered motion, Structure from motio and SLAM: Geometric intrinsic calibration, Pose estimation, Two-frame structure from motion, multi-frame structur from motion, Simultaneous localization, and mapping (SLAM)

Textbooks:

1. Richard Zaleski, "Computer Vision Algorithms and Applications", Springer-Verlag London Limited, September 2020. 2021

Reference Books:

2. Timothy, Pratt, Charles, W Bastian “Satellite Communications” 2nd Edition, Wiley Publications 2002
3. Simon J.D. Prince, “Computer vision: models, learning and inference”, Cambridge University Press 2012.
4. Michael W. Burke, “Image Acquisition”, First Edition, Chapman & Hall Publication, UK,1996.
5. Richard Hartley & Andrew Zisserman, “Multiple View Geometry in Computer Vision”, 2nd Edition, Cambridge University Press, 2003.
6. Boguslaw Cyganek & J. Paul Siebert, “An Introduction to 3D Computer Vision Techniques and Algorithms”, 1st Edition, A John Wiley and Sons, Ltd., Publication, 2009

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. http://conferences.visionbib.com/Iris-Conferences.html
2. https://sites.usc.edu/iris-cvlab/
3. https://www.siue.edu/~sumbaug/438_syl.html

<table>
<tr><td>Course Title</td><td colspan="4">Natural Language Processing</td><td colspan="2">Course Type</td><td colspan="2">PROFESSIONAL ELECTIVE</td></tr>
<tr><td>Course Code</td><td>B20EPS712</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">VII Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>LTP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>Practical</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>-</td><td>50%</td><td>50 %</td></tr>
</table>

COURSE OVERVIEW:

The course provides the basics of Natural-language processing (NLP), which is an area of computer science and artificial intelligence concerned with the interactions between computers and human (natural) languages, how to program computers to fruitfully process large amounts of natural language data. Natural language processing (NLP) is the ability of a computer program to understand human language as it is spoken. NLP is a component of artificial intelligence (AI). Challenges in natural-language processing frequently involve speech recognition, natural-language understanding, and natural-language generation.

COURSE OBJECTIVES:

The objectives of this course are to:

1. To Learn the techniques in natural language processing.
2. To be familiar with the natural language generation.
3. To be exposed to Text Mining.
4. To Understand the information retrieval techniques

5. To provide insights into the Mining Diagnostic Text Reports
6. To introduce the Finite-State Sequence Modeling

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the natural language text	1,2,3	1,2,3
CO2	Generate the natural language.	1,2,3	1,2,3
CO3	Analyze the Text mining.	1,2,3	1,2,3
CO4	Apply information retrieval techniques.	1,2,3	1,2,3
CO5	Describe the Mining Diagnostic Text Reports	1,2,3	1,2,3
CO6	Apply Finite-State Sequence Modeling	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓			
CO6	✓	✓	✓			

COURSE ARTICULATION MATRIX:

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1										1	1	1
CO2	2	2	3										1	2	3
CO3	2	2	3										1	1	3
CO4	1	2	1										1	1	1
CO5	2	2	2										2	2	1

CO6	2	2	2										1	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:
THEORY:

Contents
UNIT – 1 **Overview**: Origins and challenges of NLP Language and Grammar-Processing Indian Languages- NLP Applications. Information Retrieval. Language Modelling: Various Grammar- based Language Models- Statistical Language Model, Regular expressions, text normalization, edit distance
UNIT – 2 **Word Level Analysis**: Regular Expressions. Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word Classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing
UNIT – 3 **Introduction, Subsequence Kernels** for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labelling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: In-Fact System Overview, The GlobalSecurity.org Experience.
UNIT - 4 **Introduction, iSTART:** Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, CohMetrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. **Automatic Document Separation:** A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining

TEXTBOOKS:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.

REFERENCE BOOKS:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

Course Title	**Computational Intelligence**				**Course Type**		**Professional Elective**	
Course Code:	**B20EPS713**	**Credits**	3		**Class**		**VII Semester**	
Computational Intelligence	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	**IA**	**SEE**
	-	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50 %**	**50 %**

COURSE OVERVIEW:

Computational Intelligence (CI) is the theory, design, application, and development of biologically and linguistically motivated computational paradigms. Traditionally the three main pillars of CI have been Neural Networks, Fuzzy Systems and Evolutionary Computation. However, in time many natures inspired computing paradigms have evolved. Thus, CI is an evolving field and at present in addition to the three main constituents, it encompasses computing paradigms like ambient intelligence, artificial life, cultural learning, artificial endocrine networks, social reasoning, and artificial hormone networks.

CI plays a major role in developing successful intelligent systems, including games and cognitive developmental systems. Over the last few years there has been an explosion of research on Deep Learning, deep convolutional neural networks. Nowadays, deep learning has become the core method for artificial intelligence. In fact, some of the most successful AI systems are based on CI.

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide a strong foundation on fundamental concepts in Computational Intelligence.
2. To enable Problem-solving through various searching techniques.
3. To give insight into CI techniques in applications which involve perception, reasoning, and learning.
4. To introduce Computational Intelligence techniques for information retrieval
5. To introduce Computational Intelligence techniques primarily for machine learning.
6. To give the insights into the fundamentals of evolutionary computation

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the concepts in Computational Intelligence.	1,2,3	1, 2
CO2	Describe the Artificial Neuron and activation function	1,2,3	1, 2
CO3	Apply CI techniques in applications which involve perception, reasoning, and learning	1,2,3	1, 2

CO4	Apply Computational Intelligence techniques for information retrieval	1,2,3	1, 2
CO5	Apply Computational Intelligence techniques primarily for machine learning	1,2,3	1, 2
CO6	Describe the fundamentals of evolutionary computation	1,2,3	1, 2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓				
CO2	✓	✓	✓	✓		
CO3	✓	✓				
CO4	✓	✓		✓		
CO5	✓					
CO6	✓					

COURSE ARTICULATION MATRIX

POs/ COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO3**
CO1	3	2	2										1	2	
CO2	2	2	2										1	2	
CO3	3	2	2										1	2	
CO4	2	2	2										1	2	
CO5	3	3	3										1	2	
CO6	3	3	3										1	2	

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents

UNIT – 1

Introduction to Computational Intelligence: Computational Intelligence Paradigms, Artificial Neural Networks, Evolutionary Computation, Swarm Intelligence, Artificial Immune Systems, Fuzzy Systems, Short History.

UNIT - 2

The Artificial Neuron: Calculating the Net Input Signal, Activation Functions, Artificial Neuron Geometry, Artificia Neuron Learning, Augmented Vectors, Gradient Descent Learning Rule, Windrow-Hoff Learning Rule, Generalized Delt Learning Rule, Error-Correction Learning Rule

UNIT - 3

Supervised and Unsupervised Learning Neural Networks: Neural Network Types, Feedforward Neural Networks, Supervised Learning Rules, The Supervised Learning Problem, Leapfrog Optimization, Particle Swarm Optimization. Hebbian Learning Rule, Principal Component Learning Rule, Learning Vector Quantizer-I, Self-Organizing Feature Maps

UNIT - 4

Introduction to Evolutionary Computation: Generic Evolutionary Algorithm, Representation – The Chromosome, Initial Population, Fitness Function, Selection ,Selective Pressure, Random Selection, Proportional Selection , Tournament Selection, Rank-Based Selection, Boltzmann Selection, (μ +, λ)-Selection, Elitism, Hall of Fame ,Reproduction Operators, Stopping Conditions, Evolutionary Computation versus Classical Optimization

Textbooks:

1. Andries P Engelbrecht, “Computational Intelligence: An Introduction”, Second Edition, John Wiley 2010

Reference Books:

1. Simon Haykin, “Neural networks and learning machines”, Prentice Hall, 2009.
2. Bäck T, “Evolutionary algorithms in theory and practice: evolution strategies, evolutionary programming, genetic algorithms”, Oxford University Press, 1996.
3. Klir, G.J, Yuan B, “Fuzzy sets and fuzzy logic: theory and applications”, Prentice Hall, 1995

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://www.hindawi.com/journals/cin/
2. https://www.atlantis-press.com/journals/ijcis
3. https://www.worldscientific.com/worldscinet/ijcia

<table>
<tr><td>Course Title</td><td colspan="4">Low Power VLSI</td><td colspan="2">Course Type</td><td colspan="2">Professional Elective</td></tr>
<tr><td>Course Code</td><td>B20EPS714</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">VII semester</td></tr>
<tr><td rowspan="5">Low Power VLSI</td><td>LTP</td><td>Credits</td><td>Contact</td><td>Work</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Lecture</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Tutorial</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>42</td><td></td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

This course deals with issues and models to design low-power VLSI circuits, fundamentals of power dissipation in microelectronic devices, will be able to estimate power dissipation due to switching, short circuit. The architectural, algorithm power estimation and optimization techniques will be discussed.

COURSE OBJECTIVES:

The objectives of this course are:

1. Understand different sources of power dissipation in CMOS & MIS structure.
2. Understand the different types of low power adders and multipliers.
3. Focus on synthesis of different levels of low power transforms.
4. Understand the various energy recovery techniques used in low power design.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze different source of power dissipation and the factors involved in VLSI Circuits.	1,2,3,4	1,2,3
CO2	Explore the different techniques to design low power arithmetic circuits	1,2,3,4	1,2,3
CO3	Illustrate the impact of various low powers transformation techniques	1,2,3,4	1,2,3
CO4	Interpret the real-world low power design techniques at different levels of design	1,2,3,4	1,2,3
CO5	Use optimization and trade-off techniques that involve power dissipation of VLSI systems	1,2,3,4	1,2,3
CO6	Demonstrate the power dissipation analysis, estimation and optimization techniques at architectural level and algorithm level.	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓	✓	✓			
CO3	✓	✓	✓			
CO4	✓	✓	✓			
CO5	✓	✓	✓			
CO6	✓	✓	✓			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2								3	2	1	3
CO2	3	1	3	2								3	2	1	3
CO3	3	3	2	2								3	3	2	3
CO4	3	3	2	1								3	3	1	3
CO5	3	1	3	2								3	2	1	3
CO6	3	1	2	2								3	2	1	3

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices.

UNIT - 2
Power estimation, Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.
UNIT - 3
Low Power Design Circuit level: Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic. Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction.
UNIT - 4
Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network. **Algorithm and Architectural Level Power Analysis and Optimization:** Algorithm & Architectural Level Methodologies: Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis.

Textbooks:

1. Kaushik Roy, Sharat Prasad, “Low-Power CMOS VLSI Circuit Design” Wiley.

2. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, KAP.

Reference Book:

1. Rabaey, Pedram, “Low Power Design Methodologies” Kluwer Academic.

7th Semester
PROFESSIONAL ELECTIVE-5

Course Title	**ASIC Design**				**Course Type**		**Professional Elective**	
Course Code	**B20ENS721**	**Credits**	**3**		**Class**		**VII Semester**	
	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	**IA**	**SEE**
	-	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50 %**	**50 %**

COURSE OVERVIEW:

This course covers the principles, techniques, and tools involved in the design and implementation of application-specific integrated circuits (ASICs). It also involves a deep understanding of the principles of digital electronics, computer architecture, and VLSI (Very Large-Scale Integration) design. The course enables students to understand the various stages of design and development, from specification to final implementation.

COURSE OBJECTIVES:

The objectives of this course are:

1. Present brief idea and introduction about the ASIC design.
2. Present the idea of ASIC library design and low-level design entry.
3. Give a brief description of floor planning and system partitioning.
4. Understanding the physical design, CAD tools, methods, and algorithms.
5. Give a brief description of placement and routing.
6. Understanding the concept of time-driven placement and how it differs from traditional placement algorithms.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the various logic cells and concepts of ASIC design methodology.	1,2,3,9,10,11,12	2,3
CO2	Apply logical effort technique for predicting delay, delay minimization and desig schematics.	1,2,3,9,10,11,12	1,2,3
CO3	Explain algorithms for floor planning and partitioning of cells for optimized area and speed.	1,2,3,9,10,11,12	1,2,3

CO4	Understand the physical design process and the role of CAD tools in it.	1,2,3,9,10,11,12	1,2,3
CO5	Explain for placement and routing algorithms for optimization of length and speed.	1,2,3,9,10,11,12	1,2,3
CO6	Understand the concept of timing-driven placement and its importance in modern VLSI design.	1,2,3,9,10,11,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1		✓				
CO2		✓	✓			
CO3		✓				
CO4	✓	✓				
CO5	✓	✓				
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2						3	3	2	1		2	1
CO2	3	3	3						3	3	2	1	3	2	3
CO3	3	3	2						3	3	2	1	1	3	2
CO4	3	3	2						3	3	2	1	1	3	2
CO5	3	3	2						3	3	2	1	1	3	2
CO6	3	3	2						3	3	2	1	1	3	2

Note: 1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
UNIT - 1 **Introduction:** Types of ASICs, Full Custom ASICs, Semicustom ASICs, Standard Cell based ASICs, Gate array-based ASICs, Channeled gate array, Channel less gate array, structured gate array, Programmable logic devices, FPGA, ASIC Design flow, ASIC cell libraries, Cell Compilers.
UNIT - 2 **ASIC Library Design and Design entry:** ASIC Library Design: Logical effort: predicting delay, logical area and logical efficiency, logical paths, multistage cells, optimum delay, optimum number of stages, library cell design. Low-Level Design Entry: Schematic Entry: Hierarchical design, the cell library, Names, Schematic, Icons & Symbols, Nets, schematic entry for ASIC'S, connections, vectored instances, and buses, Edit in place, Attributes, Netlist screener, Schematic-Entry tools, Back annotation.
UNIT – 3 **ASIC Construction** Physical Design, CAD Tools, Methods and Algorithms, System Partitioning, partitioning methods, Measuring connectivity, simple partitioning, Constructive partitioning, Iterative Partitioning Improvement, The Kernighan Lin Algorithm, The Ratio-Cut Algorithm, The Look-ahead Algorithm, Simulated Annealing, Floor planning Goals and Objectives, Floor planning tools, channel definition, I/O, power, and clock planning.
UNIT - 4 **Unit 4: Placement and Routing** Placement terms and definitions, placement goals and objectives, Placement algorithms, eigenvalue placement, iterative placement improvement, placement using simulated annealing, Time driven placement methods, simple placement, global Routing, Detail Routing, Special Routing.

TEXTBOOKS:

1. M.J. S. Smith, "Application - Specific Integrated Circuits", Pearson Education, 2003.

REFERENCE BOOK:

1. Jose France, Yannis Tsividis, "Design of Analog-Digital VLSI Circuits for Telecommunication and signal processing", Prentice Hall, 1994.

2. Malcolm R. Haskard; Lan. C. May, "Analog VLSI Design – NMOS and CMOS", Prentice Hall, 1998.

3. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994.

SWAYAM/NPTEL/MOOCs:

https://archive.nptel.ac.in/courses/106/105/106105161/

Course Title	Quantum computing				Course Type		Professional Elective	
Course Code	B20EP722	Credits	3		Class		VII Semester	
Quantum computing	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightag e	
	Theory	3	3	3				
	Practice	-	-	-				
	-	-	-	-	Theory	Practical	IA	SE E
	Total	3	3	3	39	-	50 %	50 %

COURSE OVERVIEW:

The Quantum computing typically introduces quantum information at a beginning graduate level. It focuses on the fundamental understanding of how information is processed with quantum systems and how the quantum properties apply to computing and communication tasks. The study begins by introducing quantum theory as a framework for processing information. Quantum systems are introduced in one and two qubits. The axiom of quantum theory such as regions, forces, and measurements are defined as the preparation, natural occurrence, and output of qubits. Quantum computing and quantum communication are defined. Capture is considered an important tool for processing quantum information.

COURSE OBJECTIVES:

The objectives of this course are:

1. Make the students to understand basics of quantum computing.
2. Study the working principle and details of quantum mechanics.
3. Understand the basics of Qiskit and its applications.
4. Understand the consequences and effects of using quantum in computing.
5. Familiarize the students with the basic algorithms.
6. Carry out Jobs and research in quantum computing domain.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe basic operations of general computing.	1,2,3	1,2,3
CO2	Analyze the use of physics in computing	1,2,3	1,2
CO3	Assess the outcomes of modern computing techniques.	1,2,3,4	1,2
CO4	Analyze working principle and characteristics of quantum computing	1,2,3,4	1,2
CO5	Analyse career path in Quantum computing.	1,2,3	1,2

CO6	Basic Idea on designing an algorithm using principles of Quantum computing	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓				
CO2	✓			✓		
CO3	✓	✓	✓			
CO4	✓	✓	✓	✓		
CO5	✓	✓		✓		
CO6	✓	✓				✓

COURSE ARTICULATION MATRIX

CO#/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1										1	2	1
CO2	3	3	3										3	2	1
CO3	3	3	2	1									3	3	2
CO4	3	3	3	1									3	3	
CO5	3	3	3										3	3	
CO6	3	3	2	1									3	3	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
UNIT - 1
Introduction to Computing: Introduction to Information and computation, characteristics of computational systems, computability and algorithms related to computing. History of computing, Evolution of quantum computing (Hilbert problem, Turing machine), Introduction to quantum physics, Advantages and disadvantages of quantum computing and career path in quantum computing.

UNIT - 2
Qbit and logic gates: Importance of 0 and 1s in computing, need to invent Qbit, Properties and characteristics of Qbit, Basics of operations on Qbit, NOT gate, the Hadamard gate, general single qubit gates, CNOT gate, multi gates, Problems on operations.
UNIT - 3
Algorithms in Quantum Computing: Quantum adder, Deutsch's algorithm, Quantum search algorithm (searching 1 out of 4 items), Quantum Fourier transforms, Using Qiskit to simulate few algorithms and gates (IBM open-source tool).
UNIT - 4
Quantum- Communications & Applications: Basics of Cryptography, Classic cryptography techniques like the vernam cypher, public key cryptography RSA Protocol, no-cloning theorem, BB4 protocol, E91 protocol, SHA Algorithms, Applications of quantum computing. Case study: IBM Daimler association on electric vehicles.

TEXT BOOKS:

1. Scott Aaronson, "Quantum computing since Demarcates", 2017.

REFERENCE BOOK:

1. Eleanor Rieffel and Wolfgang Polak, "QUANTUM COMPUTING A Gentle Introduction", MIT press 2018.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. http://mmrc.amss.cas.cn/tlb/201702/W020170224608149125645.pdf
2. https://homepages.cwi.nl/~rdewolf/qcnotes.pdf
3. https://homes.cs.washington.edu/~oskin/quantum-notes.pdf
4. http://www-reynal.ensea.fr/docs/iq/PrinciplesOfQuantumComputation1.pdf
5. https://indico.cern.ch/event/970909/attachments/2165159/3654057/PIQC%20Lecture%207.pdf

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc21_cs103/preview
2. https://www.coursera.org/learn/quantum-computing-algorithms?specialization=quantum-computing-from-basics-to-the-cutting-edge
3. https://arxiv.org/pdf/quant-ph/9809016.pdf
4. https://people.inf.ethz.ch/ccarlos/assets/qc/presentation.pdf
5. https://onlinecourses.nptel.ac.in/noc19_cy31/preview

LAB Reference:

https://quantum.country/qcvc

<table>
<tr><td>Course Title</td><td colspan="4">Social Media Analysis</td><td colspan="2">Course Type</td><td colspan="2">Professional Elective</td></tr>
<tr><td>Course Code</td><td>B20EPS723</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">VII Semester</td></tr>
<tr><td rowspan="5">Social Media Analysis</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>-</td><td>-</td><td>-</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SE
E</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>-</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW:

Analysing the social media provides a framework for the analysis of public data currently available and being generated by social networks and social media, like Facebook, Twitter, and Foursquare. Access and analysis of this public data about people and their connections to one another allows for new applications of traditional social network analysis techniques that let us identify things like who are the most important or influential people in a network, how things will spread through the network, and the nature of peoples' relationships. Analysing the social media introduces you to these techniques, shows you their application to many different types of social media, and discusses how social media can be used as a tool for interacting with the online public.

COURSE OBJECTIVES:

The objectives of this course are:

13. Make the students to understand basics of social media analysis.
14. Study the working principle and details of social media analysis.
15. Understand the basics of social media visualization.
16. Understand the consequences and effects of Building and Propagation in networks.
17. Familiarize the students with the firefighter problem and Stochastic models.
18. Familiarize the students with Social Media Interaction and Information Filtering

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the basics of social media analysis.	1,2,3	1,2,3
CO2	Analyze the use of nodes and edges in social media networks	1,2,3	1,2
CO3	Analyze the Visualizing network features	1,2,3	1,2
CO4	Describe the Building and Propagation in social media networks	1,2,3,4	1,2
CO5	Describe the firefighter problem and Stochastic models	1,2,3,4	1,2
CO6	Apply the Social Media Interaction and Information Filtering for real time problems	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓			
CO2	✓	✓	✓			
CO3	✓	✓	✓			
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓			

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3										1	2	1
CO2	3	3	3										3	2	1
CO3	3	3	2										3	3	2
CO4	3	3	3	1									3	3	
CO5	3	3	3	1									3	3	
CO6	3	3	2										3	3	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
UNIT - 1
Introduction: Analyzing the social media, A brief history of the social media, Basics of network structure, representing networks, Basic network structures and properties, describing nodes and edges, Describing networks

UNIT - 2
Social Network Visualization: Graph layout, Visualizing network features, Scale issues, the role of tie strength, measuring tie strength, Tie strength and network structure, Tie strength and network propagation, defining trust, Nuances of trust, measuring trust, Trust in social media, Inferring trust, Network-based inference, Similarity-based trust inference.
UNIT - 3
Building and Propagation in Networks: Modeling networks, Sampling methods, Egocentric network analysis, Epidemic models, Threshold models, The firefighter problem, Stochastic models
UNIT - 4
Social Media Interaction and Information Filtering: Location technology, Mobile location sharing, Location-based social media analysis, Privacy and location-based social media, social sharing and social filtering, Automated recommender systems, Case study: Reddit voting system, Case study: Trust-based movie recommendations

TEXTBOOKS:

1. Jennifer Golbeck, "Analyzing the Social Web", 2017.

REFERENCE BOOK:

1. Ganis and Kolhatkar, "Social Media Analytics", Pearson Education India, 2018

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. **https://www.sciencedirect.com/science/article/pii/S0148296322001321**
2. **https://www.springer.com/journal/13278**
3. **https://www.searchenginejournal.com/social-media-analytics/463340/**
4. **https://www.mdpi.com/2673-9585/2/2/14**
5. **https://www.jmir.org/2020/12/e21418/**

SWAYAM/NPTEL/MOOCs:

Course Title	VLSI Design and Verification				Course Type		HC	
Course Code	B20EPS724	Credits	3		Class		VII Semester	
VLSI Design and Verification	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	IA	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50 %**	**50 %**

COURSE OVERVIEW:

This course focuses on providing detailed knowledge in VLSI design starting from sequential and combinational design, hardware descriptive languages, verification, implementation. In this process the student will understand the entire logic design process and will be able to take on the challenges posed by the even demanding chip design industry.

COURSE OBJECTIVES:

The objectives of this course are:

1. Understand the concepts of combinational circuit design concepts.
2. Understand the concepts of sequential circuit design concepts.
3. Understand the Verilog HDL and operators for Verilog Programming.
4. Understand the Verilog modelling at Programming level.
5. Understand System Verilog Language and Demonstrate How to Build Verification Environment for Performing Verifications of VLSI Circuits.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	State the concepts of combinational circuit design.	1,2,3,12	1,2,3
CO2	State the concepts of sequential circuit design.	1,2,3,12	1,2,3
CO3	Able to learn all the operators and apply it for both combinational and sequential circuits at Verilog programming level.	1,2,3,12	1,2,3
CO4	Able to apply and analyze the different modelling at Verilog programming.	1,2,3,4,5,12	1,2,3
CO5	Able to analyze and verify its functionality of any VLSI Design.	1,2,3,4,5,12	1,2,3
CO6	Able to analyze and verify the test-bench of any VLSI Design	1,2,3,4,5,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓			
CO2	✓	✓	✓			
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX

CO#/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2									2	2	1	1
CO2	3	2	2									2	2	1	1
CO3	3	2	2									2	2	1	1
CO4	3	2	2	2	2							2	2	1	1
CO5	3	2	2	2	2							2	2	1	1
CO6	3	2	2	2	2							2	2	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
UNIT - 1
Combinational Logic Circuit Design: Logic Synthesis, RTL Synthesis, High-Level Synthesis, Synthesis Design Flow, Design and Analysis of Combinational Circuits, Synthesis of Combinational Circuits, Arithmetic Circuits, Initial Design and Optimization, Encoder, Decoder, De-Multiplexer Circuits, Multiplexer Circuits and their Implementation Using Verilog, Design of a 4-Bit Comparator, Design of a 4-Bit ALU and a Simple Processor.

UNIT – 2
Sequential Logic Circuit Design: Synthesis of Sequential Circuits, Study of Synchronous and Asynchronous Sequential Circuits, Flip Flops, Shift Registers, Counters and their Design Using Verilog. State Machine: Basic Finite State Machines (FSM) Structures, Mealy and Moore Type FSM, Mealy Vs. Moore, Common FSM Coding Style, Serial Adder Design Using FSM, FSM as an Arbiter Circuit, FIFO, Bus Interfaces.
UNIT – 3
System Verilog Different Data Types, User-Defined and Enumerated Types: String Data Types, Event Data Types, User-Defined Types, Enumerated Types, Nets, Reg, Logic, Type Casting, Constants, Attributes. Array: Packed Array and Unpacked Array, Dynamic, Associate Array, Its Methods, QUEUE Operators and Expressions, Control Structure: If-Else, Switch. Loop. Tasks, functions, Enhancements to tasks and functions, Task and function argument passing, Import and export functions, System Tasks and System Functions. Combinational Logic, Latch Logic, Sequential Logic, Fork Join (Join, join_Any, Join_None), Event Controls, Process Control.
UNIT – 4
UVM: History of Testing, Introduction to Universal Verification Methodology (UVM): Typical UVM Test bench Architecture, UVM Library Class. **UVM Basics:** UVM TB Architecture, Creating UVCs and Environment, Creating agent, UVM simulation phases, Test Flow. **Transaction Level Modelling (TLM)** Overview, TLM, TLM1, Merit, Demerit, TLM 2, Implementation **Creating and Using UVM Testbench**: Configuring UVM Environment: UVM Sequences, UVM Sequencers, Connecting DUT-Virtual Interfaces, Virtual Sequences and Sequencers, Transaction Class. **Use of Verification Components:** Test Plan and Coverage: Creating Test Plan from Specification Coverage: Code Coverage and Functional Coverage.

TEXTBOOKS:

1. Palnitkar, Samir. "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education India, 2003
2. Navabi, Zainalabedin, and Yuwen Xia. "Verilog Digital System Design: Register Transfer Level Synthesis, Testbench, and Verification", McGraw-Hill, 2006
3. Mishra, Kishore K. "Advanced chip design: Practical examples in Verilog", Create Space Independent Publishing Platform, 2013.
4. Sutherland, Stuart, Simon Davidmann, and Peter Flake, "SystemVerilog for Design Second Edition: A Guide to Using System Verilog for Hardware Design and Modeling", Springer Science & Business Media, 2006
5. R. Salemi, "The UVM Primer: A Step-By-Step Introduction to The Universal Verification Methodology" Boston Light Press, 2013
6. V.R. Cooper, "Getting Started with UVM: A Beginner's Guide," Austin: Verilab Publishing, 2013
7. H. Height, "A Practical Guide to Adopting The Universal Verification Methodology (UVM)" Lulu. Com, 2010
8. C. Spear, "SystemVerilog for verification: A Guide to Learning the Testbench Language Features," Springer Science & Business Media, 2008

REFERENCE BOOK:

1. Bhasker, Jayaram. "Verilog HDL Synthesis: A Practical Primer", Star Galaxy Publishing, 2008.
2. Wolf, Wayne. FPGA-Based System Design". Pearson education, 2004.
3. Ciletti, Michael D, "Advanced Digital Design with the Verilog HDL", Vol. 1. Upper Saddle River: Prentice Hall, 2003.

School of Electronics and Communication Engineering

GUIDELINES FOR THE IMPLEMENTATION OF FINAL YEAR PROJECT

2020-24 batch of all B. Tech Programs

Major project or final year Project is team (Group)/ Individual project, which is to be executed in 7th and 8th semesters. It is a mandatory course for students to be awarded with B. Tech degree in their respective programs. The students are expected to undergo research studies that relate to this course.

The Major project consists of two phases: Major project phase 1 in 7th semester is a prerequisite for Major project Phase 2 in 8th semester.

The objective of the Major project is to enhance the student's knowledge and skills in solving problem through structured project research to produce a competent and productive engineer.

Upon completion of Major project, the student should be able to:

1. Identify and describe the problem and scope of the project.
2. Collect, analyze, and present data into meaningful information using relevant tools.
3. Select plan and execute a proper methodology in problem solving.
4. Work independently and ethically
5. Present the results in written and oral format effectively.
6. Identify basic entrepreneurship skills in project management.

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P12**	**PSO1**	**PSO2**	**PSO3**
CO1		3		3		3	3	3			3		3	2	3
CO2	3	3		3								3	3	2	3
CO3	3		3	3		3	3		3				3	2	3
CO4	3		3	3	3				3			3	3	2	3
CO5					3			3	3	3		3	3	2	3
CO6									3	3	3	3	3	2	3

The Major project is to **learn and experience the process** of conducting agood research project. The various activities that takeplace in the process are

1. Formation of Problem statement
2. Objective of the Project

3. Scope
4. Literature Review
5. Methodology
6. Result, Analysis and Discussion

The above points can be briefly described in following paragraphs:

1. **Formation of Problem statement:** A problem statement is a brief statement of the problems, which initiate the research questions or design ideas. Some of the points that could be highlighted are:

I. What is the issue/Problem/question that we want to address?
II. Why need to address the issues?
III. How the proposed methodology can solve the issues?

2. Objective of the Project:

Objective is set of clear goals of what we want to accomplish by doing the project/research work. Student should statethe technical objective of the project with respect to evaluate the performance of the design. Measurable verbs are to be included while framing the objectives.

3. Scope

Scope sets a clear boundary with respect to time, geography, environment, function etc. of project work to provide a common understanding of the project among students, lecturer, panels. Scope makes project achievable and realistic by defining the limits and constrains of the study

4. Literature review

A literature review discussed published information in a particular subject area. The purpose of a literature review is to summarize and synthesize the ideas of others. When we write a literature review, it usually consists of 3 main sections:

- Introduction section that describe the topic of the review.
- Body section, which contain the discussion of sources.
- Conclusions from the discussion of sources and recommendations

The discussion of the sources could be arranged chronologically, thematically or methodologically or in combination of any of them. In the discussion, students should:

- Be clear of the items that need to be discussed. It can be a variable, a technique, or different design decision.
- Make comparisons and give technical comments. Summary of the comparison could be tabulated or shown in graphs to clarify the differences.
- For engineering design, discuss on the tradeoff a particular design decision.

5. Methodology

Methodology is the part where we design and execute our research. We design our research methodology by asking the following questions:

- What is the objective of the study? Like given a new design idea, we want to evaluate the performance of the new design in terms of its sensitivity, accuracy, processing time etc.

- What do we want to measure? For example time, storage size, current, cost, sensitivity, accuracy etc.)
- How do we perform the measurement?
- What are the tools :simulation software or equipment required for the experiment
- How are the measurements going to be recorded? What is the procedure of the experiment?
- What error, situations, or part of the procedure that we design that could interfere with the measurements and how we could overcome them?
- How do we analyze the result of the experiment? What kind of statistical tools/calculations/graphs/tables/figures could we used in order to make the data meaningful?

6. Result, Analysis and Discussion

The results of the study/experiments in the forms of graphs or tables that summarize measurements (data). At this stage of the research process, we are expected to discuss the results. Examples of points of discussion are:

- Statement of how the variable of interest changes with the change ofanother variable and whether the trend is expected.
- Academic interpretation of the result (i.e. with proof, comparisonwith other works, intelligent guess).
- Significance (its impact to the world) and implication of findings.
- Possible applications.

Implementation Method and Guideline

I. The student teams after approved by the coordinators and panel are allotted with project supervisors/guides as per the specialization of the faculty. The teams are advised to submit the problem title and the domain for the allotment of guides.

The duties of project supervisors/guides include:

- Supervise project implementation and progress.
- Provide guide for continual improvement.
- Verify student’s logbook in each meeting.
- Evaluate student works and outcomes.
- Ensure that the title given to students as well as projects objectives remain unchanged without prior approval.
- Verify any related final year project forms.
- Commit to FYP implementation.
- Execute any related tasks given by project coordinator.

Any supervisors who tend to change project title and project scope after week 4 must seek approval project panel.

II. Project Title Registration:

The project team has to present 5 or 6 project titles to the supervisor/guide, Based on the confidence level of the team the team can choose a project. Student must fill the final year project Title Registration Form and to be signed by supervisor/guide.

III. Project Proposal:

Project Proposal Form submitted by team to his/her supervisor/guide prior tothe commencement of the projects. The form must include a title, abstract , objectives /aim (or goal) and scope of the project, literature review and proposed methodology. The first proposal is submitted before the proposal presentation (seminar) for panel assessment. Then after Presentation, student must resubmit the proposal after correction complying the panel comments.

IV. First Seminar – proposal presentation –Phase 1

Project team will be required to make a brief presentation about the project proposal, to ensure that they are entitled to present their findings; they need approval from their supervisor/guide.

The presentation slideshow should cover the following:

- Introduction and overview of the project.
- Problem statement.
- Project objectives and scope.
- Literature survey and theory.

During the presentation, students are evaluated in various aspects of knowledge. These may include communication skill, presentation contents, ability to answer any question, readiness of facing critics and comment, as well as ability to interact with audience. Students are advised to wear formal attire during the presentation.

V. Second Seminar - Project Presentation-Phase 1

At the end of final year project 2 , team will be presenting the progress of their project .Once again, to ensure that they are entitled to present their findings, The verified form must be submitted to the panels during the presentation.

- Introduction and overview of the project.
- Problem statement.
- Project objectives and scope.
- Literature survey and theory.
- Methodology.

- References

During the presentation, students are evaluated in various aspects of knowledge. These may include communication skill, presentation contents, ability to answer any question, readiness of facing critic and comment, as well as ability to interact with audience. Students are advised to wear formal attire during the presentation.

The project demonstration (if any) takes place right after the presentation on the same day of presentation schedule.

The evaluation rubrics for Major presentation Phase 1- in 7th semester is as follows.

overview of the project (5)	Problem statement (5)	Problem objectives (5)	Literature survey (5)	Methodology(5)	reference (5)	Independent Learning (10)	Oral Presentation (10)	Total(50)

Guidelines for Major presentation Phase 2- Eight Semester

In continuation of the final year project phase II, the team will be concentration on implementation of the propose methodology followed in the project. Result and analysis.

IV. First Seminar – proposal presentation –Phase 2

Project team will be required to make a brief presentation about the project proposal, to ensure that they are entitled to present their findings; they need approval from their supervisor/guide.

- Introduction and overview of the project.
- Problem statement.
- Project objectives and scope.
- Literature survey and theory.
- Methodology.
- References

During the presentation, students are evaluated in various aspects of knowledge. These may include communication skill, presentation contents, ability to answer any question, readiness of facing critics and comment, as well as ability to interact with audience. Students are advised to wear formal attire during the presentation.

V. Second Seminar - Project Presentation-Phase 2

At the end of final year project 2 , team will be presenting the progress of their project .Once again, to ensure that they are entitled to present their findings, The verified form must be submitted to the panels during the presentation.

- Introduction and overview of the project.

- Problem statement.
- Project objectives and scope.
- Literature survey and theory.
- Methodology.
- Results and discussions
- Future scope
- References

During the presentation, students are evaluated in various aspects of knowledge. These may include communication skill, presentation contents, ability to answer any question, readiness of facing critic and comment, as well as ability to interact with audience. Students are advised to wear formal attire during the presentation.

The project demonstration (if any) takes place right after the presentation on the same day of presentation schedule.

VI. Final Draft Report

Upon completing the project, a draft report should be submitted to project guide and the panel for evaluation. The report must contain an updated progress report, and all information as pre-determined by the Project coordinator.

VII. Final Report

Complete report (**6 copies with CDs)** must be submitted to the faculty after the draft report has been evaluated and corrected by the project guide. This report is a corrected form (if any) of draft report which sent to the panel or project guide beforehand. It must be a press-bind with standard front cover

VIII .Evaluation Scheme

Students undertake final year project must go through seminar (project presentation) and produce proposal/report for each part of the project. Students areevaluated by their project guide and also by panels.

Project Supervisor/ Guide Evaluation

Individual supervisor/guide evaluates students based on peer-to-peer meeting and weekly progress. Logbook as an evidence to a student task may also contribute a portion of marks.

Panel Evaluation

Panels evaluate the project presentations, as well as final report and project demonstration in final year project.

Evaluation Rubrics:

overview of the project (5)	Problem statement (5)	Problem objectives (5)	Literature survey (5)	Methodology (5)	Results and discussions(10)	References(5)	Oral Presentation (05)	Demonstration of project(5)	Total(50)

Final year Project Activities Calendar

Committee produced an activity calendar to help students plan and execute their project within the semester. The followings are general activities for Phase 1 and Phase 2.The exact dates shall be informed at the beginning of each semester. However the dates are subject to change depends on the current Academic Calendar.

Phase 1 Calendar – Semester 7

ACADEMIC WEEK	ACTIVTY
1	Group Formation
2	Topic and Guide Selection
3	Literature Survey
4	Title Finalization
5	Phase-0 presentation with Title scrutinization
06	Updating of Title
07	Hardware and Software components finalization
08	Weekly Project progress to guide
09	Weekly Project progress to guide
10	Weekly Project progress to guide
11	Weekly Project progress to guide
12	Phase-1 PPT preparation and Report (Chapter: Introduction, Literature Survey and Methodology)
13	Verification and Printing (Soft binding of report)
14	Phase -1

Phase 2 Calendar – Semester 8

ACADEMIC WEEK*	ACTIVITY
1	Weekly Project progress to guide
2	Weekly Project progress to guide
3	Progress presentation
4	Weekly Project progress to guide
5	Weekly Project progress to guide
06	Weekly Project progress to guide
07	Weekly Project progress to guide
08	Project Model Demonstration
09	Expert Talk on Research Paper Writing
10	Paper writing
11	Paper writing and Plagiarism checking
12	Phase-2 PPT preparation and Report (Chapter: All Chapters)
13	Verification and Printing (Hard binding of report)
14	Phase -2 presentation

REVA UNIVERSITY

Project Diary

Group No.	

Project Title

Project Phase:

	PHASE I	SEM VII
	PHASE II	SEM VIII

Academic Year	

School of Electronics and Communication Engineering

REVA University Bangalore

<u>PROJECT GROUP MEMBER DETAILS:</u>

Sr. No.	Roll No.	Name	Mobile No.	Sign
MEMBER 1				
MEMBER 2				
MEMBER 3				
MEMBER 4				

Supervisor: ______________________________

(Sign with Date)

TABLE OF CONTENTS

LIST OF BASE & REFERENCE PAPERS

Sr. No.	Paper Title	Name of Author	Month And Year of Publication
01			
02			
03			
04			
05			

REV:0	PROJECT WEEKLY MONITORING SHEET - WEEK 1	PRO-05

STATUS	
TO DO	

Monitoring Process Criteria:

Sr. No.	Grading Criteria	Max Marks	Member1	Member2	Member3	Member4
1.	Timely Completion	2				
2.	Involvement & Coordination	2				
3.	Level of Understanding	2				
4.	Proof of Work Done	2				
5.	Attendance (Member Sign)	2				
	Weekly Score	10				
	Supervisor (Sign)	1``				

Note : Final Cumulative Weekly score will be added in the Presentation ONE Evaluation Sheet.

REV:0

PROJECT PRESENTATION-ONE EVALUATION SHEET

PRO-06A

Sr. No.	Cumulative Weekly Score	Presentation Skills of Member	Quality of Presentation or Demonstration	Total Score (Max out of 30)	
	(10)	(10)	(5)	(25)	(50)
Member 1					
Member 2					
Member 3					
Member 4					

Note :

1. Cumulative Weekly score out of 10 will be added from previous Weekly Monitoring Sheets.

Improvement Remark :

____

PROJECT GUIDE **Director**

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Yelahanka, Bengaluru - 560 064
Karnataka, India.

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