NAAC GRADE A+
ACCREDITED UNIVERSITY

REVA UNIVERSITY
Bengaluru, India

HANDBOOK

B. Tech.

Academic Year 2024-25

RUKMINI EDUCATIONAL
Charitable Trust

www.reva.edu.in

Chancellor's Message

"Education is the most powerful weaponwhich you can use to change the world."

- Nelson Mandela.

At REVA University, we are firm believers in this truth.
The power of education lies not only in the acquisition of knowledge but in its ability to transform lives, communities, and nations. As the world rapidly evolves, driven by technological advancements and global interconnectedness, education remains the catalyst for progress, innovation, and positive change.

Today, we live in an era where knowledge is no longer confined to books or classrooms. Information is accessible at the touch of a button, and opportunities forlearning abound in every corner of the world. Yet, the true essence of education lies beyond the mere accumulation of information. It is about cultivating critical thinking, fostering creativity, and empowering individuals to contribute meaningfully tosociety. At REVA University, we are committed to nurturing seekers of knowledge who aspire to make a difference in the world.

Guided by our founding philosophy of "Knowledge is Power," we strive to create an environment where intellectual curiosity is encouraged, and dreams are transformed into reality. India is a land of immense talent and potential, and it is our duty as educators to provide the spark that ignites this potential. Through the transformative power of education, we aim to shape future leaders who possess not only technical proficiency but also strong ethical values and a commitment to social responsibility.

A university is more than just a place of learning; it is a place of growth, exploration, and transformation. Our faculty, with their expertise and dedication, are at the heart ofthis transformation. They are more than teachers; they are mentors who guide students on their journey of self-discovery and academic excellence. Our student-centric, transformational approach ensures that every learner is given the opportunity to explore their full potential and exceed their own expectations.

At REVA University, we take great pride in our state-of-the-art infrastructure and facilities, designed to provide an inspiring and conducive environment for both academic and extracurricular pursuits. Our campus is a vibrant space where students are encouraged to challenge their minds, develop their skills, and grow as individuals.

As we move forward, I am reminded of the words of Benjamin Disraeli: "A university should be a place of light, of liberty, and of learning." This vision continues to inspire us at REVA University, where we work as a team to create a brighter future for our students and our society.

I invite you to join us on this journey of enlightenment, growth, and transformation. Together, let us lay the foundation for a future built on values, wisdom, and knowledge.

Dr. P. Shyama Raju

Chancellor REVA

University

Pro Chancellor's Message

REVA University has emerged as a premier destination for higher education across diverse fields such as engineering, science, commerce, management, architecture, law, arts, and humanities. Our commitment to excellence in education is reinforced by the adoption of cutting-edge technologies and innovative teaching methods thatensure our students are equipped for the future.

The integration of modern tools and ICT-based technologies is at the core of our academic philosophy. We focus on digital learning, project-based learning, and personalized learning experiences that cater to individual student needs. By harnessing the power of advanced technologies such as AI-powered learning platforms, data analytics, and virtual/augmented reality, we are able to offer dynamic, interactive educational experiences that transcend traditional classroom boundaries. This technological transformation enables us to deliver STEM education more effectively while providing our faculty with ongoing professional developmentto stay at the forefront of teaching innovations.

Our programs are meticulously designed after a thorough analysis of current industry needs and trends, with a focus on knowledge assimilation, practical application, and global employability. We recognize the importance of preparing students not just for today's job market but for a rapidly changing future where automation, artificial intelligence, and data-driven decision-making will play pivotal roles. To meet these demands, we emphasize hands-on learning, skill development, and innovation, ensuring that our students are well-prepared to thrive in their respective fields.

At REVA University, we have implemented the Choice Based Credit System and Continuous Assessment Grading Pattern (CBCS – CAGP) in all our programs. This system provides students with the flexibility to choose subjects that align with their interests while developing essential skills. CBCS courses integrate knowledge on local, regional, national, and global issues, fostering a comprehensive understanding of the world and enabling students to become entrepreneurial and employable in a competitive global marketplace. Furthermore, students are offered a variety of value-added courses to enhance their skillsets, ensuring they are equipped to navigate the evolving demands of their chosen careers.

The future of the engineering profession, and indeed many other fields, will beshaped by dramatic technological and societal changes. The rise of automation, sustainability concerns, and increased globalization will create both opportunities and challenges for the next generation of professionals. REVA University is fully prepared to meet these challenges head-on. Through state-of-the-art laboratories, research centers, and partnerships with premier industries and academicinstitutions, we are committed to creating talented professionals and leaders who can navigate these future transformations.

Our growth and success have been built on a foundation of excellence in curriculum design, student-centric teaching methods, and hands-on learning practices. I extend my gratitude to our students, parents, faculty, staff, and well-wishers for their contributions in helping REVA University become a next-generation, globally recognized education hub.

Mr. Umesh S. Raju

Pro Chancellor

REVA University

Vice Chancellor's Message

The last two decades have seen remarkable growth in higher education in India and across the globe. The move towards interdisciplinary studies and interactive learning has opened up 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 young human resources on the foundation of ethical and moral values while boosting their leadership qualities, research culture and innovative skills.

Built over 50 acres of green campus, this 'temple of learning' has excellent and state-of-the-art infrastructure facilities conducive to a higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programmes are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of a student-centric learning environment through innovative pedagogy, form the backbone of the University. All the programmes 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. Benchmarked 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 - a large number of faculty members, experts from industries and research-level organizations.

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 STI HUB, ISRO, 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 commitment to providing premium quality education accessible to all and an environment for the growth of overall personality development leading to generating "GLOBAL PROFESSIONALS".

Dr. N. Ramesh
Vice Chancellor (I/C), REVA University

Rukmini Educational Charitable Trust

In October 2005, the long-standing dream of Smt. Rukmini Shyama Raju to educate the youth became a reality with the establishment of Rukmini Educational Charitable Trust (RECT). The RECT is a Charitable Trust to promote, establish, and conduct developmental activities in the fields of Arts, Commerce, Engineering, Environmental Science, Management, Science & Technology, Law, Architecture, Performing Arts, and others.

To meet this aim, the Trust has set up the REVA Group of Educational Institutions comprising REVA Institute of Technology and Management, REVA Institute of Science and Management, REVA Institute of Management Studies, REVA Institute of Education, REVA First Grade College, REVA Independent PU College Kattigenahalli, REVA Independent PU College-Ganganagar, and REVA Independent PU College Sanjaynagar, and REVA University. Through these institutions, the Trust seeks to fulfil its vision of providing world-class education and creating abundant opportunities for the youth to excel in academics.

Every great human enterprise is powered by the vision of extraordinary individuals and is sustained by the people who derive their motivation from the founders. Dr. P. Shyama Raju, the Chairman of the Trust, is a developer and builder of repute, a captain of the industry in his own right, and the Chairman & Managing Director of the DivyaSree Group of companies. The other trustees are Shri Bhaskar N Raju, and Smt Arathi B. Raju, Shri. Umesh. S. Raju and Smt. Tanisha U. Raju.

The Rukmini Educational Charitable Trust is driven by the purpose of nurturing students who are in pursuit of quality education and excellence. REVA, today, is a family of 10 institutions providing education from pre-university to post-graduation and providing research and resource support to PhD degree aspirants.

About REVA University

REVA University is a State Private University established in Karnataka State under the Government of Karnataka Act No. 13 in the year 2012 in Bengaluru, the IT capital of India. REVA University, recognized by the University Grants Commission (UGC) and approved by the All India Council for Technical Education (AICTE), has an A+ grade from NAAC. The University has a sprawling green campus spread over 43 acres of land.

The University has a DIAMOND Band ranking from QS I Gauge. As per QS Asian UniversityRankings, it is ranked 47th among all the private Universities of India and 6th among allprivate universities of Karnataka. In less than a decade, REVA University, Bengaluru, hasestablished itself as a Global University in education by earning recognition as a forward-thinking institution across all disciplines.

The University currently offers 38 full-time undergraduate Programmes, 33 full-time postgraduate programmes, 20 Ph.D. programmes, and certification and diploma programmes. The University offers programmes under the faculty of Engineering, Architecture, Science and Technology, Commerce, Management Studies, Law, Arts & Humanities, and Performing Arts & Indic Studies. REVA offers some of the trending fields of study as undergraduate courses in Sports Science (B. Sc.), Agricultural Engineering (B. Tech), and Aerospace Engineering (B. Tech) which are full-time application-based programmes with a unique blend of theory and practical components.

With state-of-the-art infrastructure, the University has created a vibrant academic environment conducive to higher learning and research. This includes 200 smart classrooms that support blended learning, real-industry-like labs that foster on-the-job learning in students, a tech-enabled library with over 1 lakh collections of books, and most importantly, modern pedagogy. REVA currently has numerous students on campus from around the country. The campus has exclusive Halls of Residence which provides comfortable accommodation for boys and girls, apart from catering to the needs of all cuisine and ensuring adequate amenities are provided to make their stay an extended home.

In its mission to become a social impact university, REVA University has initiated several Corporate Social Responsibility initiatives. Jagruti, Abhivriddhi, Vanamahotsava, Education on Wheels, and Pragna are a few of the several projects in REVA. REVA has now moved on to become a Social Impact University and has aligned with the United Nations Sustainable Development Goals. Through these initiatives, REVA aspires to become an innovative University by developing a social connection with leadership qualities, ethical and moral values, research culture, and innovative skills through higher education of global standards.

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 andextension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement inthrust 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

REVA UNIVERSITY

Bengaluru, India

Rukmini Knowledge Park, Kattigenahalli
Yelahanka, Bengaluru - 560 064 Karnataka,
India.

Ph: +91- 90211 90211, +91 80 4696 6966
E-mail: admissions@reva.edu.in


@revauniversity


@revauniversity


@revauniversity


/@revauniversity_official


@revauniversity


@revauniversity


+918046966966

REVA UNIVERSITY
Bengaluru, India

ACADEMIC REGULATIONS

B.Tech., (4years) Degree Programs
(Applicable for the programs offered from 2023-27)

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

THESE ACADEMIC REGULATIONS ARE UNDER CHOICE BASED CREDIT SYSTEM AND CONTINUOUS ASSESSMENT GRADING PATTERN (CBCS-CAGP)

1. Title and Commencement:

1.1 These Regulations shall be called **"REVA University Academic Regulations – B. Tech., Degree Program for the batch of students admitted for AY 2023-24 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 for the admitted batch during AY 2023-24 under respective schools.

SL No.	Name of the School	Name of the Program
1	School of Civil Engineering	BTech in Civil Engineering BTech in Agriculture Engineering
2	School of Computing and Information Technology	BTech Computer Science and Engineering (AI and ML)
		BTech in Computer Science and Information Technology
		BTech in Information Science and Engineering
		BTech in Computer Science and Systems Engineering
3	School of Computer Science and Engineering	BTech in Computer Science and Engineering
		BTech in Computer Science and Engineering(AI and DS)
		BTech in Computer Science and Engineering (IoT, Cyber security and Blockchain)
4	School of Electrical and Electronics Engineering	BTech in Electrical and Electronics Engineering
5	School of Electronics and Communication Engineering	BTech in Electronics and Communication Engineer
		BTech in Electronics and Computer Engineering
		BTech in Robotics and Automation
6	School of Mechanical Engineering	BTech in Mechanical Engineering
		BTech in Mechatronics Engineering
		B Tech in Aerospace 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 has to 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 and project, listed under a program; 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,T and P, where,

L stands for **Lecture** session consisting of class room 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 such as laboratory experiments, field studies, case studies, project based learning or course endprojectsandself-studycoursesthatequipstudentstoacquiretherequiredskillcomponent.

4.2 Classification of Courses

Courses offered are classified as follows:

4.2.1 **Foundation Course (FC):**The foundation Course is basic course which should be completed successfully as apart of graduate degree program irrespective of the program of study.

4.2.2 **Professional Core Course (also known as Hard Core (HC) Course):** The **Professional Core** 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.

4.2.3 Professional Elective Course (also known as Soft Core (SC) Course): Professional Elective course 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.

4.2.4 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.

4.2.5 Audit Course (also known as Non-Credit Course / Mandatory Course (MC)): These courses are mandatory for students joining B.Tech. Program and students have to successfully complete these courses before the completion of degree.

4.2.6 Project Work / Dissertation: Project work / Dissertation work is a special course involving application of knowledge in solving / analyzing / exploring a real life situation / difficult problems to solve a multivariable or complex engineering problems. The project will be conducted in two phases, Phase-I, consists of literature survey, problem identification, formulation and methodology. In Phase-II, students should complete the project work by designing or creating an innovative process or development of product as an outcome. A project work is carried out as minor project in 3rd year and major project in 4th year with appropriate credits allocated.

4.2.7 Skill Development Course (SDC): It is a practice-based course introduced in first year, second year, and third year that lead to advanced job skills as per current industry/societal requirements to enhance high employability index of graduates. It may also lead to a certificate, diploma, and advanced diploma, etc.

4.3 "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 BTech Program of 4years(8Semesters) 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)	3 Years (6 Semesters)	A. Passed Minimum THREE years/TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in ANY branch of Engineering and 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. F. Passed D. Voc. Stream in the same or allied sector. (The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the program
3	Bachelor of Technology (B Tech)		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 fulfills the University requirements.

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, CIA and the remaining 4 weeks for SEE, evaluation, and result declaration.

6.3 The credit hours defined as below:

In terms of credits, L refers to lecture hour (theory) credit per week, that indicate every one hour lecture per week of L amounts to 1 credit per Semester; T and P refer to tutorial hours and practice hours credit per week, that indicate every two hours of T and P per week amounts to 1 credit per Semester or a three hour session of T / P amounts to 2 credits per 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	2	6	0:0:3	3	6
4	0	0	4:0:0	4	4
2	0	0	2:0:0	2	2

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

7. Different Courses of Study:

Different **Courses of Study** are labeled as follows:

a. Foundation Course (FC)

b. Professional Core Course (Hard Core (HC))

c. Professional Elective Course (Soft Core (SC))

d. Open Elective Course (OE)

e. Skill Development Course (SDC)

f. Audit Course (Non-credit Course/Mandatory Course) (MC)

g. Project Work / Dissertation: A project work is carried out as minor project in 3rd year and major project in 4th year with appropriate credits allocated. These are defined under Section 4.2.6 of this regulation.

8. Credits and Credit Distribution

8.1 A candidate has to earn 168 credits for successful completion of B Tech degree with the distribution of credits for different courses with the credit distribution given in the scheme of study.

8.2 The concerned BOS based on the credits distribution shall prescribe the credits to various types of courses listed in section 4.2 and shall assign title to every course the Reon.

8.3 Every course including project work, practical work, fieldwork, self-study elective should be entitled as per the list declared in section 4.2. However, as per AICTE, the credit distribution for various category of courses is given below in the table.

Sl. No.	Course Category	Abbreviation (AICTE)	Abbreviation (REVA)	Suggested breakup of credits (AICTE)	Credit break up (REVA)
1	Humanities and Social Sciences including Management courses (HSMC)	HSMC	FC	12	2
2	Basic Science Courses	BSC	FC	25	15
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	ESC	FC	24	19
4	Professional core courses	PCC	HC	48	86
5	Professional Elective courses relevant to chosen specialization/branch	PEC	SC	18	21
6	Open subjects – Electives from other technical and /or emerging subjects	OE	OE	18	-
7	Project work, seminar and internship in industry or elsewhere	PROJ	HC	15	10
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]	MC (3)	MC (3)	-	
9	Skill Development Courses (SDC)	-	SDC		15
TOTAL CREDITS				160	168

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. A candidate can enroll for a maximum of 26 credits and a minimum of 16 credits per Semester. However, he/she may not successfully earn a maximum of 26 credits per semester. This maximum of 26 credits does not include the credits of courses carried forward by a candidate.

8.5 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 168 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.

8.6 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 to168creditsforthe BTech Degree program**.**

8.6.1 Addon 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 18extra credits either in the same discipline /subject or in different discipline/subject in excess to168 credits for the BTech 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. Continuous Internal Assessment(CIA);and
ii. Semester End Examination(SEE)

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

9.3 The50marks of CIA shall comprise of:

Internal Assessment Test	40marks
Assignments/Seminars/Model Making/Integrated Lab /Project Based Learning/Quizzes ,etc.	10marks

9.4 There shall be two Internal Assessment Tests are conducted as per the schedule Announced below. The Students' shall attend both the Tests compulsorily.

- 1st test is conducted for 20 marks during **8th week** of the Semester;
- 2nd test is conducted for 20 marks during **15th week** of the Semester.

The coverage of syllabus for the said tests shall be asunder:

- Question paper of the **1st test should be based on first 50% of the total syllabus (Unit 1& 2)**;
- Question paper of the **2nd test should be based on remaining 50 % of the total syllabus (Unit 3 &4)**;
- An assignment must be designed to cover the entire syllabus

9.5 There shall be two Assignments/Project Based Learning/Field Visit/Quiz test carrying 10 marks covering the entire syllabus.

9.6 SEE for 50 marks practical exam shall be held in the 16^{th} and 17^{th} week of the semester.

9.7 SEE for 50 marks theory exam shall be held during $18^{th}19^{th}$ and 20^{th} week of the semester and it should cover entire syllabus.

9.8 Internal test paper is set for a maximum of 40 marks to be answered in 1.5 hours duration (for 1credit course, exam is conducted for 25 marks with a duration of 1 hour). A test paper can have 5main questions. Each main question is set for 10 marks. The main question can have 2-3 sub questions all totaling 10 marks. Students are required to answer any 4 main questions. Each question is set using Bloom's action 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 (internal BoE members) to bring the quality and uniformity in the question paper.

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 plagiarize the answer from web or any other resources. 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 also self-study.

9.12 Internal assessment marks must be decided well before the commencement of SEE.

9.13 SEE theory question 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 to 4 sub-questions. A total of 8 questions are set so that students will have a choice. Each question is setusingBloom'sactionverbs.Thequestionsmustbesettoassessthestudentsoutcomesdescribedinthe course document (question paper shave to be set to test the course outcomes).

9.14 There shall be minimum three sets of question papers for the semester end examination, of which one set along with scheme of examinations shall be set by the external examiners and two sets along with scheme of examinations shall be set by the internal examiners. All the question papers set shall be scrutinized by the Board of Examiners (BoE). It shall be responsibility of the BOE 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.

9.15 There shall be single evaluation by the examiners for each paper. However, there shall be moderation by one of the senior examiners, either internal or external.

9.16 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.

9.17 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.

9.18 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.

9.19 During unforeseen situations 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.

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

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

9.22 Online courses maybe offered asper UGC norms.
For online course assessment guidelines would be as follows:

a. 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.

b. 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.

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

9.23 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

9.24 **Summary of Internal Assessment, Semester End Examination and Evaluation** Schedule is provided in the table given below (for theory courses having Credits>=2).

Summary of Internal Assessment and Evaluation Schedule

Sl. No.	Type of Assessment	When	Syllabus Covered	Max Marks	Scaled down to	Date by which the Process must be completed
1	Test-1	During 8th week	First50%	40	20	9th week
2	Test-2	During 15th Week	Remaining50 %	40	20	16th Week
3	Assignment 1/Quiz- 1	Every weektillTes t-1	First50%	10	05	9th Week
4	Assignment2/ Quiz-2	Every week during Test-1andTest-2	Remaining50 %	10	05	16th Week
5	SEE	18th to20th W eek	100%	100	50	20th Week

Summary of Internal Assessment, Semester End Examination and Evaluation Schedule is provided in the table given below(for theory courses having Credit 1).

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 8th week	First50%	25	12.5	8th week
2	Test-2	During 15th Week	Remaining50%	25	12.5	15th Week
5	SEE	18th to 20th Week	100%	50	25	20th Week

9.25 Assessment of Students Performance in Practical Courses

Lab courses are of two types: integrated labs and separate labs.

The performance in the practice tasks/experiments shall be assessed on the basis of:

a. Knowledge of relevant processes;

b. Skills and operations involved;

Results/products including calculation and reporting.

9.26 Assessment of lab courses

10.1.1 Assessment of Separate lab course

The 50marks of CIA is based on the performance of students in each lab experiment for a lab course that shall further be allocated asunder:

i	Conduction of regular practical/experiments throughout the semester	20marks
ii	Maintenance of lab records	10marks
iii	Performance of internal lab test to be conducted after completion of all the experiments before last working day of the semester	20marks
	Total	**50marks**

9.27 Assessment of integrated lab course

The 10 marks meant for CIA is based on the performance of students in each lab experiment for integrated lab course that shall further be allocated as under. Integrated lab is evaluated and awarded marks meet the requirement of assignment/quiz/field work component of respective theory course having integrated lab component. No separate assignment/quiz/field work is assessed for such courses.

i	Conduction of regular practical/experiments throughout the semester	05marks
ii	Maintenance of lab records and performance of internal lab test to be conducted after completion of all the experiments before last working day of the semester	05marks
	Total	**10marks**

9.26 The 50 marks meant for SEE incase of separate lab course shall be allocated asunder:

i	Conduction of practical(experiment)	30marks
ii	Write up about the experiment/tabulation/results/inference	10marks
iii	Viva Voce	10marks
	Total	**50marks**

Note: No Separate SEE for integrated lab course

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

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

For >=2creditcourses

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

For 1 credit courses

i	IA (Performance of internal test to be conducted after completion of entire syllabus)	25marks
iii	Semester end examination by the concern schoolboard (demo, test, viva voice etc.)	25marks
	Total	**50marks**

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

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also 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 has to submit final report of the project/dissertation, as the case may be, 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. Evaluation of mandatory courses: Students should maintain minimum of 75% attendance to appear for SEE of Mandatory course. The SEE should be conducted in MCQ pattern and students should get minimum pass grade to obtain the degree. There is no internal assessment

13. Evaluation of **Skill Development Courses:** The concerned BoS shall recommend to conduct test/demo/viva-voce/MCQ to test the student knowledge.

14. **Requirements to Pass a Course:**
A candidate's performance from CIA and SEE will be in terms of scores, and the sum of CIA and SEE scores will be for a maximum of 100 marks (CIA = 50, SEE = 50) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 30% (15 marks) out of 50 marks in SEE, which is compulsory.

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

Marks, P	**Grade, G**	**Grade Point (GP=VxG)**	**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 scored in each course by the student (P = marks scored {CIA(50) + SEE(50)}) 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) = $\sum$(Ci x Gi) / $\sum$Ci where Ci is the number of credits of the i^{st} course and Gi is the grade point scored by the student in the I^{st} course.

Illustration for Computation of SGPA and CGPA

IllustrationNo.1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course1	3	A+	9	3X9=27
Course2	3	A	8	3X8=24
Course3	3	B+	7	3X7=21
Course4	4	O	10	4X10=40
Course5	1	C	5	1X5=5
Course6	2	B	6	2X6=12
Course7	3	O	10	3X10=30
	19			159

Thus, **SGPA=159 ÷19 =8.37**

IllustrationNo.2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course1	4	A	8	4X8=32
Course2	4	B+	7	4X7=28
Course3	3	A+	9	3X9=27
Course4	3	B+	7	3X7=21
Course5	3	B	6	3X6=18
Course6	3	C	5	3X5=15
Course7	2	B+	7	2X7=21
Course8	2	O	10	2X10=20
	24			175

Thus, SGPA=175÷24=7.29

IllustrationNo.3

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade point)
Course1	4	O	10	4 x 10 = 40
Course2	4	A+	9	4 x9= 36
Course3	3	B+	7	3 x7= 21
Course4	3	B	6	3 x6 =18
Course5	3	A+	9	3 x9= 27
Course6	3	B+	7	3 x7= 21
Course7	2	A+	9	2 x9= 18
Course8	2	A+	9	2 x9= 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 (168) for B. Tech degree in Engineering & Technology is calculated taking into account all the courses under gone by a student over all the semester so far program ,i.e.: **CGPA =∑(CixSi)/∑Ci**

Where S is the SGP A of the semester and C is the total number of credits in that semester.

Illustration:

CGPA after Final Semester

Semester(i^{th})	No. of Credits (Ci)	SGPA (Si)	Credits SGPA(CiXS)
1	21	6.83	21 x6.83=143.43
2	23	7.29	23 x7.29=167.67
3	22	8.11	22 x8.11=178.42
4	24	7.40	24 x7.40=177.6
5	22	8.29	22 x8.29=182.38
6	24	8.58	24 x8.58=205.92
7	22	9.12	22 x9.12=200.64
8	10	9.25	10x9.25=92.50
Cumulative	**168**		**1348.56**

Thus,

$$CGPA=\frac{21\times6.83+23\times7.29+22\times8.11+24\times7.40+22\times8.29+24\times8.58+22\times9.12+10\times9.25\_1346.58}{168}=\frac{8.02}{168}$$

c. Conversion of grades in to percentage:

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored=CGPA Earnedx10

Illustration: CGPA Earned 8.02x 10=80.2

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

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)	Letter Grade	Performance	FGP
	G			Qualitative Index
9>=CGPA10	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
> 5CGPA <5.5	5.5	C+	Average	
> 4CGPA <5	5	C	Satisfactory	Pass
<4CGPA	0	F	Unsatisfactory	Unsuccessful

Over all percentage=10*CGPA

e. **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).**

f. **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.

14.2 Attendance Requirement

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

14.2.2. Student has to maintain a minimum attendance of 70% in each course (Theory and Practical) and 75% attendance in aggregate of all courses in a semester, with a provision of condonation of 10% of the attendance by the Vice-Chancellor on the specific recommendation of the Directorate School.

14.2.3. 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 sand such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of65% of the classes taught.

14.2.4. Any student with less than 70% of attendance in individual courses of respective semester including practical courses / field visits etc., shall not be permitted to appear to SEE in the respective course.

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.

17.1 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-Off cochairman/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.

17. 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., and 70% attendance in each courses shall be eligible to appear for Semester End Examination

18. Provision for Supplementary Examination

a. In case a candidate fails to secure a minimum of 30% marks out of 50 (15 marks) in Semester End Examination (SEE) and a minimum of 40% marks (out of 100) together with IA and SEE to declare pass in the course, such candidates shall seek supplementary examination of only such course(s) where in 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 a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

b. A student failed in any course is eligible to take supplementary exam under following category for each course: either to improve internal marks (IA1, IA2, and Assignment/Quiz), or to improve SEE.

c. Supplementary exam is permitted only during summer vacation (between even and odd semester break).

d. Eligibility to register for supplementary exam is that the students should have maintained pre-requisite attendance of ≥75% in respective semester.

e. No separate additional classes would be conducted for the students availing this facility.

f. Every student should pay the supplementary exam fee for each course as prescribed by the university.

19 Provision to Carry Forward the Failed Subjects/Courses:

Students who have failed in courses totaling 16 credits or fewer across both odd and even semesters combined will be allowed to proceed to the next semester of the following year(s) of their academic program.

For vertical progression, students have to clear all the courses of first year to be eligible to take admission to third year and they have to clear all the courses till second year to be eligible to take admission to fourth year. For lateral entry students, students have to clear all the courses of second year to be eligible to take admission to fourth year.

Case 1: A student who has failed in a maximum of 16 credits in 1st and 2nd semester together shall move to the 3rd semester of the succeeding year.

Case 2: A student who has failed in a maximum of 16 credits from semester 1 to 4 together shall move to the 5th semester of the succeeding year only if he/she successfully completes all the courses of first and second semester.

Case 3: A student who has failed in a maximum of 16 credits from semester 3 to 6 together shall move to the 7th semester of the succeeding year only if he/she successfully completes all the courses of third and Fourth semester.

19. Re-evaluation of Answer Scripts and Announcement of Re-evaluation Results

After declaration of the results of programs within next 10 days, if any candidate wishes to apply for Photocopy/Revaluation (only theory courses), s/he shall apply to the Controller of Examinations, by paying the prescribed fees notified by the University from time to time. The photocopies of the said answer books shall be made available within next TEN working days after the last date prescribed for receipt of the application at the Office of the Controller of Examinations. Photocopies will not be issued for practical/drawing/audit courses.

20. Results of Re-Evaluation will be announced within TWENTY working days (except for third evaluation).

21. With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

22. 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.

23. For lateral entry students, the minimum credits to be earned for the award of the degree would be the credits earned in 3 years from 2nd year to 4th year.

RATIONALE OF THE DEPARTMENT OF AGRICULTURAL ENGINEERING

Agricultural Engineering, program is also referred as Biological Engineering, as it covers multi-disciplinary subjects such as crops production, farm mechanization, food processing, soil and water conservation, micro-irrigation, renewable energy, and climate control.

Agriculture Engineering program, is one of the growing branches of engineering that deals with the designing new agriculture processes, systems and construction machinery used for agriculture and agricultural operations. In other words, we can say that this sub-field of engineering is a fusion of technology and agriculture. It includes deep knowledge of agricultural activities, alternatives for farming, food production, food processes, and food marketing. It also combines other related areas such as plant biology, animal biology, civil engineering, mechanical engineering, and chemical engineering.

India is a leading agriculture-based country in the world hence, the agriculture sector and its related industries have always been in high demand. To bring technical advancement and development in the agriculture sector, agriculture engineers and professionals are in high demand. To fulfill the demand of agriculture engineers, many higher educational institutions in India and across the world offer agriculture and farm engineering courses.

Some of the specific engineering-centered goals and targets set for the agricultural sector to drive technological advancements and achieve sustainable development by the Government of India include:

1. Doubling Farmers Income.
2. Increase in Farm Mechanization
3. Water Use Efficiency
4. Soil Health Management
5. Crop Diversification and High-Value Agriculture
6. Post-Harvest Infrastructure and Technology
7. Technology Transfer and Capacity Building
8. Sustainable Agriculture and Environmental Conservation.

Fulfilling to these ambitious goals and targets the state has envisioned In converting 5.0 lakh ha. under zero tillage, increasing farm mechanization rate to 50%, establishing 50 agri-business incubation centers, 100% mechanization in paddy cultivation, 80% mechanization in all crops, 10.0 L ha. in micro-irrigation and reducing post-harvest losses to 15%.

The bachelor of technology degree in agricultural engineering provides a technical focus on applying advancements in engineering technology to an agricultural and environmentally challenged society. Agriculture engineers find better ways to reduce crop loss from field damage, during handling, sorting, packing and processing. The warehousing of food and fiber are an important part of the agriculture industry. The agricultural engineer is the person who plans the heating, cooling, ventilation, post-harvest handling, logistics and more. Precision farming is a necessity. Today all the ramifications of a high-tech society beckon us to apply new technologies with speed and accuracy.

To develop good understanding skills in student communities about Civil Engineering, ethical practices, automation design and society need centric teaching and learning and imparting value addition skills.

On completion of agricultural engineering program from an engineering institution in India are awarded degrees that open up a gateway to a world of lucrative career opportunities some of the popular career paths that a graduate can opt as career options are: agriculture engineer at the agro-based organizations, agriculture specialists, agriculture inspectors, agriculture crop engineers, farm shop managers and agriculture researchers, etc.

Vision

To create quality distinction in agricultural engineering education, research, and outreach for innovative sustainable agricultural development and livelihood security of farming community and stakeholders.

Mission

1. To educate and prepare the scholars as entrepreneurs and professionals to manage agricultural challenges for productive outcome.
2. To capacitate with the network analysis to discover and redefine new technologies from allied partners to formulate efficient system.

Program Overview

The agriculture engineering degree program is a comprehensive curriculum that focuses on enhancing agricultural, land, water, and human resources to improve crop yields. It is a multidisciplinary program that explores various aspects of agriculture, irrigation, and environmental sciences to conduct research in agricultural, horticultural, water, and environmental engineering. The program emphasizes providing extensive knowledge to support agricultural practices, optimize irrigation techniques, and conserve natural resources.

Students pursuing this degree will study subjects such as agricultural mechanization, soil and water conservation, crop production technology, agricultural machinery, irrigation systems, farm power and machinery, post-harvest technology, and environmental engineering. The coursework combines theoretical learning with practical applications, enabling students to gain hands-on experience in designing and developing innovative agricultural systems and machinery. Through a blend of theoretical knowledge and practical experience, students are prepared to contribute to the advancement of agricultural practices, enhance productivity, and address environmental concerns in the agricultural sector.

Upon graduation, students may pursue careers in areas such as agricultural research, farm machinery manufacturing, irrigation system design, agribusiness, and environmental consulting. The program aims to produces killed professionals who can innovate and implement sustainable solutions to promote food security and efficient resource utilization in agriculture.

Director’s Message

I am privileged to announce that the REVA University with its vision and commitment to the agricultural sector in ensuring food and nutritional security, has engaged to launch a maiden agricultural engineering program in its academic ambit. I am delighted to also announce that our Department of Agriculture Engineering has been recently introduced in its school of civil engineering with all the due competent academic validations and infrastructure. An undergraduate 4-year B. Tech Agricultural Engineering degree program covers a total of 167 credit hours including basic engineering and applied for agro-centric science courses. Academic norms and guidelines issued by the Agricultural Education Department of the Indian Council of Agricultural Sciences are widely adopted in the structuring and conduct of the program.

I would like to extend a warm welcome to every one of the students get enrolled in this newly emerging course. The future of the agrarian sector belongs to those who innovate and embrace technology which is the wisest pursuit to contribute the most to real wealth, culture, and happiness. The department is committed to engaging everyone in an innovatively inclusive approach and being distinct in generating new academic enthusiasm and ecosystem.

The department and the faculty team will focus on the opportunity to explore novel techniques to prioritize and fulfill the national and state priorities of increasing farm mechanization, micro-irrigation, and reducing post-harvest losses with data-driven applications that will shape the future of agriculture. The department will have a broad spectrum of disciplines such as soil and water engineering, farm machinery and power engineering, food process engineering, and renewable energy. Prevailing exclusive professional expertise in the REVA University Edu-system will be inclusively intervened in the program.

I hereby encourage everyone to actively participate in a wide range of Edu-interactions and discussions for our department's continued success. As we move forward, let us remain committed to our mission of revolutionizing agricultural engineering, I appeal to all concerned to stand with us to overcome initial challenges and look forward to celebrating our achievements on new and exciting endeavors together.

Dr. Bhavana

Director, School of Civil Engineering,

REVA University

Program Educational Objectives(PEOs)

PEO1: Develop a diverse capability to work with agriculture equipment's and implement manufacturing industries, seed processing industries, irrigation and drainage companies, and also to run self- entrepreneurship like dairy farming and custom hiring centres.

PEO2: Take up higher studies in reputed institutes and motivate towards innovative research by applying their skills in Agriculture water management, farm machinery and power, processing, and energy management systems in agriculture.

PEO3: Understand the issues of ethics, safety, professionalism, cultural diversity, globalization, environmental impact, and responsibility for serving society and the environmental issues.

Program Outcomes(POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, and engineering fundamentals for the solution of complex problems.

PO-2: Problem analysis: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using the 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 public health and safety, and 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 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 team work: 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 and 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.

Program Specific Outcomes (PSOs)

PSO 1: The graduates will be proficient with multi-disciplines will excel in with skills and technologies application in core areas of farm mechanization, food processing, soil and water conservation, micro-irrigation and renewable energy aligning with the productive utilization of natural resources.

PSO2: The graduates are capacitated with sound knowledge in the emerging trends such as IT, IoT, ICT and others to enable to apply in robotics, automation and smart farming systems to achieve higher crop productivity.

PSO 3: The graduates will be empowered to manage the state and national priorities and targets of Agri-sector in improving farm mechanization, micro irrigation, reducing post-harvest losses and value addition practices.

DEPT. OF AGRICULTURE ENGINEERING
SCHEME OF INSTRUCTIONS (2023-2027 BATCH)
B. Tech in AGRICULTURE ENGINEERING

I SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/ OE/ MC/SDC	Credit Pattern				Contact Hours/Week	Examination			Course category(As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23AS0110	Calculus and Linear Algebra	FC	3	0	0	3	4	50	50	100	BSC
2	B23AS0111	Applied Physics	FC	2	0	0	2	2	50	50	100	BSC
3	B23EU0101	Surveying and Levelling-I	FC	2	0	1	3	4	50	50	100	PCC
4	B23EU0102	Engineering Properties of Biological Materials	HC	2	0	1	3	4	50	50	100	PCC
5	B23EE0103	Basics of Electrical and Electronics Engineering	FC	2	0	0	2	2	50	50	100	ESC
6	B22EE0104	Basics of Electrical and Electronics Engineering Lab	FC	0	0	1	1	2	25	25	50	ESC
7	B23CI0108	Programming with C	FC	0	0	1	1	2	25	25	50	ESC
8	B23ME0104	Engineering Workshop	FC	0	0	2	2	4	50	50	100	ESC
9	B23AS0112	Applied Physics Lab	FC	0	0	1	1	2	25	25	50	BSC
10	B23EU0103	Agri-Allied Skills and Technology	FC	0	0	1	1	2	25	25	50	HSMC
TOTAL				**11**	**0**	**8**	**19**	**28**	**400**	**400**	**800**	
TOTAL SEMESTER CREDITS				**19**								
TOTAL CUMULATIVE CREDITS				**19**								
TOTAL CONTACT HOURS				**28**								
TOTAL MARKS				**800**								

REVA UNIVERSITY
Bengaluru, India

Detailed Syllabus
Semester-I
COURSE PACK FOR AGRICULTURAL ENGINEERING

1. Course Details: Surveying and Levelling-I – (B23EU0101)

COURSE OVERVIEW

Surveying is a vital course within the agricultural engineering program that focuses on the principles and techniques of land measurement, mapping, and layout design specific to agricultural applications. This course aims to provide students with specialized knowledge in surveying practices relevant to agricultural engineering, enabling them to conduct accurate field surveys, establish reference points, and design agricultural structures and systems. Through a combination of theoretical knowledge and practical field exercises, students will develop the necessary skills to apply surveying principles in agricultural engineering projects and promote efficient land management practices.

COURSE OBJECTIVE

1. Students will develop skills in measuring and calculating areas, volumes, and distances related to agricultural land.
2. Students will learn to analyze and interpret survey data, and use geographic information system (GIS) software to create maps and generate visual representations of survey results.
3. Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data on plane figures.
4. Students will become familiar with different surveying instruments and their applications in agricultural engineering.
5. They will be able to accurately measure angles, determine directions, identify and correct errors, plot compass traverses, and use surveyor's and prismatic compasses effectively in agricultural engineering surveying projects
6. Comprehend the basic principles, concepts, and terminology of plane table surveying.

COURSE OUTCOMES (COs)

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

CO#	Course Outcome	POs	PSOs
CO1	**Introduce Surveying Fundamentals**: Understand basic principles, classifications, and surveyor duties.	1,2,3,4,5	1,2,3
CO2	**Familiarize with Instruments**: Learn linear measurement tools and their maintenance.	1,2,3,4,5	1,2,3
CO3	**Understand Chain Surveying**: Grasp the concept of chain surveying, triangulation, and selecting base lines, stations, and offsets.	1,2,3,4,5	1,2,3
CO4	**Master Compass Surveying Concepts**: Understand angular measurements, meridians, bearing systems, and error corrections in compass traversing.	1,2,3,4,5	1,2,3
CO5	**Develop Practical Compass Skills**: Learn to use and adjust Surveyor's and Prismatic compasses for accurate field surveys.	1,2,3,4,5	1,2,3
CO6	**Understand and Apply Plane Table Surveying**: Learn the principles, instruments, methods, and usage of minor instruments like clinometers, Abney levels, pantographs, and planimeters in surveying..	1,2,3,4,12	1,2,3

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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	PSO4
CO1	3	3	2	2										3	3	3
CO2	2	2	2	2										3	3	3
CO3	3	3	2	2										3	3	3
CO4	3	3	3	2										3	3	3
CO5	3	3	3	2										3	3	3
CO6	3	3	3	2										3	3	3

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

COURSE CONTENT THEORY

Course: Surveying and Levelling-I

Surveying and Levelling-I
UNIT-I
Surveying - Introduction, classification of surveying and Four main principles of surveying and work or duties of a surveyor (Field work, office work and Care and Maintenance of instruments). Linear measurements -measuring instruments, method of chaining, errors and mistakes in chaining, correction for linear measurement. Setting offsets by chord method and swinging methods.
UNIT-II
Chain surveying - Concept, triangulation, selection of base line,stations and offsets. Methods of ranging, obstacles in chaining and ranging. Calculation of field areas - regular shaped field's areas calculation and various approaches to find irregular field areas. Cross staff method – Problems of area calculations by cross staff method.
UNIT-III
Compass surveying - Concept, angular measurement, meridians, bearings - whole circle and quadrantal bearing systems, measurement of included angles and local attraction. Plotting of compass traverse and closing error in compass traverse. Errors in measurements - elimination and correction. Surveyor's compass and prismatic

compass differences and Adjustments of compass – permanent and temporary (centering, levelling and focusing). Use of Surveyor's and prismatic compass for survey.
UNIT-IV
Plane table surveying– Principles, instruments, advantages and disadvantages and traversing methods. Uses of minor instruments in surveying. Introduction and usage of minor instruments in surveying – Clinometers, Abney level, pantograph and Planimeter.
Text Books: 1. Punmia, B C 1987. Surveying (Vol.I). Laxmi Publications, New Delhi. 2. Arora K R 1990. Surveying (Vol.I), Standard Book House, Delhi. 3. Kanetkar T P 1993. Surveying and Levelling. Pune Vidyarthi Griha, Prakashan, Pune. Reference Books: 1. Rangwala 1991. Surveying and levelling. Charotar Publishing House Pvt. Ltd. Gujarat.

Surveying and Levelling Lab

Sl. No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Acquaintance with chain survey instruments	Chain, Tape, Ranging rod, Cross staff, Optical square, Offset rod, Arrow, Peg, Plumb bob and Offset rod (Instruments)	To know about various instruments used in chain and cross-staff survey.
2	Ranging and Measurement of Offsets	Instrumental	To learn about a ranging a line in the field. To learn about setting out exact offsets and measurement of offsets.
3	Obstacles in chaining	Instrumental	To conduct survey under various obstacles in the field.
4	Use of field book, Chain survey of given area and plotting	Instrumental	To learn about the use of filed book to enter details of field survey.

			To learn plotting procedure of survey work.
5	Calculations of field areas and field area measurements	Instrumental	To learn about simple calculations of land area by different methods.
6	Measurement of angles using prismatic and surveyor compasses	Instrumental	Conduction of Experiments
7	Compass traversing, closing errors and corrections	Instrumental	Conduction of Experiments
8	Plane table survey – Temporary adjustments and orientation.	Plane table	Conduction of Experiments
9	Plane table survey – Radiation, intersection and traversing methods	Instrumental	Conduction of Experiments
10	Digital planimeter for area measurement	Instrumental	Conduction of Experiments
11	Pantograph – For scale reduction and enlargement	Instrumental	Conduction of Experiments
12	Use of minor instruments – Abney level and Clinometer	Instrumental	Conduction of Experiments

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Course Title: Engineering properties of Biological materials (EP) (B23EU0102)

Course Details:

(a). Course description: Engineering Properties of Agricultural Produce is an essential course within the agricultural engineering program that focuses on understanding and analyzing the physical and mechanical properties of various agricultural produce. This course aims to provide students with specialized knowledge of the engineering properties of crops and post-harvest produce, enabling them to design efficient handling, processing, and storage systems for agricultural products. Through a combination of theoretical knowledge and practical applications, students will develop the necessary skills to assess, test, and optimize the handling and processing of agricultural produce, ensuring quality preservation and post-harvest management.

(b). Course contents:

COURSE OBJECTIVE

1. To acquaint and equip the students with different engineering properties applicable in food processing.
2. To study and understand the different measuring scales required for the Good Laboratory Practices.
3. To study basic principles, concepts, importance's and applications of engineering properties of biological materials.
4. Measure and analyze physical properties such as size, shape, color, and texture of different produce.
5. Comprehend basic electrical concepts, including voltage, current, resistance, and power.
6. Study the impact of wind on agricultural structures such as greenhouses, barns, and storage facilities.

COURSE OUTCOMES (COs)

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

CO#	Course Outcome	POs	PSOs

CO1	quaint and equip students with engineering properties relevant to food processing.	?,3,4,5	?,3
CO2	derstand measuring scales for Good Laboratory Practices.	?,3,4,5	?,3
CO3	dy principles, concepts, and applications of engineering properties of biological materials.	?,3,4,5	?,3
CO4	easure and analyze physical properties of various produce, including size, shape, color, and texture.	?,3,4,5	?,3
CO5	mprehend basic electrical concepts such as voltage, current, resistance, and power.	?,3,4,5	?,3
CO6	plore the impact of wind on agricultural structures like greenhouses, barns, and storage facilities.	?,3,4,5	?,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	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓

COURSE ARTICULATION MATRIX

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2										3	3	3
CO2	2	2	2	2										3	3	3
CO3	3	3	2	2										3	3	3
CO4	3	3	3	2										3	3	3
CO5	3	3	3	2										3	3	3
CO6	3	3	3	2										3	3	3

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

Theory syllabus

1.1 Engineering Properties of biological materials
UNIT-I
Physical properties: (10 Hrs) : Classification and importance of physical properties of

agricultural produce. Shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surface area, and moisture content of food grains, fruits and vegetables.
UNIT-II
Thermal properties: (10 Hrs) : Classification and importance of thermal properties of agricultural produce. Heat capacity, Specific heat, Thermal conductivity, Thermal diffusivity, Heat of respiration; Co-efficient of thermal expansion.
UNIT-III
Frictional properties: (10 Hrs) : Classification and importance of frictional properties of agricultural produce. Static friction, Kinetic friction, Rolling resistance, Angle of internal friction, Angle of repose, Flow of bulk granular materials.
UNIT-IV
Aero dynamic properties: (9 Hrs) : Classification and importance of aero dynamic and rheological properties of agricultural produce. Drag coefficients and terminal velocity. Force, Deformation, Stress, Strain, Elastic, Plastic and Viscous behavior, Newtonian and Non- newtonian liquid, Visco-elasticity, Newtonian and Non-newtonian fluid, Pseudo-plastic, Dilatant, Thixotropic, Rheopectic and Bingham plastic foods, and Flow curves.
UNIT-V
Electrical properties: Classification and importance of electrical properties of agricultural produce. Dielectric loss factor, Loss tangent, A.C. conductivity and Dielectric constant, Methods of determination. Application of engineering properties: Handling and harvesting of agricultural produce, Processing machines and storage structures.
Text Book: 1. Nuri N. Mohsenin, 1986, Physical properties of plant and animal materials: Structure, physical characteristics and mechanical properties. Second Revised and Updated Edition. Gordon and Breach Science Publishers, New York, United States of America. **Reference Books:** 2. K. M. Sahay and K. K. Singh., Unit operations agricultural processing, 2009, Second Revised Edition, Vikas Publishing House Pvt Ltd. Noida (UP). 3. Nuri N. Mohsenin, 1981, Thermal properties of foods and agricultural materials. Gordon and Breach Science Publishers, New York, United States of America.

1.2.1 Engineering Properties of Biological Materials Lab

SL. No.	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Determination of the shape and size of grains, fruits and vegetables	Vernier caliper and Screw gauge	Measurement skills and ability to read scale
2	Determination of bulk density of food grains, fruits and vegetables.	Platform scale method, Weighing balance	Understand the theory, principle and perform the

			experiment, collect the data and interpret the results
3	Determination of angle of repose of food grains.	Angle of repose measurement rig	Measurement skills and ability to read scale
4	Determination of the particle density/true density and porosity of solid grains	Gas Pycnometer with tolune and density bottle.	Collection of the data and interpret the results
5	Determination of and moisture content of food grains	Gravimetric method, Hot air oven, moisture boxes, and weighing balance.	Measurement skills and ability to calculate moisture content
6	Determination of surface area of food grains	Grap paper and Digital plani meter	Measurement skills and ability to messure surface area of different biological materials.
7	Determination of co-efficient of external and internal friction of food grains	Friction block with measuring weights	Understand the theory, principle and perform the experiment
8	Determination of terminal velocity of food grains	Vertical wind tunnel and Anemometer	Understand the theory, principle and perform the experiment
9	Thermal conductivity of different food grains	Conductivity probe	Understand the theory, principle and perform the experiment, collect the data and interpret the results
10	Determination of specific heat of some food grains	Bomb colorimeter or Differential Scanning colorimeter	Understand the theory, principle and perform the experiment, collect the data and interpret the results
11	Determination of hardness of food material	Hardness tester or textural analyzer	Understand the theory, principle and perform the experiment, collect the data and interpret the results
12	Determination of viscosity of liquid foods	Viscometer or Digital rheometer	Understand the theory, principle and perform the experiment, collect the data and interpret

			the results

COURSE PACK FOR : Basics of Electrical and Electronics Engineering – (B23EE0103)

Course Title	Basics of Electrical and Electronics Engineering				Course Type		Regular	
Course Code	B23EE0103	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	0	0	0	Theory	Practical	CIE	SEE
	Tutorial	0	-	-				
	Total	**2**	**2**	**2**	**28**	**0**	**50%**	**50%**

Course Overview

Basic Electrical & Electronics Engineering covers the fundamental concepts and principles of electrical and electronic principles. It serves as prerequisite to courses in electrical and electronics engineering and those domains where the electrical and electronics machines are employed. The topics include the introduction to AC and DC circuits with its configuration. The course also introduces to the concepts of electromagnetism and the working of electrical machines and transformers. Analog circuits and digital circuits are discussed understanding their properties with simple applications.

Course objectives

The objectives of the course are:

1. To understand circuit theory and associated laws and principles
2. To understand the working principle of electromagnetics and its application in electrical machines
3. To understand the fundamentals of semiconductor devices such as diodes and transistors
4. To analyze the working of semiconductor devices like diode and transistor and their applications in electronic circuits
5. To understand the fundamentals of digital logic levels, digital gates and to realize the logic circuits
6. To understand the fundamental principles of sensing and mechanisms by which sensors can detect physical quantities

Course outcomes

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

1. Demonstrate a clear understanding of basic electrical and electronics concepts,

principles, and terminology
2. Describe the operating principles and characteristics of basic electrical machines, such as DC machines and transformers
3. Identify and explain the properties and working principles, common electronic components like diodes and transistors
4. Apply the common electronic components like diodes and transistors in electronics circuits
5. Design and analyze simple digital logic circuits using basic logic gates
6. Describe the operating principles and characteristics of sensors in various applications

CO#	Course Outcome	POs	PSOs
CO1	Demonstrate a clear understanding of basic electrical and electronics concepts, principles, and terminology	1,2,3,4,5	1,2,3
CO2	Describe the operating principles and characteristics of basic electrical machines, such as DC machines and transformers	1,2,3,4,5	1,2,3
CO3	Identify and explain the properties and working principles, common electronic components like diodes and transistors	1,2,3,4,5	1,2,3
CO4	Apply the common electronic components like diodes and transistors in electronics circuits	1,2,3,4,5	1,2,3
CO5	Design and analyze simple digital logic circuits using basic logic gates	1,2,3,4,5	1,2,3
CO6	Describe the operating principles and characteristics of sensors in various applications	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	✓	✓	✓	✓		

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COURSE ARTICULATION MATRIX

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2		2									3	3	2	
CO2	3	2	2	1									2	3	3	
CO3	3	3														
CO4	2	2														
CO5	2	3											3	3	2	
CO6	3	3											2	3	3	

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

Content:

Unit – 1:

Introduction to Electrical Engineering: Basics of DC Circuits: Ohms law, Kirchhoff's Current Law, Kirchhoff's Voltage law, Numerical examples as applicable. Basics of AC Circuits: Sinusoidal voltage and currents, Magnitude and phase, polar and rectangular representation, RL, RC and RLC series and parallel circuits, power factor, phasor diagrams, three phase AC – types of three phase connection (star and delta), Comparison between single phase and three phase AC, Numerical examples as applicable.

Unit – 2:

Magnetic Circuits and Electrical Machines: Magnetic Circuits: Definition of magnetic circuit and basic analogy between electric and magnetic circuits, Faradays laws, permittivity, permeability, EMF, MMF equations, Reluctance. Electrical machines: DC Generator, DC Motors, Transformers - Principle of operation, Construction and EMF equations, types and applications. Induction motor: Concept of RMF, Working principle, types and applications Numerical examples as applicable.

Unit-3:

Semiconductor Diodes and Transistors: Semiconductor Diodes : 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.
Transistors: Bipolar junction Transistors BJT configuration: BJT Operation, Common Base, Common Emitter and Common Collector, Characteristics, Numerical examples as applicable.

Unit-4:

Digital Electronics and Sensors: Introduction, Switching and Logic Levels, Digital Waveform, Binary addition, Binary subtraction. Boolean Algebra Theorems, De Morgan's theorem, Logic gates, Algebraic Simplification, Realization of all logic and Boolean expressions.
Sensors: introduction to sensors, definition and classification, principles of sensing, sensor characteristics, sensor measurement techniques (contact and contactless methods, active and passive sensors, analog and digital sensors), introduction to temperature sensors, velocity sensors, force and pressure sensors

Text Books

1. Nagrath I. J. and D .P. Kothari, "Basic Electrical and Electronics Engineering", Second Edition Tata Mc Graw Hill, 2020.
2. Hayt and Kimberly, "Engineering Circuit Analysis",8th Edition, Tata Mc Graw Hill, 2013.
3. Kulshreshtha D.C., "Basic Electrical Engineering", Second Edition, Tata Mc Graw Hill, 2019.
4. David A. Bell, "Electronic Devices and Circuits", Oxford UniversityPress,5thEdition,2008.
5. D. P. Kothari, I. J. Nagrath, "Basic Electronics", Second Edition, Mc Graw Hill Education(India)PrivateLimited,2017.
6. Clarence W. de Silva, " Sensors and Actuators", Second Edition, CRC Press, 2015

Reference Books

1. Hughes, "Electrical Technology", International Students 9th Edition, Pearson, 2005.
2. Robert L.Boylestad and Louis Nashelsky,"Introduction to Electricity, Electronics and Electromagnetics" PrenticeHall,5th edition, 2001
3. Paul Scherz and Simon Monk "Practical Electronics for Inventors", 4thedition, McGraw-Hill Education

Swayam/Nptel/Moocs

1. https://nptel.ac.in/courses/108108076
2. https://nptel.ac.in/courses/108101091
3. https://www.udemy.com/course/basic-electrical-engineering-part-1

COURSE PACK FOR: Basics of Electrical and Electronics Engineering Lab – (B22EE0104)

<table>
<tr><td>Course Title</td><td colspan="4">Basics of Electrical and Electronics Engineering Lab</td><td colspan="2">Course Type</td><td colspan="2">FC</td></tr>
<tr><td>Course Code</td><td>B23EE0104</td><td>Credits</td><td colspan="2">1</td><td colspan="2">Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="5">Course Structure</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>-</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">CIE</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>28</td><td>50%</td><td>50%</td></tr>
</table>

COURSE OVERVIEW

Basic Electrical & Electronics Engineering lab covers the concept of various types of electrical apparatus, tools and conduction of experiments to Analyze, Design of KCL & KVL, two-way switch or staircase wiring, Determination of VI characteristics Zener Diode, Silicon Diode ,Half Wave rectifier using Diode ,study &analyses of Lead& lag component, verification of logic gates.

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COURSE OBJECTIVES

The objectives of the course are to

1. Establish abroad concept of various types of electrical apparatus, tools and instrumentation.
2. Provide hands on experience with electrical apparatus and electrical safety norms.
3. Train students to read and understand schematics so as to make electrical connection for different appliances.
4. Train students in collecting and interpreting experimental data.
5. Enhance written skills of students.

COURSE OUTCOMES(CO'S)

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

CO#	Course Outcomes	PO's	PSO's
CO-1	Use appropriate electrical tools for electrical connections and repair of electrical equipment's.	1,2,4,5,9,10	1
CO-2	Recognize various symbols in a schematic and make connection as per the schematic	1,2,9,10	1
CO-3	List out various safety procedures	4,5,9,10	1
CO-4	Make use of various measuring instruments to collect experimental data	2,4,9,10	1
CO-5	Analyze the results obtained from experiments.	2,3,9,10	1
CO-6	Demonstrate the ability to critically evaluate the performance of electrical appliances.	1,2,9,10	1

COURSE ARTICULATION MATRIX

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	3		3	3				3	3			1		
CO-2	3	3							3	3			1		
CO-3				3	3				3	3			1		
CO-4		3		3					3	3			1		
CO-5		3	2						3	3					
CO-6	3	2							3	3					

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

COURSE CONTENT

List Experiment

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	Study and Analysis of Lead & Lag networks by using R-Components.	Measuring instruments (Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a Team
3	Two-way switch/stair case wiring. To study &verify the connection procedure fortwo-Way switch or staircase wiring	Two-way switch or stair case wiring Kit	Connection, Working & application of Two-way switch
4	Study and analysis the Characteristics :light sensor and temperature sensor	Sensor kit	Characteristics of sensors
5	Study and analysis of V-I Characteristics of Zener PN Junction diodes (Both Forward and Reverse Characteristics).	VI characteristics of Zener Diode kit	VI characteristics of Zener Diode
6	Study and analysis of Transits to restitch	Measuring instruments(Ammeter, Multimeter, CRO) and design equations	Design and circuit debugging. Working in a team
7	Design half wave, Full wave-center tap and Bridge rectifier with and without capacitive filter and measure efficiency And ripple factor.	Rectifier kit	Determine the efficiency, Voltage regulation, ripple factor of rectifiers
8	Design of Clippers and clamper switch reference voltages	Measuring instruments(Ammeter, Multimeter, CRO)and design equations	Design and circuit debugging. Working in a team
9	Study and analysis of input output characteristic of CE configuration of BJT.	Characteristics of BJT in Common Emitter Configuration	Input & Output Characteristics of BJT
10	Verification of basic logic gate using discrete components	Trainer kit	Universal gates will be realized Using basic gates

Demo:

1. To Study the importance of Earthing during accidental shorting of line wire and the body of equipment.
2. To study the Importance and mechanism of MCB.

TEXT BOOKS

1. Nagrath I. J. and D.P. Kothari, “Basic Electrical Engineering”, Third Edition Tata Mc Graw Hill, 2009.
2. Hayt and Kimberly, “Engineering Circuit Analysis” ,8th Edition, Tata Mc Graw Hill, 2013.
3. Kulshreshtha D.C., “Basic Electrical Engineering”, Tata Mc Graw Hill, 2009.
4. Rajendra Prasad, “Fundamentals of Electrical Engineering”, Prentice Hall, India, 2009.

REFERENCE BOOKS

1. The odore Wildi, “Electrical Machines, Drives, and Power, 5thSystems” ,Pearson Edition, 2007.
2. Hughes, “Electrical Technology”, International Students 9th Edition ,Pearson ,2005.

SWAYAM/NPTEL/MOOCs

1. https://nptel.ac.in/courses/108108076
2. https://nptel.ac.in/courses/108101091

https://www.udemy.com/course/basic-electrical-engineering-part-1

1.

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Course Title	Applied Physics				Course Type		Regular	
Course Code	B23AS0111	Credits	3		Class		I 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	CIE	SEE
	Tutorial	0	0	0				
	Total	**3**	**3**	**3**	**40**	**0**	**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 Agricultural Engineering courses by emphasizing the concepts underlying four units .1 Magnetic Materials, 2.Quantum Physics3.Semiconductors and Superconductors, 4. Lasers and Optical fibers. This subject has basic laws, expressions and theories which helps to increase the scientific knowledge to analyze upcoming technologies. The course also consists of real time numerical examples which makes subject interesting and attractive.

COURSE OBJECTIVE

This course enables graduating students

1. To understand the basic concepts and principles of Physics to analyze practical engineering problems and apply its solutions effectively and efficiently.
2. To Understand the Concepts of Magnetic materials and its applications.
3. To understand the Quantum physics and Raman spectroscopy concepts.
4. To understand semiconductor properties, types and Superconductivity phenomena.
5. To understand the characteristics, working, principle and applications of Lasers.
6. To gain the knowledge of optical phenomena in optical fibers and its applications

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Explain the types and properties of magnetic materials.	PO1, PO2, PO4	PSO1, PSO2,PSO 3
C02	Understanding the Quantum aspects in Physics and Raman spectroscopy.	PO1,PO2	PSO1, PSO2,PSO 3
CO3	Explain the classification of semiconductors.	PO1,PO2, PO3	PSO1, PSO2,PSO
CO4	Explain the Concepts of super conductivity phenomena in materials.	PO1,PO2, PO3	PSO1, PSO2,PSO 3

C05	Explain the working, principle and applications Ruby and He-Ne lasers, characteristics of lasers and applications.	PO1,PO2, PO7	PSO1, PSO2,PSO 3
CO6	To gain knowledge in optical phenomena in optical fibers and applications.	PO1,PO2, PO7	PSO1, PSO2,PSO 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	✓	✓	✓	✓		
C04	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3		1									3	3	3	
CO2	3	2	1										3	3	3	
CO3	3	2	1										3	3	3	
CO4	3	2											3	3	3	
C05	3	2					3						3	3	3	
CO6	3	2					3						3	3	3	

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

COURSE CONTENT THEORY

Contents	
	10hrs

UNIT:1 Magnetic materials : Introduction, Magnetic field and induction – magnetization – magnetic permeability and susceptibility. Dia, Para and ferromagnetism-classification. Langevin theory of Dia and paramagnetic. Adiabatic demagnetization. Weiss molecular field theory and ferromagnetism. Curie-Weiss law. Applications of magnetic materials.
10hrs
UNIT:2 Quantum Physics: Introduction to light theories, Wave particle quality, de-Broglie concept, uncertainty principle. Wave function. Time dependent and time independent Schrodinger wave equation, Qualitative explanation of Zeeman effect, Stark effect and Paschan Back effect, Raman spectroscopy. Statement of Bloch's function. Band sin solids, velocity of Bloch's electron and effective mass.
10hrs
UNIT: 3 Semiconductors and superconductors: Distinction between metals. insulators and semiconductors. Intrinsic and extrinsic semiconductors, law of mass action. Determination of energy gap in semiconductors. Donors and acceptor levels. Superconductivity, critical magnetic field. Meissner effect. Isotope effect. Type-I and II superconductors, Josephson's effect DC and AC, Squids. Introduction to high T_C superconductors.
10hrs
UNIT:4 Lasers and optical fibers: Spontaneous and stimulate demission, Einstein A and B coefficients. Population inversion, He-Ne and Ruby lasers. Ammonia masers, Holography. Optical fiber. Physical structure. basic theory. Mode type, input output characteristics of optical fiber and applications. Illumination: laws of illumination, luminous flux, luminous intensity, candle power, brightness.

Text Books:

1. Gaur and Gupta: Engineering Physics, Dhanpat Rai Publishers, New Delhi, 8th revised edition 2017.
2. M. N. Avadhanulu and P. G. Kshirsagar: A Textbook of Engineering Physics, 10th revised edition, S. Chand & Company Ltd, New Delhi

Reference Books:

1. Resnick, Halliday and Jearl Walker - Fundamentals of Physics, John Wiley & Sons, Inc., 11th edition, 2018.
2. Brijlaland Subrahmanyam. Text Book of optics. S. Chand and Co., New Delhi.
3. Sarkar Subir Kumar. Optical State Physics and Fiber Optics .S .Chand and Co. ,New Delhi.
4. Gupta S L, Kumar V Sharma R C. Elements of Spectroscopy. Pragati Prakasam, Meeruth.
5. Saxena BS and Gupta RC. Solid State Physics. Pragati Prakasam, Meeruth.
6. Srivastava BN. Essentials of Quantum Mechanics. Pragati Prakasam, Meeruth.
7. Vasudeva DN. Fundamentals of Magnetism and Electricity. S. Chand and Co., New Delhi.

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B23AS0112	**Applied Physics Lab – (B23AS0112)**	**L**	**T**	**P**	**C**	**Hrs. /Wk.**
Duration: 16weeks		**0**	**0**	**2**	**2**	**3**
Internal Assessment: 25 Marks	Semester End Examination: 25 Marks (Minimum 10 Marks)					

Course Prerequisite: Basic knowledge about setting up experiments measuring various parameters

The objectives of this course are to:

1. To make the students gain practical knowledge to co-relate with the theoretical studies.

2. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipment's.

3. Design of circuits using new technology and latest components/software's and to develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.

COURSEOUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of Physics to find the values and comparison of results with theoretical calculations.	1, 2, 4,10	1,2,3
CO2	To study the design of instruments with practical knowledge.	1,2, 3,9,10	2, 3
CO3	Gain knowledge of new concept in the solution of practical oriented problems.	2,3, 4, 8,9, 10	1, 2, 3
C04	Usage of different instruments and real time applications in engineering studies.	2,3, 4,8, 9, 10	1, 2, 3
CO5	Use measurement instruments and find the errors.	1 to 5, 8 to 10	1, 2, 3
CO6	To analyze the available data with the help of experiments.	1 to 5, 8 to 10	1,2, 3

BLOOM'SLEVELOFTHECOURSEOUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply(L3)**	**Analyze(L4)**	**Evaluate(L5)**	**Create(L6)**
CO1		✓				
CO2			✓			
CO3				✓		
C04			✓	✓	✓	✓
CO5		✓				✓
CO6			✓			✓

COURSE ARTICULATIONMATRIX

Course Code	POS/ COs	PO1	P2	PO3	PO4	PO5	PO6	P7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
B23AS 0112	**CO1**	3	3	2	2	2			1	3	3			3	3	3
	CO2	2	2	2	2	2			1	3	3			3	3	3
	CO3	3	3	2	2	2			1	3	3			3	3	3
	CO4	3	3	3	2	2			1	3	3			3	3	3

	CO5	3	3	3	2	2			1	3	3			3	3	3
	CO6	3	3	3	2	2			1	3	3			3	3	3

Where, L (Low), M (Medium) and H (High) represents strength of correlation between CO and PO.

List of Experiments

Sl NO	Title of the Experiment	Tools and Technics	Expected Skill/Ability
1	To find the frequency of A.C. supply using an electrical vibrator.	Electrical vibrator, stop clock	Understand the theory, principle and perform the experiment, collect the data and interpret the results.
2	To find the low resistance using Carey Foster bridge without calibrating the bridge wire;	An unknown resistance, known resistance(variable) galvanometer, dry cell, plug key, meter bridge with jockey	Understand the theory, principle and perform the experiment, collect the data and interpret the results to estimate the Value of the material.
3	To determine the value of specific charge (e/m) for electrons by helical method;	CRO Tube, power supply, multimeter, rheostat.	Understand the theory, principle and perform the experiment, collect the data and interpret the results to estimate the Value of the material.
4	Determination di electric constant of material by charging and discharging method.	Dielectric constant setup, connecting wires.	Understand the theory, principle and perform the experiment, collect the data and interpret the results by using graph to estimate the Value of the material and compare with standard values.
5	To find the induced e E.M.F as a function of the velocity of magnet.	Coil, Multimeter, connecting Wires.	Understand the theory, principle and perform the experiment, collect the data and interpret the results.
6	To obtain hysteresis curve (B-H curve) on a C.R.O. and to determine related magnetic quantities;	B-H curve setup and CRO.	Understand the theory, principle and perform the experiment, determine the value of magnetic quantities.
7	Determination of energy band gap in a semiconductor using ap-n Junction diode	Diode, Multimeter, circuit board setup and wires	Understand the theory, principle and perform the experiment, collect the data and interpret the results.
8	Determination of Numerical apertur of optical fiber.	Optical fiber, Laser source, screen.	Understand the theory, principle and perform the experiment, collect the data and interpret the results.
9	Study the Characteristics of LCR Series and parallel circuit	LCR kit, connecting wires	Understand the theory and perform the experiment, collect the data and draw the characteristics curve of given LCR..
10	Determination of Attenuation coefficient of optical fiber	Optical fiber, Laser source.	Understand the theory and perform the experiment, collect the data and interpret the results.
11	Study the forward and reverse bias Characteristics of Zener diode.	Zener diode, Multimeter, circuit board and wires	Understand the theory, circuit connection and perform the experiment, collect the data and interpret the results to know the knee and break down voltage.

12	Determination of wavelength of Laser by diffraction.	Laser source, grating	Understand the theory and perform the experiment, collect the data and calculate the wavelength of given laser.

REFERENCE BOOKS:

1. G.L. Souires, "Practical Physics:", 4th Edition, Cambridge University, UK, 2001.
2. D. Chattopadhyay, P. C. Rakshit and B. Saha, "An Advanced Course in Practical Physics", 2nd ed., Books & Allied Ltd., Calcutta, 1990.
3. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
4. Practical Physics – S. L. Gupta &V. Kumar (Pragati Prakashan).
5. Advanced Practical Physics Vol. I& II – Chauhan & Singh (Pragati Prakashan).

HE	**Calculus and Linear Algebra**				
B23AS0110	Credit Pattern				
Prerequisites	L	T	P	Total	Contact Hours
Matrices, Differentiation	2	1	0	3	4

Course Details:

Course description:

This course is introduction to applied mathematics, which is useful for agricultural engineering students. This course covers identifying and methods of finding rank of the matrices and inverse of matrices, finding transformations and diagonalization along with applications to engineering problems. Most importantly learn multiple integration and vector identities.

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	PSO4
CO1	3	3		1									3			
CO2	3	3		1									3			
CO3	3	3		1									3			
CO4	3	3		1									3			
CO5	3	3		1									3			
CO6	3	3		1									3			

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

Unit No.	Contents	Weighting of marks
1	**Matrices:** Elementary transformations, rank of a matrix, reduction to normal form, Gauss-Jordon method to find inverse of a matrix, Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof), linear transformation, orthogonal transformations, diagonalization of matrices, quadratic forms. PAQ form.	25
2	**Differential calculus:** Taylor's and Maclaurin's expansions; indeterminate form; function of two or more independent variables, partial differentiation, homogeneous functions and Euler's theorem, composite functions, totalderivatives, maxima, and minima.	25
3	**Vector calculus:** Differentiation of vectors, scalar and vector point functions, vector differential operator Del, Gradient of a scalar point function, Divergence and Curl of a vector point function and their physical interpretations, identities involving Del, second order differential operator	25
4	**Integral calculus:** Double and triple integrals, change of order of integration, application of double and triple integrals to find area and volume.	25

a) **Objectives:**

The overall objective of the Course is as follows:
This course enables Engineering students to identify the requirement of applied mathematics and their applications.

a) **Learning Outcomes**

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

CO#	Course Outcomes	POs	PSOs
CO1	Compute the rank of echelon and normal form and to obtain inverse by Gauss Jordan method.	1,2,4	1

CO2	Compute the Eigen values and Eigen vectors of square matrix to diagonalize and to obtain the canonical form of quadratic form.	1,2,4	1
CO3	Apply Taylor's and Maclaurin's series for expanding the functions and to find the limit of indeterminate form using L' Hospital rule.	1,2,4	1
C04	Study partial differentiation, homogeneous functions and Euler's theorem, composite functions, totalderivatives, maxima, and minima	1,2,4	1
CO5	Study scalar and vectorpoint functions, vector differential operator and vector identities.	1,2,4	1
C06	Evaluate multiple integrals, change of order of integration, and application problems.	1,2,4	1

b) Suggested Textbooks and References

Textbook:

1. Higher Engineering Mathematics by B.V. Raman Publisher: TMH
2. Higher Engineering Mathematics by Dr. B.S Grewal, Khanna publishers, 44th edition.

Reference Books:

1. Advanced Engineering Mathematics by E. Kreyszig Publisher: John Willey & SonsInc- 8th Edition
2. Advanced Engineering Mathematics by P.V. O'Neil Publisher: Thomson Mathematical Methods by Potter & Goldberg; Publisher: PHI.

Programming with C
B23CI0108

Course Title	Programming with C				Course Type		HC	
Course Code	B23CI0108	Credits	1		Class		I Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	1	2	2				
	Total	1	2	2	-	28	**50%**	**50%**

COURSE OVERVIEW:

Algorithms and flowcharts are the fundamental tools for problem solving which can be used by the computers. The computer programs can be developed using algorithms and flowcharts to provide solutions to problems. C Language is a general-purpose, structured and procedure oriented programming language. It is one of the most popular computer languages today because of its structure and higher-level abstraction C. This course introduces algorithms, flowcharts and various C Programming language constructs for the development of real world applications.

COURSE OBJECTIVE (S):

1. Explain algorithms, flowcharts and different programming constructs of C to be used for Development of applications.
2. Illustrate the use of iterative statements and conditional Statements for solving the real world problems.
3. Demonstrate the use of functions with parameter passing mechanisms for solving the real world problems.
4. Discuss the use of structures, unions, pointers and file operations for solving the real world Problems.
5. Learn new algorithms and technologies in C Programming and apply for suitable application development.
6. Develop solutions by using C Programming to the complex problems, either individually or as a part of team and report the results.

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Identify the programming constructs of C language to solve a given problem.	1-3	1
CO2	Apply the concepts of matrices to develop data processing and analysis solutions in various application domains.	1-5	1
CO3	Develop text processing based applications using string operations.	1-3,5	2,
CO4	Create solutions for real world problems using Pointers, Union, Structures and file operations.	1-5	2, 3
CO5	Use algorithms and technologies in C Programming for suitable application development	1-5	2, 3
CO6	Develop solutions by using C Programming to the complex problems, either individually or as a part of the team and report the results	1-5,9	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			✓			
CO4						✓
CO5		✓	✓			
CO6						✓

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COURSE ARTICULATIONMATRIX

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

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

List of Practice Sessions/Experiments			
No	**Title of the Experiment**	**Tools and Techniques**	**Expected Skill /Ability**
1	Calculator allows you to easily handle all the calculations necessary for everyday life with a single application. Write a C program using switch statement to design a basic calculator that performs the basic operations such as addition, subtraction, multiplication and division.	Condition statement	Apply switch and if-else
2	People frequently need to calculate the area of things like rooms, boxes or plots of land where quadratic equation can be used. Write a C program to find the coefficients of a quadratic equation and compute its roots.	Conditional branching statement	If or if-else or else-if ladder
3	Consider the age of 3 persons in a family, Write a C program to identify the eldest person among three of them.	Condition checking	Apply if-else
4	Consider student's marks in Computer based Test. Write a C Program to display the grade obtained by a student in Computer Test based on range of marks.	Condition checking	Apply if-else, switch
5	In a stock market at the end of the day, summation of all the transactions is done. Write a C program using arrays to a) Display transactions IDs from1 to 'n'. b) Find the sum of 'n' natural numbers	Looping, sum	Apply for loop and arrays
6	In computer based applications, matrices play a vital role in the projection of three dimensional image into a two dimensional screen, creating the realistic seeming motions. Write a C program using 2-dimensional array to check for compatibility of two matrices and perform matrix Multiplication.	Condition checking, matrix operations	Apply if-else, looping and 2-D array
7	Implement a Program to read N integer numbers into a single dimensional array, sort them in ascending order using bubble sort technique and print both the given array and the sorted array with suitable headings.	Sorting	Use 1-D array, looping
8	Suppose students have registered for workshop, and their record is maintained in ascending order based on student ID's. Write a C program to find whether a particular Student has registered for that particular workshop or not using binary search.	Searching	Use 1-D array, looping
9	In a memory game, you first enter a first string and again enter second string, Write a C program to check whether both the strings are same or not.	Comparison, condition	Use string, if

10	Write a C program to define a structure named Student with name and DOB, where, DOB in turn is a structure with day, month and year. Using the concept of nested structures display your name and date of birth.	Nested structure	Use structure to store the data

TEXT BOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, PRENTICE HALL
2. SOFTWARE SERIES, 2005.
3. Herbert Schildt, "C: The Complete Reference", 4th edition, TATA McGraw Hill, 2000.
4. B.S. Anami, S.A. Angadi and S. S. Manvi, "Computer Concepts and C Programming: A
5. Holistic Approach", second edition, PHI,2008.

REFERENCE BOOKS:

1. Balaguruswamy," Programming in ANSI C", 4th edition, TATA MCGRAW Hill, 2008.
2. Donald Hearn, Pauline Baker," Computer Graphics C Version", second edition, Pearson Education, 2004.

Course Pack: Engineering Workshop – (B23ME0104)

COURSE OVERVIEW

Workshop technology lab provides the basic knowledge of the various production process used to manufacture of components and properties of different materials used in the industry. It also explains the use of different tools, equipment's, machinery and techniques of manufacturing, which ultimately facilitate shaping of these materials into various usable forms. This course focuses on basic manufacturing process such as fitting, welding, forging, casting, turning, drilling shaping and grinding. It also provides knowledge on various tools like hand tools and power tools including machine tools and skills on various manufacturing methods.

COURSE OBJECTIVES

1. To make student familiar with various manufacturing methods and materials used to make a component.
2. To gain the skills on usage of tools and instrument and their selection for carrying out the fitting, welding, casting, forging and machining operations
3. To understand the manufacturing processes used to prepare the component from the raw material as per the given dimension

Course Title	**Engineering Workshop**				**Course Type**		**Hard Core**	
Course Code	**B23ME0104**	**Credits**	**2**		**Class**		**I/II Semester**	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	2	4	4	Theory	Practical	IA	SEE

	Tutorial	0	0	0				
	Total	**2**	**4**	**4**	**0**	**56**	**50 %**	**50 %**

COURSE OUTCOMES (COs)

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

CO	Course Outcomes	POs	PSOs
CO1	Select suitable tool or machine tool to prepare the model as per the given dimension		
CO2	Prepare the fitting model as per the given dimension by using appropriate fitting tools.		
CO3	Prepare the welding model using arc/gas welding		
CO4	Develop the casting and forging model as per the given dimension		
CO5	Prepare the turning model as per the dimension using lathe machine		
CO6	Prepare the technical document about the process to be followed, tools used and dimensions followed in preparing model		

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 ARTICULATIONMATRIX

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

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

List of Practice Sessions/Experiments

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1.	Familiarization of hand tools, power tools and machine tools	Fitting tools/welding tools/casting tools/Machine tools	Identify and select the suitable tool for specific

			operation
2.	Preparing fitting model 1(square joint or V joint)	Fitting tools, filing, marking, dimensioning	Usage of tools, filing skills, dimensioning skills, time management
3.	Preparing fitting model 2(Semicircular joint/ Trapezoidal Joint)	Fitting tools, filing, marking, dimensioning	Usage of tools, filing skills, dimensioning skills, time management
4.	Preparing welding model 1(Lap Joint)	Welding tools, welding, cleaning	Welding skills and safety skills
5.	Preparing Welding model 2(Butt Joint))	Welding tools, welding, cleaning	Welding skills and safety skills
6.	Development of casting mold using single piece pattern	Molding tools, molding, cleaning	Usage of molding tools, molding process
7.	Development of casting mold using two piece pattern	Molding tools, molding, cleaning	Usage of molding tools, molding process
8.	Development of forging model	Forging tools, forging process	Usage of folding tools, folding process, safety in forging
9.	Preparing of turning model using lathe (step turning)	Cutting tools, lathe and plain turning, step turning	Use of lathe, turning operation, inspection
10.	Preparing of turning model using lathe (taper turning)	Cutting tools, lathe and plain turning, step turning, taper turning	Use of lathe, various turning operation, inspection
11.	Demonstration of drilling and shaping operation	Drilling machine and shaping machine	Familiarization of drilling and shaping

TEXTBOOKS

1. SKH Chowdhary, AKH Chowdhary and Nirjhar Roy, "The Elements of Workshop Technology - Vol I & II", Media Promoters and publisher, 11th Edition, 2001.

2. N Khurmiand R.S Khurmi "A Textbook Of Workshop Technology: Manufacturing Processes'. S Chand & Company,16th edition 2021.

REFERENCE BOOKS

1.K.C. John "Mechanical Workshop Practice", 2/E 2nd edition.PHI,2010

JOURNALS/MAGAZINES

1. International Journal of Machine Tools and Manufacture

SWAYAM/NPTEL/MOOCs:

1. https://www.coursera.org/browse/physical-science-and-engineering/mechanical-engineering

COURSE PACK FOR: Agri-Allied Skills and Technology – (B23EU0103)

Course Title	Agri-Allied Skills and Technology				Course Type		Theory	
Course Code	B23EU0103	Credits	1		Class		I semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**1**	**2**	**2**	**0**	**14**	**50%**	**50%**

Course :Agri-Allied Skills and Technology – (B23EU0103)

Course Overview

Agri-Allied Skills and Technology is a fundamental course within the agricultural engineering program that focuses on soil preparation, potting, pruning, plant propagation, post-harvest handling, hydroponics, soil testing, seed germination, composting, irrigation, and more. Participants learn practical gardening skills and sustainable techniques for personal or professional use. Ideal for gardening enthusiasts.

Course objectives

1. Understand soil components and structure, and learn potting techniques to create an ideal environment for plant growth and development.
2. Gain knowledge of pruning methods to shape plants, stimulate growth, and improve fruiting and flowering.
3. Learn various plant propagation methods, including seed propagation, cuttings, layering, grafting, and division, for efficient plant multiplication.
4. Explore basic irrigation methods like drip irrigation and sprinklers to efficiently water plants and conserve water resources.

5. Familiarize with essential tools and equipment used in agriculture and gardening, and learn their functions and maintenance.
6. Learn how to observe and interpret weather patterns for better farming and gardening decisions.

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand soil components and structure, and learn potting techniques to create an ideal environment for plant growth and development.	7,9	
CO2	Gain knowledge of pruning methods to shape plants, stimulate growth, and improve fruiting and flowering.	7,9	
CO3	Learn various plant propagation methods, including seed propagation, cuttings, layering, grafting, and division, for efficient plant multiplication.	7,9	
CO4	Explore basic irrigation methods like drip irrigation and sprinklers to efficiently water plants and conserve water resources.	7,9	
CO5	Familiarize with essential tools and equipment used in agriculture and gardening, and learn their functions and maintenance.	7,9	
CO6	Learn how to observe and interpret weather patterns for better farming and gardening decisions.	7,9	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember	Understand	Apply	Analyze	Evaluate	Create
CO1		✓		✓		
CO2		✓	✓	✓		
CO3		✓		✓		
CO4		✓		✓		✓
CO5		✓	✓	✓		✓
CO6		✓	✓	✓		✓

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Sl. No	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1.	Prepare and compare different potting mixes for seedlings/cuttings.	Containers/pots	Understanding the impact of different potting mixes on plant growth and health
2.	Practice pruning techniques on fruit trees and ornamental shrubs.	Pruning shears or secateurs Pruning saw Loppers (for thicker branches)	Knowledge of how pruning affects plant growth and development.
3.	Propagate plants through seed sowing and stem cutting.	Planting trays or pots Seed sowing equipment (for seed propagation) Pruning shears or scissors (for stem cutting)	Understanding the best propagation techniques for different plant species.
4.	Implement post-harvest handling techniques for horticultural produce.	Harvesting knives or shears Drying racks or dehydrators Cold storage facilities or refrigerators	Knowledge of post-harvest techniques to preserve horticultural produce.
5.	Set up a hydroponic system and compare plant growth with soil culture.	Hydroponic system components (e.g., reservoir, nutrient solution, net pots)	Understanding the advantages and disadvantages of each cultivation method.
6.	Analyze soil samples for pH, nutrients, and texture.	Soil sampling tools (soil auger, trowel) pH meter or pH testing kit Nutrient testing kits	Ability to make informed decisions for soil improvement and fertilization.
7.	Conduct seed germination tests and transplant seedlings.	Planting trays or pots Seed germination paper or media Hand trowel or dibber for transplanting	Practical experience in transplanting seedlings.
8.	Create compost piles and set up a vermin composting bin.	Compost bin or pile Organic waste materials Worms (for vermicomposting)	Understanding the role of worms in verminn composting and its benefits.
9.	Install and compare simple irrigation systems.	Drip irrigation kit or drip hoses Sprinkler system or watering can Water meter or rain gauge	Efficient water use through proper irrigation practices.

10.	Learn to use agricultural tools for various tasks.	Spade or shovel Hoe Pruning shears or secateurs Rake	Proficiency in using essential agricultural tools for various tasks.
11.	Cultivate a kitchen garden and monitor plant growth.	Containers or raised bed materials Potting mix or garden soil Seeds or seedlings of fast-growing vegetables	Establishment of a productive kitchen garden with healthy plants.
12	Identify local plants during a nature walk.	Labels or plant tags for identified plants	Ability to identify common plants and trees in the local environment.
13	Build a rainwater harvesting model for water conservation.	Containers or barrels for water storage Guttering system (for collecting rainwater)	Understanding the concept of rainwater harvesting and its implementation.
14	Record weather observations for a week.	Thermometer Rain gauge	Recording and interpreting weather data for agricultural planning.
15	Plant and explore an herb garden with aromatic herbs.	Containers or pots for planting herbs Potting mix or garden soil Aromatic herbs seeds or seedlings	Practical knowledge of herb care and uses in daily life.

COURSEARTICULATIONMATRIX

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

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II SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC /SC/ OE/ MC/SDC	Credit Pattern				Contact Hours/Week	Examination			Course category (Asper AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23AS0211	Differential Equation and Fourier Series	FC	3	0	0	3	4	50	50	100	BSC
2	B23AS0209	Chemistry for Agriculture Engineering	FC	2	0	0	2	2	50	50	100	BSC
3	B23EU0201	Advanced Surveying and Levelling	HC	0	0	1	1	2	25	25	50	PCC
4	B23EU0202	Principles of Soil Science and Agronomy	SC	2	0	1	3	4	50	50	100	PEC
5	B23EU0203	Thermodynamics and Heat Engines	HC	2	0	1	3	4	50	50	100	PCC
6	B23EU0204	Unit Operations in Agricultural Processing	HC	2	0	1	3	4	50	50	100	PCC
7	B23EU0205	Soil Mechanics	HC	2	0	1	3	4	50	50	100	PCC
8	B23EU0206	Engineering Mechanics and Strength of Materials	HC	2	0	1	3	4	50	50	100	ESC
9	B23AS0210	Chemistry for Agriculture Engineering Lab	FC	0	0	1	1	2	25	25	50	BSC
10	B22AH0103	Communication Skills	FC	0	0	1	1	2	25	25	50	HSMC
TOTAL				15	0	8	23	32	425	425	850	
TOTALSEMESTERCREDITS				23								
TOTALCUMULATIVECREDITS				23								
TOTALCONTACTHOURS				32								
TOTALMARKS				850								

Course Title	Engineering Mathematics – II (Differential Equation and Fourier Series)				Course Type		Theory	
Course Code	B23AS0211	Credits	3		Class		I semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	-	-	-	The	Practical	CIE	SEE
	Tutorial	-	-	-				
	Total	**3**	**3**	**3**	**3**	**0**	**50%**	**50%**

COURSE PACK FOR: Differential Equation and Fourier Series – (B23AS0211)

Course description:

This course is introduction to applied mathematics, which is useful for agricultural engineering students. This course covers identifying and methods of solving differential equation of first and higher order along with applications to engineering problems. Most importantly learn partial differential equations and Fourier series.

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COURSE OVERVIEW:

This course is introduction to applied mathematics, which is useful for agricultural engineering students. This course covers identifying and methods of solving differential equation of first and higher order along with applications to engineering problems. Most importantly learn complex variables and Fourier series.

COURSE OBJECTIVE:

This course enables Engineering students to identify the requirement of applied mathematics and their applications.

CO#	Course Outcomes	POs	PSOs
CO1	Study various methods to solve first order ordinary differential equations and its application.	1,2	1
CO2	Solve higher order linear differential with constant coefficients and method of variation of parameters	1,2	1
CO3	Solve higher order linear differential equations with variable coefficients	1,2	1
C04	Solve partial differential equation by direct and indirect methods	1,2	1
CO5	Solve langrage's linear PDE and method of separation of variables	1,2	1
C06	Study and understand the application approach of the concepts of Fourier series and transforms.	1,2	1

COURSE CONTENT THEORY

Unit No.	Contents	Weighting of marks
1	**UNIT:1 Differential equations I** Introduction to differential equations, Variable separable, Linear equation, Bernoulli's equation, Exact and equations reducible to exact form by integrating factors. General and singular solutions, Clairaut's equation and applications	25
2	**UNIT:2 Differential equations-II** Linear Differential equations of higher orders, methods of finding complementary functions and particular integrals, method of variation of parameters, solution of differential equations with variable coefficients: Cauchy's, and Legendre's linear equations.	25

3	**UNIT:3 Partial differential equations** Formation of partial differentialequations, solutions of non-homogeneous PDE by direct integration, solution of homogenous PDE involving derivatives with respect to one independent variable only. Lagrange's Linear PDE and solution of PDE by the method of separation of variables.	25
4	**UNIT:4 Fourier Series** Periodic functions, Fourier series, Euler's formulae, Dirichlet's conditions, functions having arbitrary period, even and odd functions, half range series, Harmonic analysis.Fourier Sine and Cosine Series transforms.	25

Text Book:

1. Higher Engineering Mathematics by B.V. Raman Publisher: TMH
2. Higher Engineering Mathematics by Dr. B.S Grewal, Khanna publishers, 44th edition.

Reference Books:

1.Advanced Engineering Mathematics by E. Kreyszig Publisher: Johnwilley & SonsInc- 8th Edition
2.Advanced Engineering Mathematics by P.V. O'Neil Publisher: Thomson Mathematical Methods by Potter & Goldberg; Publisher: PHI.

Course Title: Chemistry for Agriculture Engineering – (B23AS0209)

Course Title	**Chemistry for Agriculture Engineering**				**Course Type**		FC	
Course Code	**B23AS0209**	**Credits**	2		**Class**		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	2	2	0				
	Practice	0	0	0	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	2	2	0	32	1	40%	60%

COURSE OUTCOMES (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Know the significance of energy sources and their characteristics.	1, 7	1
CO2	Assess the quality of fuels based on theoretical calculations.	1,7	1
CO3	Understand the significance of water quality assessment for various applications	1,7	1
CO4	Understand the various components of food materials and their impact on health	1,7	1
CO5	Know the importance of materials for engineering applications.	1,3,7	1
CO6	Realize the current scenario of nano materials and their applications.	1,3,7	1

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BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand(L 2)	Apply(L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	1	2	2			
CO2		2				
CO3	2	2	2			
CO4		3				
CO5	2	3				
CO6	2	2				

COURSE ARTICULATION MATRIX

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

Content
Unit-I **Energy Sources and Characteristics** Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value.
Unit- II **Water Chemistry and its analysis** Sources and impurities, Water quality parameters: Definition and significance of-color, odor, turbidity, pH, hardness, alkalinity, COD and BOD (definition), **Municipal water treatment:** primary treatment and disinfection, Desalination of brackish water: Reverse Osmosis, Boiler troubles: Scale and sludge, Boiler corrosion (only types), Priming &foaming. **Treatment of boiler feed water:** External treatment – Ion exchange demineralization.
Unit– III **Food chemistry** Introduction to lipids/fatty acids and their chemistry- saturated and unsaturated fatty acids, proteins, carbohydrates, vitamins, food preservatives, and their significance, coloring and flavoring reagents of food. Bordeaux mixture, fertigation

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Unit- IV

Engineering Materials

Lubricants: properties. Mechanism. Classification and tests.

Polymers: types of polymerization, properties, uses and methods for the determination o f molecular weight of polymers (any one method).

Nano materials: definition, classification with examples, properties and applications, sensors-definition, classification, application in engineering.

Suggested Readings

1. Jain P L and JainM.1994.Engineering Chemistry. Danpat Rai publishing company Pvt. Ltd., Delhi.

3. Bahl B S, Arun Bahl and Tuli B D.2 007.Essentials of Physical Chemistry. S. Chand and Co. Ltd., Delhi.

Course Title: Chemistry for Agriculture Engineering Lab – (B23AS0210)

Course Title	Chemistry for Agriculture Engineering Lab				Course Type		FC	
Course Code	B23AS0210	Credits	1		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	2	0				
	Practice	0	0	0	Theory	Practical	IA	SEE
	Tutorial	0	0	0				
	Total	1	2	0	2	16	50%	50%

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	To analyse hard water quality through its hardness test	1,7	1
CO2	Know how to analyse waste water quality through its DO, COD and BOD Values	1,7	1
CO3	Perform experiment to find chlorine availability to bleach water	1,7	1
CO4	To analyse and assess the viscosity of known oils for known applications	1	1
CO5	To study the application of beer-lamberts lawto analyse copper content	1	1
CO6	Carry out analysis of known functional groups in a given organic material	1,7	1

BLOOM'SLEVELOFTHECOURSEOUTCOMES

CO#	Bloom'sLevel					
	Remember (L1)	Understand(L 2)	Apply(L3)	Analyse (L4)	Evaluate (L5)	Create (L6)
CO1		2	2	2		
CO2		2	2	2		
CO3		2	2			
CO4	1					
CO5	1					
CO6	1					

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COURSEARTICULATIONMATRIX

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

Content

PRACTICAL

1. Determination of temporary and permanent hardness of water by EDTA method:

2. Estimation of dissolved oxygen in water:

3. Determination of BOD in water sample: Determination of COD in water sample:

4. Estimation of available chlorine in bleaching powder:

5. Determination of viscosity of oil:

6. Estimation of activity of water sample: Estimation of alkalinity of water sample:

7. Determination of λ_{max} and verification of Beer Lambert Law:

8. Determination of calorific value of fuel:

9. Identification of functional groups(alcohol, aldehyde, ketones, carboxylic acid and amide) by IR: Chromatographic analysis:

Suggested Readings

1. Jain P L and JainM.1994.Engineering Chemistry. Danpat Rai publishing company Pvt. Ltd., Delhi.

2. Bahl B S, Arun Bahl and Tuli B D.2 007.Essentials of Physical Chemistry. S. Chand and Co.Ltd., Delhi.

Advanced Surveying and Levelling - (B23EU0201)

COURSE OVERVIEW

Advanced Surveying and Levelling is a fundamental course within the agricultural engineering program that focuses on the principles and practices of precise height determination and land levelling specific to agricultural applications. This course aims to provide students with specialized knowledge in levelling techniques relevant to agricultural engineering, enabling them to assess and modify the terrain for efficient water distribution, soil conservation, and enhanced crop productivity. Through a combination of theoretical knowledge and practical field exercises, students will develop the necessary skills to apply levelling principles in agricultural engineering projects and promote sustainable land management practices.

COURSE OBJECTIVE

1. Introduce students to the fundamental principles and concepts of levelling in surveying.
2. Enable students to calculate height differences and elevations accurately using levelling techniques.
3. Provide hands-on experience in conducting levelling surveys in the field, including setting up instruments, taking readings, and recording data.
4. Teach students how to make precise angular measurements using theodolites for horizontal and vertical angles.
5. Provide students with a comprehensive understanding of total stations, their components, and their role in modern surveying and engineering.
6. Provide students with an overview of laser-guided land levelling machines, their components, and their significance in modern agricultural practices.

COURSE OUTCOMES (COs)

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

CO#	Course Outcome	POs	PSOs
CO1	Introduce fundamental principles and concepts of levelling in surveying.		
CO2	Enable accurate calculation of height differences and elevations using levelling techniques.		
CO3	Provide hands-on experience in conducting field levelling surveys, including instrument setup, readings, and data recording.		
CO4	Teach precise angular measurements using theodolites for horizontal and vertical angles.		
CO5	Foster a comprehensive understanding of total stations, their components, and their role in modern surveying and engineering.		
CO6	Provide an overview of laser-guided land levelling machines, their components, and their significance in modern agricultural practices.		

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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						
CO6						

COURSE ARTICULATION MATRIX

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2																
CO3																
CO4																
CO5																
CO6																

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

Sl.No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Basics of Levelling	Instrumental	Conduction of Experiments
2	Dumpy level – Parts and its temporary adjustments	Dumpy level	To know about parts and functions of dumpy level
3	Entry of level book – Height of instrument method and Rise and Fall method	Instrumental	Conduction of Experiments
4	Levelling methods – Simple and differential levelling	Instrumental	Conduction of Experiments
5	Survey for preparation of contour map using dumpy level and preparation of contour map		To learn about conducting grid survey of an area.
6	Interpretation of contour maps		To learn about interpretation of contour maps / lines.
7	Study of laser guided land levelling machine	Instrumental	Conduction of Experiments
8	Calculation of area and volume	Instrumental	Conduction of Experiments
9	Theodolite – Description of the instrument and traversing	Instrumental	Conduction of Experiments
10	Introduction to setting of curves	Instrumental	Conduction of Experiments
11	Total survey station – Components and usage	Instrumental	Conduction of Experiments
12	Global positioning system – Components and usage	Instrumental	Conduction of Experiments
13	Remote sensing application in Surveying and Levelling	Software	To learn about advance surveying and levelling

Course Pack for : Principles of Soil Science and Agronomy - (B23EU0202)

COURSE OVERVIEW

This course provides a foundational understanding of the principles governing soil science and agronomy, essential for students pursuing studies in agriculture and related fields. The curriculum is designed to cover key topics such as soil formation, crop classification, tillage practices, soil chemistry, nutrient management, water relationships in crops, and sustainable agricultural practices.

Practical applications and field-based learning are integrated to ensure students acquire both theoretical knowledge and hands-on skills.

COURSE OBJECTIVE

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

CO#	Course Outcome	POs	PSOs
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

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	PSO4
CO1																
CO2																
CO3																
CO4																
CO5																
CO6																

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

COURSE CONTENT THEORY

Detailed Course-wise Syllabus

Course: Principles of Soil Science and Agronomy – (B23EU0202)

Principles of Soil Science and Agronomy
UNIT-I

Introduction and scope of Soil Science and Agronomy. Classification of crops, Effect of different weather parameters on crop growth and development. Principles of tillage, tilth and its characteristics. Nature and origin of soil; soil forming rocks and minerals, their classification and composition, soil forming processes, classification of soils – soil taxonomy orders;

UNIT-II

Important soil physical properties; and their importance; soil particle distribution; soil organic matter – its composition and decomposition, effect on soil fertility; soil reaction – acidic, saline and sodic soils; soil inorganic colloids – their composition, properties and origin of charge. quality or irrigation water;

UNIT-III

Essential plants nutrients – their functions and deficiency symptoms in plants; important inorganic fertilizers and their reactions in soils. Use of saline and sodic water for crop production, Gypsum requirement for reclamation of sodic soils and neutralising

UNIT-IV

Crop seasons. Methods, time and depth of sowing of major field crops. Methods and time of application of manures and fertilizers. Organic farming-Sustainable agriculture. weeds and their control, crop rotation, cropping systems, Relay cropping and mixed cropping. Practice of ploughing, Practice of Puddling, Practice of sowing.

Text Book:

1. William L Donn. 1965. Meteorology. McGraw-Hill Book Co. New York.
2. Arnon L. 1972. Crop Production in Dry Regions. Leonard Hill Publishing Co. London.
3. Yawalkar K S and Agarwal J P. 1977. Manures and Fertilizers. Agricultural Horticultural Publishing House, Nagpur.
4. Gupta O P. 1984. Scientific Weed Management in the Tropics and Sub- Tropics. Today and Tomorrow's Printers and Publishers. New Delhi.
5. Brady Nyle C and Ray R Well. 2002. Nature and properties of soils. Pearson Education Inc.,New Delhi.
6. Indian Society of Soil Science. 1998. Fundamentals of Soil Science. IARI, New Delhi.
7. Sehgal J.. A. Textbook of Pedology Concepts and Applications. Kalyani Publishers, New Delhi.

8. Hillel D. 1982. Introduction to Soil Physics. Academic Press, London.

Reference Books:

1. Rao V S. 1992. Principles of Weed Science. Oxford and IBH Publishing Co. Ltd. New Delhi.
2. Reddy Yellamanda T and Shankar Reddy G H. 1995. Principles of Agronomy. Kalyani Publishers Ludhiana.

Principles of Soil Science and Agronomy Lab			
SL. No.	**Title of the Experiment**	**Tools and Techniques**	**Expected Skill/Ability**
1	Study of area, production and productivity of important crops.	Field Experiment	Practical and Technical Skills
2	Classification and identification of crops.	Field Experiment	Practical and Technical Skills
3	Raising of cafeteria of important crops.	Field Experiment	Practical and Technical Skills
4	Farm implements, methods of sowing and hands-on experience.	Field Experiment	Practical and Technical Skills
5	Calculation of seed rate and method of sowing of important field crops.	Field Experiment	Practical and Technical Skills
6	Essential nutrients and their role, identification of deficiencies and remedial measures.	Field Experiment	Practical and Technical Skills
7	Study of growth and yield parameters of importantcereals, pulses, oilseeds, commercial and forage crops.	Field Experiment	Practical and Technical Skills
8	Organic manures, green manures and fertilizers. Methods, rates and time of application of manures and fertilizers.	Field Experiment	Practical and Technical Skills
9	Composting methods, Inter cultivation implements and hands-on experience. Weed flora and weed management practices.	Field Experiment	Practical and Technical Skills

10	Methods of irrigation. Calculation of cost of cultivation, gross returns and net returns of important crops. Crops, cropping systems/ farming systems of agro-climate zones of Karnataka.	Field Experiment	Practical and Technical Skills
11	Determination of bulk density; particle density and porosity of soil	Field Experiment	Practical and Technical Skills
12	Determination of organic carbon of soil; Determination of Nitrogen, Determination of Phosphorus and Determination of Potassium;	Field Experiment	Practical and Technical Skills
13	Determination of water quality parameters.	Field Experiment	Practical and Technical Skills

Thermodynamics and Heat Engines – (B23EU0203)

COURSE OVERVIEW

The course on Thermodynamics and Heat Engines holds significant importance for agriculture engineering students as it equips them with the foundational knowledge and skills to comprehend and address complex thermal processes essential in agricultural practices. Understanding thermodynamics aids in optimizing energy utilization, while proficiency in heat engines enhances expertise in the design and maintenance of agricultural machinery, contributing to sustainable and efficient farming practices.

COURSE OBJECTIVE

1. To understand the fundamentals of thermodynamics, encompassing thermodynamic concepts, while comprehending the applications and limitations of the thermodynamic laws.
2. Students will be able to classify heat engines, distinguish between external and internal combustion engines, and comprehend the basic components of engines.
3. Get familiar with different air standard cycles and understand the construction and working of steam engines.
4. Students will be able to understand the principles governing the operation and working of I.C. engines, as well as differentiate the I.C. engine and examine the components that constitute an Internal Combustion (I.C.) engine.
5. Familiarize with terminologies related to engine power and learn methods for the measurement of engine power.
6. Comprehend the basic concept of I.C. engine fuel supply system, fuel ignition system and familiar with valve timing.

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COURSE OUTCOMES (COs)

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

CO#	Course Outcome	POs	PSOs
CO1	Illustrate a knowledge of the basic concepts of thermodynamics to comprehend thermal processes essential in agricultural practices.	1,2,3,4	1,2,3
CO2	Students will gain knowledge of the basic laws of thermodynamics, their applications, and limitations.	1,2,3,4,5,6	1,2,3
CO3	Students will learn comprehension of heat engines, covering their classification, external and internal combustion engines, and the fundamental components of engines.	1,2,3,4,5	1,2,3
CO4	Familiarize with different air standard cycles and their applications in agricultural engineering.	1,2,3,4,6	1,2,3
CO5	Understanding Internal Combustion (I.C.) engines, their classification, principles, operations, and performance evaluation, with a focus on engine power terminology and measurement.	1,2,3,4,5	1,2,3
CO6	Comprehend the basic principles and concepts of the fuel supply system and ignition system.	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	✓	✓	✓	✓	✓	✓

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COURSE ARTICULATION MATRIX

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3										3	3	3
CO2	2	3	3	2	2	3								3	3	3
CO3	2	2	3	2	2									3	3	3
CO4	3	2	3	3		2								3	3	3
CO5	2	3	2	3	2									3	3	3
CO6	2	2	3	2	2									3	3	3

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

COURSE CONTENT THEORY

Thermodynamics and Heat Engines
UNIT-I
Basic concepts of thermodynamics - Thermodynamic system and surroundings. Thermodynamic state, process and cycle. Thermodynamic equilibrium. Gas law and Ideal gas equation. Zeroth and first law of thermodynamics, limitations of first law. Second law of thermodynamics- Carnot cycle, Carnot theorem, entropy.
UNIT-II
Heat engines - Classification of heat engines, external combustion and internal combustion engines, basic components of engine. Air standard cycles - Otto cycle, diesel cycle and dual cycles. Steam engine - Classification of steam engines, construction and working of simple steam engine.
UNIT-III
I.C. Engine- Classification of IC engines, principle and working of IC engine. Two stroke and four stroke cycle engines, comparison of S.I. and C.I. Engine, components of I.C. Engine. Performance of I.C. Engine- terminologies related to engine power, measurement of engine power.
UNIT-IV
Fuel supply systems- Classification and properties of fuels, fuel supply system in S.I and C.I engines. Carburation, fuel injection system, fuel filters. Ignition system – Battery ignition and magneto ignition system. Valve working and valve time diagram. Firing order and firing interval.
Text Books: 1. **R K Rajputh 2007. Engineering Thermodynamics. Laxmi Publications, New Delhi.** 2. **V Ganesan 2012. Internal Combustion engines. Tata McGraw-Hill Publishing company limited, New Delhi.** **Reference Books:**

1. **R Yadav 2012. Thermodynamics and Heat Engines. Central Publishing House. Allahabad**

Thermodynamics and Heat Engines Lab

Sl.No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Tutorials on laws of thermodynamics	Videos and PPT	To understand the principles governing energy transfer and transformation and apply these laws to solve engineering problems.
2	Tutorials on Air standard cycles	Videos and PPT	To learn about different air standard cycles.
3	Study of the principles and working of four-strokes engines	Cut section of four stroke engine	To understand the construction and working of a four-stroke engine.
4	Study of the principles and working of two-strokes engines	Cut section of two stroke engine	To understand the construction and working of a two-stroke engine.
5	Study of the principles and working of S.I. and C.I. engines.	Model of S.I. and C.I. engine	To understand the construction and working of a S.I. and C.I. engine.
6	Study of diesel fuel supply system of I.C. engine	Model of diesel engine fuel supply system	To understand the construction and working of diesel fuel supply system of I.C. engine
7	Study of fuel supply system of a petrol engine	Model of petrol engine fuel supply system	To understand the construction and working of petrol fuel supply system of I.C. engine
8	Study of battery ignition and magneto ignition system	battery ignition and magneto ignition system	To understand the construction and working of ignition and magneto ignition system
9	Determination of Valve /Port timing diagram of four stroke engine	Cut section of four stroke engine	To understand and compare the actual and ideal valve/port opening times of four stroke engine.
10	Solve numeric problems on the performance of an IC engine	Calculator	Develop numerical problem solving skills
11	A visit to food processing plant showing the thermodynamics applications/ devices	Transport facilities	Developing students' practical insights into thermodynamic applications in processing industries and gaining exposure to real-world

			applications.

Course: Unit Operations in Agricultural Processing - (B23EU0204)

Theory syllabus

Unit Operations in Agricultural Processing
UNIT-I
Introduction to agricultural processing: Introduction, importance, principles, and applications of different unit operations in agricultural processing. **Cleaning, grading and scalping** – sieving, types of sieves, cleaning efficiency, effectiveness of screens, Various types of separators: specific gravity, magnetic, disc, spiral, pneumatic, inclined draper, velvet roll, colour sorters, cyclone.
UNIT-II
Drying: Principles, theories of drying, constant and falling rate periods of drying, parameters affecting drying. **EMC concept:** static and dynamic methods and EMC models. Types of dryers, batch and continuous. Drying models.
UNIT-III
Size reduction: Principles of size reduction, crushing efficiency. Size Energy and power requirements - Rittinger's, Bond's and Kick's law. Methods of crushing, impact, shearing and cutting. Cereal grinding, degree of grinding, hulling/milling efficiency and various equipment's. **Milling equipment's:** Crushers, grinders, fine grinders and cutting machines types, operation and performance
UNIT-IV
Oil expression: hydraulic press and screw press. **Material handling:** Concept, mechanical devices for handling agricultural produce, belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor**,** Trucks (refrigerated/ unrefrigerated).
Text Book: 1. K. M. Sahay and K. K. Singh., Unit operations agricultural processing, 2009, Second Revised Edition, Vikas Publishing House Pvt Ltd. Noida (UP). Reference Books: 1. A. Chakraverty, Post harvest technology of cereals, pulses, and oil seeds. 2019. Oxford IBH Publishing Co. Pvt. Ltd. New Delhi. 2. Handbook of Agrucultural Engineering, 2013, Directorate of Knowledge Management In Agriculture, Indian Council of Agricultural Research, New Delhi. ISBN: 978-81-7164-134-5.

Practical

Unit Operations in Agricultural Processing Lab			
SL. No.	**Title of the Experiment**	**Tools and Techniques**	**Expected Skill/Ability**
1	Determination of dry basis and wet basis moisture content of the some of the agricultural products.	Gravimetric method, Hot air oven, moisture boxes, and weighing balance.	Measurement skills and ability to calculate moisture content
2	Determination of fineness modulus and practical size analysis	Sieve Shaker	To study the partical size of grinded product
3	Study on different types dryers	Continuous and batch types of dryers	Understand concept and principles

4	Solve numerical problems on EMS	Calculator	Develop numerical problem solving skills
5	Solve numerical problems on power requirement in grinding by Kicks law Rittingers law	Calculator	Develop numerical problem solving skills
6	Solve numerical problems on power requirement in grinding by Bonds law	Calculator	Develop numerical problem solving skills
7	Study on crushers, grinders, fine grinders and cutting machines	ball mill	Understand working principles, operations and applications
8	Study on crushers, grinders, fine grinders and cutting machines	Hammer mill	Understand working principles, operations and applications
9	Study on design requirements of belt conveyor.	Belt conveyor unit, Measurement tape, Calculator, Tachometer, and Energy meter.	Understand the design and fabrication skills of belt conveyor
10	Study on design requirements of screw conveyor.	Screw conveyor unit, Measurement tape, Calculator, Tachometer, and Energy meter.	Acquire skills on design of screw conveyor
11	Study on design requirements of bucket elevator.	Bucket elevator unit, Measurement tape, Calculator, Tachometer, and Energy meter.	Explore skills on design and fabrication of bucket elevator
12	Visit to food processing industries	Transport facilities	Develop student's knowledge on different industries unit operations and exposures.

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Soil Mechanics – (B23EU0205)

Course Overview:

Soil Mechanics is a fundamental course within the agricultural engineering program that focuses on the behavior, properties, and engineering characteristics of soils relevant to agricultural applications. This course aims to equip students with a comprehensive understanding of soil mechanics principles specific to agricultural engineering, enabling them to analyze soil behavior, assess soil-water interactions, and design appropriate agricultural structures and systems. Through a combination of theoretical knowledge and practical applications, students will develop the necessary skills to make informed decisions in agricultural engineering projects and promote sustainable land management practices.

COURSE OBJECTIVE

1. To impart the students the fundamentals of soil mechanics and to enable the students to understand the basic, index and engineering properties of soil.
2. To equip the students to understand the properties and behavior of soil for the design of foundations, earth and earth retaining structures.
3. Students will be able to assess erosion risks, design erosion control measures and implement soil conservation practices to protect agricultural land from soil erosion and improve sustainability.
4. Students will be able to analyze the behavior of soil-structure systems, assess load-bearing capacity and design stable agricultural structures on soil conditions.
5. Students will understand the water movement in soil and its implications for irrigation practices, soil erosion prevention, and drainage system design in agricultural fields.
6. Students will be able to assess and control soil compaction to optimize soil conditions for crop growth, irrigation, and drainage in agricultural fields.

COURSE OUTCOMES (COs)

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

CO#	Course Outcome	POs	PSOs
CO1	Impart fundamentals of soil mechanics and understand basic, index, and engineering properties of soil.		
CO2	Equip students to Understand plasticity index, particle size classification, and textural classification methods.		
CO3	Gain insights into physical and biological soil classifications, analyze soil structure, and understand stress conditions in soils.		
CO4	Analyze permeability and its influencing factors, shear strength with emphasis on Mohr stress circles, direct shear test for shear parameters,		
CO5	Understand shear strength principles,		

	emphasizing Mohr stress circles and their theoretical relationships.		
CO6	Understand plastic equilibrium in soils and the concepts of active and passive states in earth pressure.		

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	PSO4
CO1	3	3											3			
CO2	3	3											3			
CO3	3	3											3			
CO4	3	3											3			
CO5	3	3											3			
CO6	3	3			3								3	2		

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

COURSE CONTENT THEORY

Soil Mechanics
UNIT-I
Introduction of soil mechanics, phase diagram, Water content; Bulk Density, Particle density, Unit weight of soil; Specific gravity; Void ratio; Porosity; Degree of saturation; Functional relationships; Importance of Business and Wester guards analysis, new mark influence chart.
UNIT-II
Determination of index properties; Liquid limit; Plastic limit; Shrinkage limit; Plasticity index; Particle size classification; Textural classification; Unified soil classifications; and Indian standards classification; Physical and Biological Classification of Soil; Soil structure; Modes of occurrence of water in soils; Stress

condition in soil;
UNIT-III
Permeability; Factors affecting permeability; Shear strength, Mohr stress circle and theoretical relationship between principle stress circle; Determination of shear parameters by direct shear test; Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory, Laboratory consolidation test, calculation of void ratio and coefficient of volume change, Taylor's and Casagrande's method, determination of coefficient of consolidation.
UNIT-IV
Earth pressure: plastic equilibrium in soils, active and passive states, importance of Rankine's theory of earth pressure, Stability of slopes: introduction to stability analysis of infinite and finite slopes friction circle method, Taylor's stability number. Remote sensing and GIS application for soil mapping
Text Books: 1. Punmia B C, Jain A K and Jain A K. 2005. Soil Mechanics and Foundations. Laxmi Publications (P) Ltd. New Delhi. 2. Ranjan Gopal and Rao A S R. 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi. 3. Singh Alam. 1994. Soil Engineering Vol. I. CBS Publishers and Distributions, Delhi Reference Books 1. Cudoto, Geotechnical Engineering Principles and Practices, Pearson Education, 2007 2. Gopal Ranjan&Rao A. S. R., Basic & Applied Soil Mechanics, New Age International Publishers, 2000 3. Khan I.H., Text Book of Geotechnical Engineering, Prentice Hall of India 4. Terzaghi K. & Peck R.B., Soil Mechanics in Engineering Practice, John Wiley & Sons, US, 1967. 5. Venkatramiah C., Geotechnical Engineering, New Age International Publishers, 2006.

Soil Mechanics Lab

Sl. No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1.	Determination of water content by *Oven Drying method*	Instrumental	Conduction of Experiments
2.	Determination of Bulk density by *core cutter method*	Instrumental	Conduction of Experiments
3.	Determination of Bulk density by *Sand replacement*	Instrumental	Conduction of Experiments

	method		
4.	Determination of particle size distribution of soils by *Sieve Analysis*	Instrumental	Conduction of Experiments
5.	Determination of particle size distribution of soils by *Hydrometer method*	Instrumental	Conduction of Experiments
6.	Determination of liquid limit of soil	Instrumental	Conduction of Experiments
7.	Determination of Plastic limit and plasticity index of soil	Instrumental	Conduction of Experiments
8.	Determination of Shrinkage limit of soil	Instrumental	Conduction of Experiments
9.	Determination of *Proctor compact* test of soil	Instrumental	Conduction of Experiments
10.	Determination of permeability by *constant head permeameter* method.	Instrumental	Conduction of Experiments
12	Determination of permeability by *falling head permeameter* method.	Instrumental	Conduction of Experiments
13.	Determination of OMC of soil under compaction	Instrumental	Conduction of Experiments
14.	Determination of angle of repose of different soil textures	Instrumental	Conduction of Experiments
15	Remote Sensing and GIS application in soil Mapping	Software/ARC GIS	Practice

Engineering Mechanics and Strength of Materials – (B23EU0206)

COURSE OVERVIEW

This course introduces the students to basic concepts of Engineering Mechanics and Strength of Materials, which are essential for all Agriculturists. The course familiarizes students to learning about mechanical interaction between bodies. That is, students will learn how different bodies apply forces on one another and how they then balance to keep each other in equilibrium, and forces and types of forces, centroid and moment of inertia. Students will learn about basic concept of forces, force systems, beams, trusses, properties of geometric shapes. The course also introduces students to basic concepts of shear force, bending moment and torsion in beams along with analysis of columns, riveted and welded connections.

COURSE OBJECTIVE

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

1. To understand a broad concept of Engineering Mechanics.
2. To enable students to apply fundamentals and basic concepts of Rigid body Mechanics to solve problems of bodies in rest.

3. To enable the students to apply concepts of dynamics to bodies in motion.
4. To analyze the civil engineering structures namely simple frames and determinate trusses.
5. To provide an overview of moment of inertia of plane area, simple stresses and strains.

To understand shear force, bending moments and bending stresses in beams, analysis of columns and bolted and welded connections

To understand the concept of Beams and Friction in Civil Engineering.

CO#	Course Outcome	POs	PSOs
1	Ability to understand basics of mechanics related to Particle, Continuum and Rigid body; Forces, Couple & moment of couple.	1,2	2
2	Analyze civil Engineering Structures using static equilibrium conditions.	1,2,3,4,5	2,4
3	Apply concepts of dynamics to bodies in motion.	1,2,3,4,5	2,4
4	Analyze the civil engineering structures namely simple frames and determinate trusses.	1,2,3,4,5	2,4
5	Determine moment of inertia of plane area, simple stresses and strains in materials.	1,2,3,4,5	2,4
6	Analysis of beams for shear force, bending moments and bending stresses, analysis of columns and bolted and welded connections.	1,2,3,4,5	2,4

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	PSO4
CO1	3	3												1		
CO2	3	3			1									3		1
CO3	3	3	1	1	3									3		3

CO4	3	3	2	1	3								3		3
CO5	3	3	2	1	3								3		2
CO6	3	3	1	1	3								3		3

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

COURSE CONTENT THEORY

Detailed Course-wise Syllabus

ENGINEERING MECHANICS AND STRENGTH OF MATERIALS 2(1+1)

Engineering mechanics and Strength of Materials
UNIT-I
Basic concepts- Force systems, free body diagram and equilibrium of forces. Frictional forces- laws of friction, coefficient of friction, principles of dynamics. De-Alemberts principles.
UNIT-II
Moment of inertia - Centroid of different figures, moment of inertia of plane laminae and solid bodies. Analysis of frames - simple frames, Trusses- methods of joints and sections.
UNIT-III
Work, power and energy. Simple stresses – Stress-strain analysis - tensile, compressive and shear forces
UNIT-IV
Stresses in beams -shear force and bending moment diagrams of simply supported and cantilever beams. Columns and struts. Riveted and welded connections. Torsion and bending stresses in beams.
Text Book: **1.** M.N. Shesha Prakash and Ganesh.B. Mogaveer, "Elements of Civil Engineering and Engineering Mechanics", PHI Learning, 3rd Revised edition. **2.** Engineering Mechanics by RS Khurmi, S Chand and Company. **3.** Strength of Materials by S. Ramamurtham, Lakshmi Publications **Reference Books:** 1. A. Nelson, "Engineering Mechanics-Statics and Dynamics", Tata Mc-Graw Hill Education Private Ltd, New Delhi, 2009 2. S. S. Bhavikatti, "Elements of Civil Engineering", New Age International Publisher, New Delhi, 3rd edition 2009.

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Engineering mechanics and Strength of Materials Lab			
SL. No.	**Title of the Experiment**	**Tools and Techniques**	**Expected Skill/Ability**
1	Verification of the laws of forces and reactions and exercises on equilibrium of forces, moment and couples.		Analytical
2	Problems relating to centroids of composite areas		Analytical
3	Analysis of simple trusses by graphical method		Analytical
4	To perform the tension test on metal specimen (M.S., C.I.), To study the behavior of materials (G.I. pipes, M.S., C.I.) under torsion and to evaluate various elastic constants;		Analytical
5	To study load deflection and other physical properties of closely coiled helical spring in tension and compression;		Analytical
6	To perform the Rockwell, Vicker's and Brinell's Hardness tests on the given specimens;		Analytical
7	To perform the Drop Hammer Test, Izod Test and Charpay's impact tests on the given specimens;		Analytical
8	To determine compressive and tensile strength of cement after making cubes and briquettes;		Analytical
9	To measure workability of concrete (slump test, compaction factor test);		Analytical
10	To determine voids ratio & bulk density of cement, fine aggregates and coarse aggregates.		Analytical

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Course: Communication Skills – (B22AH0103)

Course Title	Communication Skills				Course Type		FC	
Course Code	B22AH0103	Credits	1		Class		II Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number ofClasses Per Semester		Assessment Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	Total	**1**	**2**	**2**	**28**	**0**	**50%**	**50%**

Course Description: 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 OBJECTIVE (S):

The Course objectives are to

1. Develop basic communication skills in English.
2. Emphasize the development of speaking skills amongst learners of Engineering and Technology
3. Impart the knowledge about the use of electronic media such as the internet and supplement the learning materialsused in the classroom.
4. Inculcate the habit of reading and writing leading to effective and efficient communication.

COURSE OUTCOMES: (COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate speaking ability with clarity, confidence, and comprehension an communicate with one or many listeners using appropriate communicative strategies (Speaking Skills).	10	
CO2	Develop the ability to write cohesively, coherently, and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically o a topic (Writing skills).	10	
CO3	Make use of reading different genres of texts by adopting various reading strategies(Reading Skills).	10	
CO4	Take part in interviews confidently and develop accurate writing skills.	10	

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BLOOM'SLEVELOFTHECOURSEOUTCOMES

CO#	Bloom's Level					
	Remembe r	Understan d	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
CO 1										3					
CO 2										3					
CO 3										3					
CO 4										3					

COURSECONTENT

THEORY

Contents
UNIT–1 **Functional English:** Language as a Tool of Communication, - Effective Communication-Modes of Communication-Email communication - Giving Instructions.
UNIT–2 **Interpersonal Skills:** Traits of good Listener types of Listening-- Formal letters (Accepting/ inviting/ declining); Personal letters (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends/relatives, - Process descriptions (general/specific).
UNIT-3 **Multitasking Skills:** Types of Speaking- Paralinguistic Features-Types of paragraphs (cause and effect / compare and contrast /narrative / analytical); Report Writing (Feasibility/ Project report - report format –

recommendations/ suggestions, PPT).

UNIT–4

Persuasive Skills: Reading and Interpretation- SQ3R- Making inference from the reading passage; predicting the content of areading passage, - Different types of Essay Writing, applying for a job; Writing a cover letter with résumé / CV.

Textbooks:

1. Thorpe, Edgar and Showick Thorpe" Objective English". Pearson Education, 2013.
2. Dixson, Robert J. "Everyday Dialogues in English". Prentice Hall India Pvt Ltd., 1988.
3. Turton, Nigel D. "ABC of Common Errors" Mac Millan Publishers, 1995.
4. Ashraf Rizvi, "Effective Technical Communication" McGraw-Hill Education (India) Pvt. LTD., New Delhi, 2018.

Reference Books:

1. Bansal, R.K. and J.B. Harrison. Spoken English. Orient Blackswan, 2013.
2. 2.Raman, Meenakshi and Sangeeta Sharma. Technical Communication. Oxford University Press, 2015.
3. 3.Samson, T. (ed.) Innovate with English. Cambridge University Press, 2010.

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III Semester

Sl. No	Course Code	Title of the Course	HC/ FC /SC/ OE/ MC/ SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category (Asper AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23AS0305	Numerical Methods and Laplace Transformation	FC	3	0	0	3	4	50	50	100	BSC
2	B23EU0301	Tractor and Automotive Engines	HC	2	0	1	3	4	50	50	100	PCC
3	B23EU0302	Farm Machinery and Equipment-I	HC	2	0	1	3	4	50	50	100	PCC
4	B23EU0303	Engineering Hydrology	HC	2	0	1	3	4	50	50	100	PCC
5	B23EU0304	Heat and Mass Transfer in Agriculture Engineering	HC	2	0	1	3	4	50	50	100	PCC
6	B23EU0305	Dairy and Food Process Engineering	HC	2	0	1	3	4	50	50	100	PCC
7	B23EU0306	Fluid Mechanics and open channel hydraulics	HC	2	0	1	3	4	50	50	100	PCC
8	B24CS0104	Fundamental of Data Science	FC	2	0	0	2	2	50	50	100	PCC
TOTAL				**17**	**0**	**6**	**23**	**30**	**400**	**400**	**800**	
TOTALSEMESTERCREDITS				**23**								
TOTALCUMULATIVECREDITS				**23**								
TOTALCONTACTHOURS				**30**								
TOTALMARKS				**800**								

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Tractor and Automotive Engines – (B23EU0301)

Course Details:

(a). Course description: This course on Tractor and Automotive Engines is essential for agricultural engineering students. It provides foundational knowledge and skills to understand the status of farm mechanization, particularly focusing on farm power availability in the Indian farming sector and sources of power for farming activities. The course delves deeply into the tractor system, comprehensively covering engine construction, working principles, and maintenance. This knowledge aids in optimizing energy utilization and enhances proficiency in heat engines, contributing to the design and maintenance of agricultural machinery for sustainable and efficient farming practices.

(b). Course contents:

COURSE OBJECTIVE

1. Understand the sources and status of farm mechanization in India, including the classification of farm power and the different types of farm tractors. Review thermodynamic cycles.
2. Learn the principles governing the operation and working of internal combustion (I.C.) engines, differentiate between types of I.C. engines, and examine their components.
3. Become familiar with different fuels used in automotive engines, their properties, and the various fuel supply systems, including their working principles. Understand the valve timing mechanism.
4. Understand the principles and operation of engine governing systems, including the types of governors, their regulation, and hunting of governors.
5. Gain knowledge of engine lubrication and cooling systems, including their classification, troubleshooting, care, and maintenance.
6. Comprehend the basic concepts of tractors, fuel ignition systems, and become familiar with valve timing and firing order.

COURSE OUTCOMES (COs)

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

CO#	Course Outcome	POs	PSOs
CO1	derstand the sources and status of farm mechanization in India, including the classification of farm power and the different types of farm tractors. Review thermodynamic cycles.	1,2,3,4	1,2,3
CO2	Learn the principles governing the operation and working of internal combustion (I.C.) engines, differentiate between types of I.C. engines, and examine their components.	,2,3,4,5,6	1,2,3
CO3	Become familiar with different fuels used in automotive engines, their properties, and the various fuel supply systems, including their working principles. Understand the valve timing mechanism.	1,2,3,4,5	1,2,3
CO4	Understand the principles and operation of engine governing systems, including the types of governors, their regulation, and hunting of	1,2,3,4,6	1,2,3

	governors.		
CO5	Gain knowledge of engine lubrication and cooling systems, including their classification, troubleshooting, care, and maintenance.	1,2,3,4,5	1,2,3
CO6	Comprehend the basic concepts of tractors, fuel ignition systems, and become familiar with valve timing and firing order.	1,2,3,4,5	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	pply (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	PSO4
CO1	3	2	3	3										3	3	3
CO2	2	3	3	2	2	3								3	3	3
CO3	2	2	3	2	2									3	3	3
CO4	3	2	3	3		2								3	3	3
CO5	2	3	2	3	2									3	3	3
CO6	2	2	3	2	2									3	3	3

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

COURSE CONTENT THEORY

Tractor and Automotive Engines – (B23EU0301)
UNIT-I
Farm power and Farm mechanization- Status of farm power and farm mechanization in India, Sources of farm power, Conventional & non-conventional energy sources. Farm Tractors-classification and selection of farm tractors. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. Study of engine components, their construction, operating principles and functions. Study of engine strokes and comparison of two-stroke and four-stroke engine cycles and CI and SI engines. Measurement of engine power.
UNIT-II

Fuel System-properties of fuel, quality of fuel. Fuel supply system in SI and CI engines. Carburation system- carburettors and their main functional components. Fuel injection system- Injection pump, their types, working principles. Fuel injector nozzles-types and working principle. Fuel filters and air cleaners. Engine Valve systems, valve mechanism, Valve timing diagram. Firing order and firing interval.
UNIT-III
Engine governing system-concept, working principle, classification, governor regulation and hunting. Lubrication System- types of lubricants, properties of lubricants and requirement of lubrication system. Types of lubrication system-splash system, forced feed lubrication system. Troubles in lubrication system, care and maintenance of lubrication system
UNIT-IV
Engine cooling system – need, cooling methods and main functional components. Air cooling and water cooling. Study of need and type of thermostat valves, Additives in the coolant. Study of radiator efficiency. care and maintenance of cooling system. ignition system of SI engines-concept, types and principle of working. Types of ignition system- battery ignition and magneto ignition system. Other method of ignition system.
Text Books: **2. Liljedahl J B and Others, 2007. Tractors and Their Power units. Van Nostrand Reinhold Company, New York.** **3. Rodichev V and G Rodicheva. "Tractors and Automobiles" 2nd Edition, 2019.** **Reference Books:** **1. V Ganesan 2012. Internal Combustion engines. Tata McGraw-Hill Publishing company limited, New Delhi.** **2. Dr. Jagadishwar Sahay, 2015. Elements of Agricultural Engineering. Standard Publisher Distributors, New Delhi**

Tractor and Automotive Engines Lab

Sl. No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Status of farm power and farm mechanization in India	Videos and PPT	To comprehend the extent of farm power availability and the level of farm mechanization in India's agricultural sector.
2	Study of the principles and working of four-strokes engines	Cut section of four stroke engine	To understand the construction and working of a four-stroke engine.
3	Study of the principles and working of two-strokes	Cut section of two stroke engine	To understand the construction and working of a two-stroke engine.

	engines		
4	Study of diesel engine fuel supply system	Model of diesel engine fuel supply system	To understand the construction and working of diesel engine fuel supply system of I.C. engine
5	Study of fuel supply system of a petrol engine	Model of petrol engine fuel supply system	To understand the construction and working of petrol engine fuel supply system
6	Determination of Valve /Port timing diagram of four stroke engine	Cut section of four stroke engine	To understand and compare the actual and ideal valve/port opening times of four stroke engine.
7	Study of lubrication system of I.C. engine	Model of I.C. engine lubrication system	To understand the construction and working of lubrication system of I.C. engine
8	Study of cooling system of I.C. engine	Model of I.C. engine cooling system	To understand the construction and working of cooling system of I.C. engine
9	Study of battery ignition and magneto ignition system	Battery Ignition and Magneto Ignition System	To understand the construction and working of battery ignition and magneto ignition system
10	Solve numeric problems on the Measurement of engine power and performance of an IC engine	Calculator	Develop numerical problem solving skills.
11	A visit to tractor/ engine manufacturer/ assembler/ spare parts agency	Transport facilities	Developing students' practical insights in the tractor industry and gaining exposure to real-world applications.

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Farm Machinery and Equipment-I – (B23EU0302)

Course Details:

(a). Course description: This course on Farm Machinery and Equipment-I is essential for agricultural engineering students, focusing mainly, the tillage and sowing operations. It provides foundational knowledge and skills to understand the objectives, methods, and implements used in these operations. The course offers a comprehensive overview of the different implements, including their principles, working mechanisms, design, construction, and maintenance. This knowledge helps optimize design parameters and equips students with insights to design and develop innovative implements and machinery for tillage and sowing operation.

(b). Course contents:

COURSE OBJECTIVE

1. Understand the sources and status of farm mechanization in India, including the classification of farm power. Learn about the different materials used in machinery production and the various heat treatments employed, especially for agricultural machinery components.
2. Familiarize with performance indices and the economics of machinery usage.

3. Understand the objectives, methods, and different tillage tools used in tillage operations, along with comprehending soil-tool interactions.
4. Learn about secondary tillage operations and become familiar with different secondary tillage tools used in agriculture, including miscellaneous tillage tools.
5. Understand the draft requirements and measurement of draft in actual field conditions, including numerical analysis of field operations.
6. Learn about different sowing methods and sowing devices, and become familiar with seed drill calibration.

COURSE OUTCOMES (COs)

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

CO#	Course Outcome	POs	PSOs
CO1	Understand the sources and status of farm mechanization in India, including the classification of farm power. Learn about the different materials used in machinery production and the various heat treatments employed, especially for agricultural machinery components.	1,2,3,4	1,2,3
CO2	Familiarize with performance indices and the economics of machinery usage.	,2,3,4,5,6	1,2,3
CO3	Understand the objectives, methods, and different tillage tools used in tillage operations, along with comprehending soil-tool interactions.	1,2,3,4,5	1,2,3
CO4	Learn about secondary tillage operations and become familiar with different secondary tillage tools used in agriculture, including miscellaneous tillage tools.	1,2,3,4,6	1,2,3
CO5	Understand the draft requirements and measurement of draft in actual field conditions, including numerical analysis of field operations.	1,2,3,4,5	1,2,3
CO6	Learn about different sowing methods and sowing devices, and become familiar with seed drill calibration.	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

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3										3	3	3
CO2	2	3	3	2	2	3								3	3	3
CO3	2	2	3	2	2									3	3	3
CO4	3	2	3	3		2								3	3	3
CO5	2	3	2	3	2									3	3	3
CO6	2	2	3	2	2									3	3	3

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

COURSE CONTENT THEORY

Farm Machinery and Equipment-I
UNIT-I
Farm Power and Mechanization-Introduction, objectives and status of mechanization in India, sources of farm power. Materials of construction of farm Equipment-Introduction to steels and alloys for agricultural application. Identification of heat treatment processes specially for the agricultural machinery components. Calculation of field capacities, field efficiency and economics of machinery usage.
UNIT-II
Tillage: Objectives, Methods, and Terminology; Introduction and Classification of Primary and Secondary Tillage Equipment. Primary Tillage Implements: Indigenous Plough, Mouldboard Plough, Disc Plough. Study of Mouldboard Plough: Accessories, Adjustments, Operation, and Material of Construction. Disc Plough: Standard and Vertical; Principle of Operation, Adjustments, and Accessories. Sub-soiler and Chisel Plough: Types, Working, and Construction. Tillage Force Analysis : Forces Acting upon Tillage Tools/Implement.
UNIT-III
Secondary Tillage: Objectives, Implements, Types, Constructional Features, Working Principles, and Operation. Construction and Working of Disc Harrows, Spike-tooth Harrows, and Spring-tine Harrows. Hitching System, Forces for Handling Implements, and Control of Implements. Study of Miscellaneous Tillage Tools: Rotary Tillage Tools, Rotavators, Stirring Ploughs, Auger Ploughs, Rotary Hoes, Oscillating Tools, etc. Measurement of Draft of Tillage Tools and Calculations for Power Requirements of Tillage Machines.
UNIT-IV
Sowing Methods and Practices, Functions, and Constructional Features of Seeding/Planting Machines. Introduction to Seed Drills, No-till Drills, and Strip-till Drills. Introduction to Planters, Bed-Planters, and Other Planting Equipment. Seed Metering Mechanism and Seed Metering Devices, Furrow Openers Used in Seed Drills and Planters. Calibration of Seeding and Planting Machines. Fertilizer Application and Broadcasting Machinery and Their Calibration. Numerical

Analysis on the Performance of Seed Metering Devices.
Text Books: 1. **Ojha, T. P., and Michael, A. M. "Principles of Agricultural Engineering Vol. I." Jain Brothers, New Delhi, 2011.** 2. **Sahay, J. "Elements of Agricultural Engineering." Standard Publishers and Distributors, New Delhi, 2015."Reference Books:** **Reference book:** **R. A. Kepner., Roy Bainer and E. L. Barger, 2015. Principles of Farm Machinery. CBS Publishers, Bengaluru.** **Yadav, R and Solanki, H. B." Numerical and Short Questions in Farm machinery, Power and Energy in Agriculture". New India Publishing Agency, New Delhi, 2009**

Farm Machinery and Equipment-I Lab

Sl.No	Title of the Experiment	Tools and Techniques	Expected Skill/Ability
1	Study of heat treatment processes subjected to critical components of agricultural machinery.	Videos and ppt	To understand the different heat treatment processes applied or used in the production of critical components of agricultural machinery.
2	Familiarization with different farm implements and tools	farm implements and tools	to familiarize students with various farm implements and tools.
3	Study of hitching systems	Tractor hitching system	To understand different hitching systems and their applicability in actual field conditions with various implements.
4	Study of primary tillage implements – construction, operation and adjustments.	Mb plough and disc plough	To understand the construction and working of moldboard ploughs and disc ploughs, and their adjustment in actual field conditions.
5	Study of secondary tillage implements – construction, operation and adjustments.	Disc Harrow	To understand the construction and working of Disc Harrow, and their adjustment in actual field conditions.
6	Measurement of draft requirements of tillage implements.	Dynamometer, tractor and farm implements	To understand the method of measuring the draft requirement of tillage implements, enhancing understanding of the force necessary for optimal operation,

			and aiding in informed implement selection and usage.
7	Calculation of field capacity and field efficiency of the farm implements	Tractor, farm implement, stop[watch, tape and calculator	To become acquainted with calculating the field capacity and field efficiency of various farm implements to analyze their field performance.
8	Study of different sowing methods	Dibbler, broadcaster and seed drill	To understand the different sowing methods and their applicability in various regions and seasons in actual field conditions.
9	study of sowing and planting equipment – construction, types, and adjustments.	Dibbler, broadcaster, seed drill and planters.	To understand the construction and working of different sowing equipment.
10	Calibration of seed drill	Seed drill, lifting jack, seed containers and weighing balance	To understand the calibration of a seed drill is to ensure the precise adjustment of seed rates, ensuring accurate planting and optimal crop growth
11	Study of different furrow openers	Different furrow openers	To understand the different sowing methods and their applicability in various soil conditions.
12	Visit to farm machinery manufacturing/training/testing/service center	Transport facilities	Developing students' practical insights in the various farm implements and gaining exposure to real-world applications.

Course Pack: Engineering Hydrology – (B23EU0303)

. Course Details:

(a). Course description: This course provides a focused study of hydrology and watershed management, covering the hydrologic cycle, rainfall measurement, and analysis, along with key hydrologic processes such as infiltration and evaporation. It includes methods for runoff estimation, watershed geomorphology, hydrograph analysis, and flood management techniques, as well as drought classification and management strategies.

(b). Course contents:

COURSE OBJECTIVE

1. U**nderstand Hydrologic Processes**: To provide a fundamental understanding of the hydrologic cycle, precipitation, and related processes.
2. **Develop Skills in Rainfall and Runoff Analysis**: To equip students with the skills to measure, estimate, and analyze rainfall and runoff using various methods and tools.
3. **Explore Hydrologic Data Interpretation**: To teach students how to interpret and utilize hydrologic data for designing water management systems.
4. **Study Watershed Geomorphology**: To introduce the concepts of watershed geomorphology and its importance in hydrologic studies.
5. **Analyze Flood and Drought Management**: To provide insights into flood routing, flood peak estimation, and drought management strategies.

6. **Apply Hydrologic Models**: To enable students to apply hydrologic models and methods like the Rational Method, SCS Curve Number Method, and others in practical scenarios.

Course Outcome

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

CO#	Course Outcome	POs	PSOs
CO1	Students will understand the hydrologic cycle and rainfall measurement techniques: Ability to explain the hydrologic cycle, different forms of precipitation, and accurately measure and estimate mean rainfall.	1,2,3,4,5	1,2,3
CO2	Students will analyze and interpret rainfall data: Proficient in performing frequency analysis, and utilizing mass curves, hyetographs, and IDF relationships for rainfall analysis.	1,2,3,4,5	1,2,3
CO3	Students will evaluate hydrologic processes and runoff dynamics: Skilled in analyzing interception, infiltration, evaporation, and measuring runoff using stage-discharge rating curves.	1,2,3,4,5	1,2,3
CO4	Students will estimate peak runoff and analyze watershed geomorphology: Capable of estimating peak runoff rate and volume using various methods and understanding watershed geomorphology, including stream order and drainage density.	1,2,3,4,5	1,2,3
CO5	Students will apply advanced hydrologic analysis methods: Proficient in using unit hydrograph theory, S-curve, and synthetic hydrographs for flood analysis.	1,2,3,4,5	1,2,3
CO6	Students will manage flood and drought scenarios effectively: Skilled in stream gauging, flood routing, and developing strategies for flood management and drought mitigation.	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

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2																
CO3																
CO4																
CO5																
CO6																

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

Theory syllabus

Engineering Hydrology
UNIT-I
Fundamentals of Hydrology and Rainfall Analysis: Hydrologic cycle, precipitation and its forms, rainfall measurement and estimation of mean rainfall, frequency analysis of point rainfall. Mass curve, hyetograph, depth-area- duration curves and intensity-duration-frequency relationship.
UNIT-II
Hydrologic Processes and Runoff Dynamics: Hydrologic processes- Interception, infiltration -factors influencing, measurement and indices. Evaporation - Estimation and measurement. Runoff - Factors affecting, measurement, stage - discharge rating curve.
UNIT-III
Runoff Estimation and Watershed Geomorphology: Estimation of peak runoff rate and volume using Rational method, Cook's method and SCS curve number method. Geomorphology of watersheds – Linear, aerial and relief aspects of watersheds- stream order, drainage density and stream frequency. Hydrograph - Components, base flow separation,
UNIT-IV
Advanced Hydrologic Analysis, Flood Management, and Drought Strategies: Unit hydrograph theory, S- curve, synthetic hydrograph, applications and limitations. Stream gauging - discharge rating curves, flood peak, design flood and computation of probable flood. Flood routing. Channel and reservoir routing. Drought – classification, causes and impacts and drought management strategy.
Text Books:
1 Raghunath, H.M. 2006. Hydrology: Principles Analysis and Design. Revised 2nd Edition, New Age International (P) Limited Publishers, New Delhi. 2. Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi. 3. Suresh, R. 2005. Watershed Hydrology. Standard Publishers Distributors, Delhi.

Reference Books:

1. Varshney, R.S. 1986. Engineering Hydrology. Nem Chand and Brothers, Roorkee, U.P.
2. Jaya Rami Reddy, P. 2011. A Text Book of Hydrology. University Science Press, New Delhi.
3. Linsley, R.K., M.A. Kohler, and J.L.H. Paulhus. 1984. Hydrology for Engineers. McGraw-HillPublishing Co., Japan.

ENGINEERING HYDROLOGY LAB

Sl. No	Title of the Experiment	Tools and equipment's	Expected Skill/Ability
1	Design of rain gauge network. Exercise on intensity - frequency - duration curves	Rain gauges, Rainfall data records, graph paper or plotting software, statistical software, rulers.	Focuses on constructing and analyzing IDF curves with rainfall data and statistical tools to understand rainfall intensity, duration, and frequency relationships.
2	Exercise on depth - area - duration and double mass curves. Analysis of rainfall data and estimation of mean rainfall by different methods.	Graph paper or plotting software, rainfall data records, rulers and compasses.	Construct and analyze depth-area-duration and double mass curves to assess rainfall distribution and trends.
3	Exercise on frequency analysis of hydrologic data and estimation of missing data, testfor consistency of rainfall records.	Graph paper or plotting software, rainfall data records, rulers and compasses	Perform frequency analysis to identify patterns and return periods of hydrologic events and Estimate missing data and test for consistency in rainfall records to ensure data reliability.
5	Exercise on computation of infiltration indices. Computationof peak runoff and runoff volume by Cook's method and rational formula.	Infiltrometers, data analysis software, rainfall and soil data.	Calculate infiltration indices to evaluate soil's infiltration capacity and characteristics and Compute peak runoff and runoff volume using Cook's method and the Rational formula to estimate surface runoff in different scenarios.
6	Computation of runoff volume by SCS curve number method.	Rainfall data, land use and soil data,	Students will Calculate runoff volume using the SCS curve

		SCS curve number tables.	number method, applying data on rainfall, land use, and soil properties to estimate surface runoff.
7	Visit to meteorological observatory and study of different instruments	-	Students will Observe and learn the operation of various meteorological instruments such as barometers, anemometers, hygrometers, and rain gauges, and understand their applications in weather and climate data collection.
8	Study of stream gauging instruments - current meter and stage level recorder.	Rainfall and Soil data	Understand the operation of current meters and stage level recorders for measuring stream flow and water levels, and gain skills in stream gauging and data collection.
9	Exercise on geomorphic parameters of watersheds. Exercise on runoff hydrograph. Exercise on unit hydrograph. Exercise on synthetic hydrograph	Rainfall and Soil data	Skills in analyzing and interpreting rainfall and runoff data to understand watershed behavior and response.
10	Exercise on flood routing.	Floods data records	Model and analyze flood routing through channels and reservoirs, and understand the impact of flood waves on different sections of a watershed.

COURSE PACK: Heat and Mass Transfer in Agriculture Engineering – (B23EU0304)

<table>
<tr><td>Course Title</td><td colspan="4">Heat and Mass Transfer</td><td colspan="2">Course Type</td><td colspan="2">Regular</td></tr>
<tr><td>Course Code</td><td>B23EU0304</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">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 in 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>Tutorial</td><td>0</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>4</td><td>4</td><td>28</td><td>14</td><td>50 %</td><td>50%</td></tr>
</table>

REVA UNIVERSITY
Bengaluru, India

COURSE OVERVIEW

Heat and Mass Transfer is a vital course within the agricultural engineering program that focuses on the principles and applications of heat and mass transfer relevant to agricultural systems. This course aims to provide students with a comprehensive understanding of the mechanisms of heat and mass transfer in various agricultural processes, enabling them to analyze and design efficient energy transfer and transport phenomena. Through a combination of theoretical knowledge and practical applications, students will develop the necessary skills to address real-world heat and mass transfer challenges in agricultural engineering projects and promote sustainable agricultural practices.

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

CO#	Course Outcome	POs	PSOs
CO1	To develop student's knowledge through well organized, core principles and aspects based heat and mass transfer phenomenon.	1,2,3,4,5	1,2,3
CO2	Explore student's knowledge on different heat and mass transfer applications in food processing industries.	1,2,3,4,5	1,2,3
CO3	To improve student's skills based on the principles and applications of heat and mass transfer for value addition of agricultural produces.	1,2,3,4,5	1,2,3
CO4	Explore heat transfer principles in food preservation techniques such as canning, pasteurization, and sterilization.	1,2,3,4,5	1,2,3
CO5	Understand heat transfer in thermal processing methods like baking, frying, and roasting.	1,2,3,4,5	1,2,3
CO6	Study heat transfer in refrigeration and freezing processes for food storage.	1,2,3,4,12	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	PSO4
CO1	3	3	2	2										3	3	3
CO2	2	2	2	2										3	3	3
CO3	3	3	2	2										3	3	3
CO4	3	3	3	2										3	3	3
CO5	3	3	3	2										3	3	3
CO6	3	3	3	2										3	3	3

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

COURSE CONTENT THEORY

Heat and Mass transfer
UNIT-I
Introduction to modes of heat transfer (10 Hrs) :Concept, modes of heat transfer, thermal conductivity of materials, measurement. General differential equation of conduction. One dimensional steady state conduction through plane and composite walls, tubes and spheres with and without heat generation.
UNIT-II
Introduction to modes of mass transfer(10 Hrs) : Mass transfer, Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients. Reynold's analogy. Electrical analogy. Insulation materials. Fins, Free and forced convection. Newton's law of cooling, heat transfer coefficient in convection.
UNIT-III
Dimensional analysis of heat and mass transfer (10 Hrs) :Dimensional analysis of free and forced convection. Useful non dimensional numbers. Equation of laminar boundary layer on flat plate and in a tube. Laminar forced convection on a flat plate and in a tube. Combined free and forced convection
UNIT-IV
Radiation heat transfer (10 Hrs.): Introduction - Absorptivity, reflectivity and transmissivity of radiation. Black body and monochromatic radiation, Planck's law, Stefan-Boltzman law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation - exchange between black surfaces, geometric configuration factor. Heat exchangers : Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units. Heat exchanger analysis restricted to parallel and counter flow heat exchangers.
Text Book: 1. Introduction to Heat Transfer by F P Incropera and D P Dewitt 2. Diffusion: Mass Transfer in Fluid Systems by E L Cussler Reference Books: 3. Fundamentals of Heat and Mass Transfer by Lavine Bergman 4. Fundamentals of Momentum, Heat, And Mass Transfer by Rorrer and Wilson

HEAT AND MASS TRANSFER IN AGRICULTURE ENGINEERING LAB			
SL. No.	**Title of the Experiment**	**Tools and Techniques**	**Expected Skill/Ability**
1	Determination of thermal conductivity through composite wall	The composite wall arrangement with heater, temperature measuring system and control panel etc.	Understand the theory, principles of thermal conductivity of through composite wall and perform the experiment, collect the data and interpret the results.
2	Determination of thermal conductivity by lagged pipe method	Lagged pipe assembly fitted with heater and filled with	Understand concept and principles

		insulating material, control panel and accessories etc.	
3	To determine the specific heat of solids	Stirror-2, Calorimeter-2, 200-ml beaker with sample-2, Temperature measurement system, Water bath, 100 ml Graduated cylinder, balance etc.	Understand the theory, principles of specific heat of solids and perform the experiment, collect the data and interpret the results.
4	Solving problems on Newton's laws of cooling and heat transfer coefficient	Calculator	Develop numerical problem solving skills
5	Determination of heat transfer coefficient in free convection	Tube with heater and thermocouples, control unit etc.	Understand concept and principles
6	Determination of heat transfer coefficient in forced convection	Forced convection apparatus, control panel, manometer etc.	Explore working principles, operations and applications
7	Determination of heat transfer coefficient in parallel and counter flow heat exchangers	Parallel and counter flow heat exchanger, thermometers, stopwatch etc.	Understand the theory, principle and performs of the parallel and counter flow heat exchangers, collect the data and interpret the results
8	Study on plate type heat exchanger	Plate heat exchanger, thermometers, stopwatch etc.	Understand the theory, principle and performs of the plate type heat exchanger, collect the data and interpret the results
9	Study on shell and tube heat exchanger	Shell and tube heat exchanger, thermometers, stopwatch etc.	Understand the theory, principle and performs of the shell and tube heat exchanger, collect the data and interpret the results
10	Determination of Steffan Boltzman's constant	Stefan-Boltzman's apparatus, Control panel, Stop watch, thermometers, etc.	Explore knowledge on Steffan Boltzman's constant

11	Determination of emissivity of a reflecting surface	Test plate and black plate with heater and thermocouple in a cabinet and control panel with power measurement and temperature measurement arrangement.	Acquire practical concept of radiation heat transfer
12	Problems on mass transfer	Calculator	Develop numerical problem solving skills n heat and mass transfer
13	Visit to food industries to explore knowledge on different type of heat exchangers	Transport facility for students food industry visit.	Explore knowledge on commercial applications of heat and mass transfer

COURSE PACK FOR: Dairy and Food Process Engineering – (B23EU0305)

<table>
<tr><td>Course Title</td><td colspan="4">Dairy and Food Process Engineering</td><td colspan="2">Course Type</td><td colspan="2">Regular</td></tr>
<tr><td>Course Code</td><td>B23EU0305</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">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 in Weightage</td></tr>
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<tr><td>Tutorial</td><td>0</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>4</td><td>4</td><td>28</td><td>14</td><td>50 %</td><td>50 %</td></tr>
</table>

Course Details:

(a). Course description: This course provides an in-depth understanding of the engineering principles and technologies used in the processing of dairy and food products. Students will explore the various unit operations involved in dairy and food processing, including pasteurization, sterilization, homogenization, evaporation, drying, and packaging. Emphasis will be placed on the design, optimization, and operation of processing equipment to ensure product quality, safety, and efficiency.

(b). Course contents:

COURSE OBJECTIVE

1. To develop students knowledge through understanding of factors causing food spoilage and the methods to control them through physical, chemical, and biological preservation techniques

2. Explore the history, fundamental concepts, and tools of nanotechnology, its applications in food packaging, and its environmental and economic impacts, including regulatory aspects.
3. Acquire knowledge about development of the dairy sector in India, the properties of milk, and the principles and equipment used in various dairy processing operations.
4. Learning the preparation methods and equipment used to produce cheese, paneer, butter, and ice cream, and understand the processes for filling and packaging milk and milk products.
5. To study the design and layout of dairy plants, plant utilities, and the principles and equipment for various thermal processing methods
6. To Study the principles and equipment for drying liquid and perishable foods, various filtration methods, membrane separation techniques, and non-thermal processing in food processing and students will able to design new equipments.

Course Outcome

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

CO#	Course Outcome	POs	PSOs
CO1	Students will acquire a deep understanding of factors causing food spoilage and the methods to control them through physical, chemical, and biological preservation techniques	1,2,3,4,5	1,2,3
CO2	Students will explore the history, fundamental concepts, and tools of nanotechnology, its applications in food packaging, and its environmental and economic impacts, including regulatory aspects.	1,2,3,4,5	1,2,3
CO3	Students will gain knowledge of development of the dairy sector in India, the properties of milk, and the principles and equipment used in various dairy processing operations.	1,2,3,4,5	1,2,3
CO4	Student will learn the preparation methods and equipment used to produce cheese, paneer, butter, and ice cream, and understand the processes for filling and packaging milk and milk products.	1,2,3,4,5	1,2,3
CO5	Students gain knowledge about design and layout of dairy plants, plant utilities, and the principles and equipment for various thermal processing methods, including canning, aseptic processing, and evaporation.	1,2,3,4,5	1,2,3
CO6	Students will Gain knowledge of the principles and equipment for drying liquid and perishable foods, various filtration methods, membrane separation techniques, and non-thermal processing in food processing and students will able to design new equipments.	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

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2										3	3	3
CO2	2	2	2	2										3	3	3
CO3	3	3	2	2										3	3	3
CO4	3	3	3	2										3	3	3
CO5	3	3	3	2										3	3	3
CO6	3	3	3	2										3	3	3

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

Theory syllabus

Dairy and Food Process Engineering

UNIT-I

Deterioration in food products and their controls, Physical, chemical and biological methods of food preservation. Nanotechnology: History, fundamental concepts, tools and techniques nanomaterials, applications in food packaging and products, implications, environmental impact of nanomaterials and their potential effects on global economics, regulation of nanotechnology.

UNIT-II

Dairy development in India, Engineering, thermal and chemical properties of milk and milk products, Process flow charts for product manufacture, Unit operation of various dairy and food processing systems. Principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation.

UNIT-III

Preparation methods and equipment for manufacture of cheese, paneer, butter and ice cream, Filling and packaging of milk and milk products; Dairy plant design and layout, Plant utilities; Principles of operation and equipment for thermal processing, Canning, Aseptic processing, Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation, vapour recompression

UNIT-IV

Drying of liquid and perishable foods: principles of drying, spray drying, drum drying, freeze drying, Filtration: principle, types of filters; Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications, Non-thermal and other alternate thermal processing in Food processing.

Text Book:

1. K. M. Sahay and K. K. Singh., Unit operations agricultural processing, 2009, Second Revised Edition, Vikas Publishing House Pvt Ltd. Noida (UP).

2. A. Chakraverty, Post harvest technology of cereals, pulses, and oil seeds. 2019. Oxford IBH Publishing Co. Pvt. Ltd. New Delhi.
3. Handbook of Agrucultural Engineering, 2013, Directorate of Knowledge Management In Agriculture, Indian Council of Agricultural Research, New Delhi. ISBN: 978-81-7164-134-

Dairy and Food Process Engineering lab

Sl.No	Title of the Experiment	Tools and Equipment's	Expected Skill/Ability
1	Study of pasteurizers	Batch pasteurizer	Students should be capable of confidently operating a batch pasteurizer, ensuring that the pasteurization process is carried out effectively and safely, and applying their knowledge to various industrial or laboratory settings.
2	Study of sterilizers	Batch Sterilizer	Students should be capable of confidently operating a batch Sterilizer, ensuring that the Sterilization process is carried out effectively and safely, and applying their knowledge to various industrial or laboratory settings.
3	Study of homogenizers	Homogenizers	Students should be proficient in the operation and optimization of a homogenizer, capable of ensuring product quality and consistency, and able to apply their knowledge to real-world industrial processes.
4	Study of butter churns	Multipurpose equipment	Students should be proficient in the operation of a butter churner, capable of producing high-quality butter, and able to apply their knowledge in various production settings, from small-scale artisanal operations to larger industrial processes
5	Study of evaporators	Calculator	Students are able to calculate the evaporator problems it will be helpful in evaporator design
6	Preparation of ice cream	Ice cream freezer	Students are expected to master the process of emulsifying and freezing mixtures to create smooth, creamy ice cream, along with understanding how to control variables like temperature, agitation, and ingredient proportions to achieve the desired texture and

			flavor
7	Study of milk dryers, Study of freezers	Freeze dryer	To understand the construction and operation of freeze dryer
8	Design of food processing plants & preparation of layout, Visit to multi-product dairy plant	Transport facilities	Gain insight into the step-by-step processes involved in the production of various food products, from raw material handling to finished product packaging.
9	Visit to Food industry	Transport facilities	Gain insight into the step-by-step processes involved in the production of various food products, from raw material handling to finished product packaging.

Fluid Mechanics and open channel hydraulics – (B23EU0306)

Course Details:

(a). Course description: This course provides an in-depth understanding of the engineering principles and technologies used in the processing of dairy and food products. Students will explore the various unit operations involved in dairy and food processing, including pasteurization, sterilization, homogenization, evaporation, drying, and packaging. Emphasis will be placed on the design, optimization, and operation of processing equipment to ensure product quality, safety, and efficiency.

(b). Course contents:

COURSE OBJECTIVE

1. To develop students knowledge through understanding of factors causing food spoilage and the methods to control them through physical, chemical, and biological preservation techniques
2. Explore the history, fundamental concepts, and tools of nanotechnology, its applications in food packaging, and its environmental and economic impacts, including regulatory aspects.
3. Acquire knowledge about development of the dairy sector in India, the properties of milk, and the principles and equipment used in various dairy processing operations.
4. Learning the preparation methods and equipment used to produce cheese, paneer, butter, and ice cream, and understand the processes for filling and packaging milk and milk products.
5. To study the design and layout of dairy plants, plant utilities, and the principles and equipment for various thermal processing methods
6. To Study the principles and equipment for drying liquid and perishable foods, various filtration methods, membrane separation techniques, and non-thermal processing in food processing and students will able to design new equipment's.

Course Outcome

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

CO#	Course Outcome	POs	PSOs
CO1	Students will acquire a deep understanding of factors causing food spoilage and the methods to control them through physical, chemical, and biological preservation techniques	1,2,3,4,5	1,2,3

CO2	Students will explore the history, fundamental concepts, and tools of nanotechnology, its applications in food packaging, and its environmental and economic impacts, including regulatory aspects.	1,2,3,4,5	1,2,3
CO3	Students will gain knowledge of development of the dairy sector in India, the properties of milk, and the principles and equipment used in various dairy processing operations.	1,2,3,4,5	1,2,3
CO4	Student will learn the preparation methods and equipment used to produce cheese, paneer, butter, and ice cream, and understand the processes for filling and packaging milk and milk products.	1,2,3,4,5	1,2,3
CO5	Students gain knowledge about design and layout of dairy plants, plant utilities, and the principles and equipment for various thermal processing methods, including canning, aseptic processing, and evaporation.	1,2,3,4,5	1,2,3
CO6	Students will Gain knowledge of the principles and equipment for drying liquid and perishable foods, various filtration methods, membrane separation techniques, and non-thermal processing in food processing and students will able to design new equipment's.	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

CO#/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2										3	3	3
CO2	2	2	2	2										3	3	3
CO3	3	3	2	2										3	3	3
CO4	3	3	3	2										3	3	3
CO5	3	3	3	2										3	3	3
CO6	3	3	3	2										3	3	3

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

Course content:

Unit	Syllabus	Weightage (%)
1	**Properties of fluids**: Ideal and real fluid. Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, meta centre and meta centric height, condition of floatation and stability of submerged and floating bodies; **Kinematics of fluid flow**: Lagrangian and Eulerian description of fluid motion, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flow net.	25
2	**Types of fluid flow**, Translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice meter and nozzle, siphon; Laminar flow: Stress strain relationships, flow between infinite parallel plates both plates fixed, one plate moving, discharge, average velocity.	25
3	Laminar and turbulent flow in pipes, general equation for head loss Darcy, Equation, Moody's diagram, Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient. Flow through orifices (Measurement of Discharge, Measurement of Time),Flow through Mouthpieces, Flow over Notches , Flow over weirs, Chezy's formula for loss of head in pipes, Flow through simple and compound pipes, Open channel design and hydraulics:	25
4	Chezy's formula, Bazin's formula, Kutter's Manning's formula, Velocity and Pressure profiles in open channels, Hydraulic jump; Dimensional analysis and similitude: Rayleigh's method and Buckingham's `Pi' theorem, types of similarities, dimensional analysis, dimensionless numbers. Introduction to fluid machinery.	25

Fluid Mechanics and Open Channel Hydraulics Lab

Sl. No	Topics to be covered	Tools and Techniques	Expected Skill/Ability
1	Verification of Bernoulli's theorem	Instrumental	Conduction of Experiments
2	Determination of coefficient of discharge of venturi-meter	Instrumental	Conduction of Experiments
3	Determination of coefficient of discharge of orifice meter	Instrumental	Conduction of Experiments
4	Determination of coefficient of friction in pipeline	Instrumental	Conduction of Experiments

5	Determination of coefficient of discharge triangular notch	Instrumental	Conduction of Experiments
6	Determination of coefficient of discharge for rectangular notch	Instrumental	Conduction of Experiments
7	Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for flow through orifice	Instrumental	Conduction of Experiments
8	Measurement of force exerted by water jets on flat vanes	Instrumental	Conduction of Experiments
9	Measurement of force exerted by water jets on hemispherical vanes	Instrumental	Conduction of Experiments
10	Determination flow in open channels using notches and determination of Manning's coefficient of rugosity.	Channel flows	Conduction of Experiments

c. Objectives:

The objectives of this course are to:

Course Objectives:

1. To understand the fundamental properties of fluids and the principles governing fluid behavior.

2. To explore various methods for pressure measurement and analyze pressure forces on different surfaces.

3. To study the fluid kinematics, including different types of fluid motion and the principles of continuity.

4. To examine the dynamics of fluid flow and apply Bernoulli's theorem to various practical applications.

5. To analyze laminar and turbulent flow in pipes, including losses due to friction and fittings.

6. To introduce dimensional analysis and similitude for understanding fluid machinery and open channel flow design.

Suggested Textbooks and References

Text Books:

1. Khurmi, R .S. 1970. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines S. Chand & Company Limited, New Delhi.
2. Modi P M and Seth S.M.1973. Hydraulics and Fluid Mechanics. Standard Book House, Delhi.
3. Chow V T 1983. Open Channel Hydraulics. McGraw Hill Book Co., New Delhi.
4. Lal Jagadish 1985. Fluid Mechanics and Hydraulics. Metropolitan Book Co. Pvt. Ltd., New Delhi.

Reference book/s:

1. Bansal, R K. 2010. A text book of fluid mechanics and Hydraulic machines. Laxmi Publications

(P) Ltd. New Delhi.

Modi P M and Seth S.M.1973.Hydraulics and Fluid Mechanics. Standard Book House, Delhi.

Fundamentals of Data Science – (B24CS0104)

Course description:

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 either by using MS-Excel/Python/R.

Course Content

UNIT	Syllabus	Marks
1	**I Introduction to Microsoft Excel:** History and importance of Microsoft Excel, Creating Excel tables, understand how to Add, Subtract, Multiply, Divide in Excel. Excel Data Validation, Sorting, Filtering, Grouping, Ungrouping and Subtotal. 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.	25 Marks
2	**Introduction to Data Science:** What is Data Science? Applications of Data Science, Data science life cycle, Tools for data science, definition of AI, types of machine learning (ML), list of ML algorithms for classification, clustering, and feature selection. Probability theory, bayes theorem, bayes probability; Cartesian plane, equations of lines, graphs; exponents. **Introduction to SQL**: SQL Commands experimental demonstrations-DDL, DML, DCL, TCL, DQL. Import SQL Database Data into Excel.	25 Marks

3	**Data Relationship Methods:** Introduction to Correlation, 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.	25 Marks
4	**Introduction to Statistics and Python:** Statistical Analysis: Descriptive statistics- Mean, Standard Deviation for Continuous Data, Frequency, Percentage for Categorical Data. Python basics, Strings, Lists, Tuples, Sets, Dictionaries. Introduction to python libraries - NumPy, Matplotlib, Pandas, Scikit-Learn, Implementation of ML.	25 Marks

a) **Objectives:**

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.

b) **Learning Outcomes:**

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

CO	Course Outcomes	Pos	PSOs
CO1	Make use of the basic concepts of Data Science in developing the real-world applications.	1 to 4, 12	1,2,3
CO2	Apply the SQL commands in developing the real-world applications.	1 to 5,12	1,2,3
CO3	Build the data analytics solutions for real world problems, perform analysis, interpretation and reporting of data.	1 to 5	1, 2, 3
CO4	Demonstrate visualization of Data using python libraries	1 to 5, 8 to 10	1,2, 3
CO5	Find modeling Error in Linear Regression	1 to 5	1, 2, 3
CO6	Use statistical principles to solve mean and standard deviations for given data.	1 to 4, 12	1,2, 3

Reference.

TEXTBOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. Ramakrishnan and Gehrke, "Database Management systems", 3rdEdition, McGraw Hill Publications, 2003.
3. Kenneth N. Berk, Carey, "Data Analysis with Microsoft Excel", S. Chand & Company, 2004.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, Wiley Publications, 2013.

REFERENCE BOOKS:

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

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Numerical Methods and Laplace Transformation(B23AS0305)

Course Details:

a. Course description:

This course is introduction to applied mathematics, which is useful for agricultural engineering students. This course covers identifying and methods of solving differential equation of first and higher order using numerical methods along with applications to engineering problems. Most importantly learn Laplace transformation and Testing Hypothesis.

b. Course content:

Unit	Syllabus	Weightage (%)
1	**Numerical analysis -I** Finite difference, various difference operators and their relationships. factorial notation, interpolation with equal intervals. Newton's forward and backward interpolation formula. Bessel's and Stirling's difference interpolation formulae. Interpolation with unequal intervals. Newton's divided difference formula. Lagrange's interpolation formula	25
2	**Numerical analysis -II** Numerical differentiations, numerical integrations, difference equationsand their solutions, numerical solutions of ordinary differential equations by Picard's Taylor's series. Euler's and modified Euler's methods. Runge-Kutta method.	25
3	**Laplace Transformation** Laplace transformation of Standard functions, Properties of Laplace transformation, inverse Laplace transformation. Applications to the solutions of ordinary and simultaneous differential equations.	25
4	**Testing of Hypothesis** Level of Significance-Degrees of freedom-Statistical errors, Large sample test (Z-test), Small sample test t-test (One tailed, two tailed and Paired tests), Testing of Significance through variance (F-test), Chi -Square test, contingency table,	25

Unit	Syllabus	Weightage (%)
	Correlation, Regression.	

c. Objectives:

The objectives of this course are to:

This course enables Engineering students to identify the requirement of applied mathematics and their applications.

1. To provide students with an introduction to the field of numerical analysis.
2. The course aims to develop and apply problem solving skills through the introduction of numerical methods.
3. To provide a ground for applying knowledge acquired in previous mathematics courses and give students an opportunity to develop and present an independent project.

d. **Course Outcomes:**

By the end of the course, the students will be able

CO1: Identify the steps required to carry out a piece of research on a topic within Numerical Analysis.

CO2: Use information and communication technology to discuss problems relevant to Numerical Analysis.

CO3: Demonstrate the ability to study the solution of a differential equation and develop a practical interpretation of the numerical results.

CO4: Effectively write mathematical solutions and their interpretation in a clear and concise manner.

CO5: Identify the steps required to carry out a piece of research on a topic within Laplace Transform

CO6: Apply the knowledge acquired in Testing of Hypothesis and demonstrate the ability to study the solution of test of significance.

Suggested Text Books and References

Text Book:

1. Higher Engineering Mathematics by B.V. Raman Publisher: TMH
2. Higher Engineering Mathematics by Dr. B.S Grewal, Khanna publishers, 44th edition.

Reference book/s:

3. Advanced Engineering Mathematics by E. Kreyszig Publisher: Johnwilley & SonsInc- 8th Edition
4. Advanced Engineering Mathematics by P.V. O'Neil Publisher: Thomson Mathematical Methods by Potter & Goldberg; Publisher:

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IV Semester

Sl. No	Course Code	Title of the Course	HC/ FC /SC/ OE/ MC/ SDC	Credit Pattern				Contact Hours /Week	Examination			Course category (As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23EU0401	Soil and Water Conservation Engineering	HC	2	0	1	3	4	50	50	100	PCC
2	B23EU0402	Smart Irrigation Systems	HC	2	0	1	3	4	50	50	100	PCC
3	B23EU0403	Tractor Systems and Controls	HC	2	0	1	3	4	50	50	100	PCC
4	B23EU0404	Farm Machinery and Equipment-II	HC	2	0	1	3	4	50	50	100	PCC
5	B23EU0405	Fundamentals of Renewable Energy Sources and Emerging Technologies	HC	2	0	1	3	4	50	50	100	PCC
6	B23EU0406	Post Harvest Engineering of Cereals Pulses and Oilseeds	HC	2	0	1	3	4	50	50	100	PCC
7	B23ED0101	Food Quality and Safety	HC	0	0	1	1	2	25	25	50	ESC
8	B23EU0407	Hi-Tech Greenhouse Farming	HC	2	0	1	3	4	50	50	100	PCC
TOTAL				14	0	7	22	30	375	375	750	
TOTALSEMESTERCREDITS				22								
TOTALCUMULATIVECREDITS				22								
TOTALCONTACTHOURS				30								
TOTALMARKS				750								

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V Semester

Sl.No	Course Code	Title of the Course	HC/FC/SC/OE/MC/SDC	Credit Pattern				Contact Hours/Week	Examination			Course category(As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23EU0501	Water Harvesting and Soil Conservation	HC	2	0	1	3	4	50	50	100	PCC
2	B23EU0502	Groundwater Wells and Pumps	HC	2	0	1	3	4	50	50	100	PCC
3	B23EU0503	Remote Sensing and GIS application in Agriculture Engineering	HC	1	0	1	2	3	50	50	100	PEC
4	B23EU0504	Instrumental and process control in food industry	HC	2	0	1	3	4	50	50	100	PEC
5	B23EU0505	Tractor Design and Testing	HC	2	0	1	3	4	50	50	100	PCC
6	B23EU0506	Tractor and Farm Machinery Operation and Maintenance		1	0	1	2	3				
7	B23EU0507	Skill Development Training-I	SDC	0	0	5	5	5	25	25	50	-
8	B23EU0508	Artificial intelligence in Agriculture engineering	HC	2	0	1	3	4	50	50	100	PCC
9	B23ED0101	Skill Development Course-1 [CAD Lab] and	SDC	0	0	1	1	2	25	25	50	ESC
10	B23EU0509	State Educational Tour	MC	0	0	0	0	0	0	0	0	MC
TOTAL				10	0	11	24	31	275	275	650	
TOTALSEMESTERCREDITS				24								
TOTALCUMULATIVECREDITS				24								
TOTALCONTACTHOURS				31								
TOTALMARKS				650								

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VI Semester

Sl.No	Course Code	Title of the Course	HC/FC/SC/OE/MC/SDC	Credit Pattern				Contact Hours/Week	Examination			Course category(As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23EU0601	Bio-energy Systems: Design and Applications	HC	2	0	1	3	4	50	50	100	PCC
2	B23EU0602	Watershed Planning and Management	HC	2	0	1	3	4	50	50	100	PCC
3	B23EU0603	Drainage Engineering	HC	2	0	1	3	4	50	50	100	PCC
4	B23EU0604	Human Safety Engineering	HC	2	0	1	3	4	50	50	100	PCC
5	B23EU0605	Micro Irrigation System Design and Operation	HC	2	0	1	3	4	50	50	100	PCC
6	B23EU0606	Agricultural Structures and Environmental Control	HC	1	0	1	2	3	50	50	100	PCC
7	B23EU0607	Basics Concepts and Applications of Agrochemicals	HC	1	0	1	2	3	50	50	100	PEC
8	B23EU0608	Landscape irrigation Design and management		0	0	1	1	2	25	25	50	
TOTAL				12	0	7	20	28	350	350	750	
TOTALSEMESTERCREDITS				20								
TOTALCUMULATIVE CREDITS				20								
TOTALCONTACTHOURS				28								
TOTALMARKS				750								

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VII Semester

Sl. No	CourseCode	Title of the Course	HC/ FC /SC/ OE/ MC/ SDC	Credit Pattern				Contact Hours/ Week	Examination			Course category(As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23EU0701	Skill Development Course (MOOC)	SDC	0	0	5	5	5	50	50	100	-
		Agri-Business and Entrepreneurship										
2	B23EU0702	Professional Development Program/Internship (Student READY)	SDC	0	0	5	5	10	50	50	100	-
3	B23EU0703	Experiential Learning Program: (Student READY)	SDC	0	0	5	5	10	50	50	100	-
4	B23EU0704	All India Educational Tour*	MC	0	0	0	0	0	0	0	0	MC
TOTAL				**0**	**0**	**15**	**15**	**25**	**150**	**150**	**300**	
TOTAL SEMESTER CREDITS				**15**								
TOTAL CUMULATIVE CREDITS				**15**								
TOTAL CONTACT HOURS				**25**								
TOTAL MARKS				**300**								

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VIII Semester

Sl. No	Course Code	Title of the Course	HC/FC /SC/ OE/ MC/SDC	Credit Pattern				Contact Hours /Week	Examination			Course category(As per AICTE)
				L	T	P	Total Credit		CIE Marks	SEE Marks	Total Marks	
1	B23EU0801	Elective Course (SWE)	HC	2	0	1	3	4	50	50	100	PEC
2	B23EU0802	Elective Course (PFE)	SDC	2	0	1	3	4	50	50	100	PEC
3	B23EU0803	Elective Course (FMP)	SDC	2	0	1	3	4	50	50	100	PEC
4	B23EU0804	Project Planning and Report Writing	HC	0	0	10	10	10	50	50	100	PROJ
TOTAL				**6**	**0**	**13**	**19**	**22**	**200**	**200**	**400**	
TOTAL SEMESTER CREDITS				**19**								
TOTAL CUMULATIVE CREDITS				**19**								
TOTAL CONTACT HOURS				**22**								
TOTAL MARKS				**400**								

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Chairperson **Dr. R. C. Biradar** Pro-VC , REVA University Rukmini Knowledge Park, Yelahanka, Bangalore - 560 064 Email: provc@reva.edu.in Mobile: 9902679446, Phone: +9180 65687563/64/65			
Sl. No.	**Name**	**Internal/External Member**	**Designation and Affiliation**
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4	Dr. Pasupuleti Visweswara Rao	Internal Member	Professor & Associate Dean, Cluster of School of Allied Science and Director, International Relations and Research Collaboration, REVA University, Bengaluru, dir.ir@reva.edu.in

5	Dr. S. Senthil	Internal Member	Professor & Director School of Computer Science and Applications REVA University Bengaluru, dir.csa@reva.edu.i n
6	Dr. Bhavana B	Internal Member	Director & Assistant Professor School of Civil Engineering REVA University Bengaluru, dir.ce@reva.edu.in
7	Dr. Bharathi, S. H	Internal Member	School of Electronics & Communication Engineering REVA University Bengaluru, bharathish@reva.edu.in

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10	Dr. Nagaratna	Internal Member	Assistant Professor (PFE) Department of Agriculture Engineering REVA University Bengaluru, Nagaratna.m@reva.edu.in
11	Dr. Madusudhan B S	Internal Member	Assistant Professor (FMPE) Department of Agriculture Engineering REVA University Bengaluru, madhusudan.bs@reva.edu.in
12	Dr. Stephan J	Internal Member	Assistant Professor Department of Agriculture Engineering REVA University Bengaluru, stephan.j@reva.edu.in