VARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Agricultural Engineering

Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC/BSC	BAG401	Thermodynamics & Fluid Mechanics		3	0	0		03	50	50	100	3
2	IPCC	BAG402	Tractor & Automotive Engines		3	0	2		03	50	50	100	4
3	IPCC	BAG403	Agricultural Process Engineering		4	0	0		03	50	50	100	4
4	PCCL	BAGL404	Machine Drawing and GD & T Lab		0	0	2		03	50	50	100	1
5	ESC	BAG405x	ESC/ETC/PLC		3	0	0		03	50	50	100	3
6	AEC/ SEC	BAG456x	Ability Enhancement Course/Skill Enhancement Course- IV	TD and PSB: Concerned department	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
4	BSC	BBOK407	Biology For Engineers	TD / PSB: BT, CHE,	3	0	0		03	50	50	100	3
7	UHV	BUHK408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	BNSK459	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK459	Yoga	Yoga Teacher									
									Total	**500**	**400**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K :This letter in the course code indicates common to allthe stream of engineering.

Ability Enhancement Course / Skill Enhancement Course - IV			
BAGL456A	Simulation and Analysis using Ansys workbench [0-0-2]	BAGL456C	Introduction to Data Analytics [0-0-2]
BAG456B	Economics for Engineers [0-2-0]	BAG456D	Human Engineering & Safety
Engineering Science Course (ESC/ETC/PLC)			
BAG405A	Tractor Systems and Controls	BAG405C	Non-Conventional Energy Resources
BAG405B	Industrial Instrumentation	BAG405D	Robotics and Automation

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of degree.

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V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	BAG501	Industrial Management & Entrepreneurship		3	0	0		03	50	50	100	3
2	IPCC	BAG502	Farm Machinery & Equipment-I		3	0	2		03	50	50	100	4
3	PCC	BAG503	Thermal Engineering		4	0	0		03	50	50	100	4
4	PCCL	BAGL504	Manufacturing Process Lab		0	0	2		03	50	50	100	1
5	PEC	BAG515x	Professional Elective Course		3	0	0		03	50	50	100	3
6	PROJ	BAG586	Mini Project		0	0	4		03	100		100	2
7	AEC	BRMK557	Research Methodology and IPR		2	2	0		02	50	50	100	3
8	MC	BESK508	Environmental Studies		2	0	0		02	50	50	100	2
9	MC	BNSK559	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		BPEK559	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK559	Yoga	Yoga Teacher									
									Total	**500**	**300**	**800**	**22**

Professional Elective Course

BAG515A	Precision Farming Techniques for Protected Cultivation	BAG515C	Storage & Packaging Technology
BAG515B	Landscape Irrigation Design and Management	BAG515D	Water Harvesting and Soil Conservation Structures

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SXX**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–

Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the Agricultural Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BAG601	Farm Machinery & Equipment-II		3	0	2		03	50	50	100	4
2	PCC	BAG602	Soil & Water Conservation Engineering		4	0	0		03	50	50	100	4
3	PEC	BAG613x	Professional Elective Course		3	0	0		03	50	50	100	3
4	OEC	BAG654x	Open Elective Course		3	0	0		03	50	50	100	3
5	PROJ	BAG685	Project Phase I		0	0	4		03	100	--	100	2
6	PCCL	BAGL606	AI and Image Processing Lab		0	0	2		03	50	50	100	1
7	AEC/SDC	BXX657x	Ability Enhancement Course/Skill Development Course V		If the course is offered as a Theory 1	0	0		01	50	50	100	1
					If course is offered as a practical 0	0	2						
8	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
									Total	**500**	**300**	**800**	**18**

Professional Elective Course

BAG613A	IOT Architecture & Protocols	BAG613C	Waste Land Development
BAG613B	Agricultural Structures and Environmental Control	BAG613D	Sustainable Agriculture and Food Security

Open Elective Course

BAG654A	Micro Irrigation Engineering	BAG654C	Hydrology, Ground Water & Well Engineering
BAG654B	Design of Agricultural Machinery	BAG654C	Watershed Development

Ability Enhancement Course / Skill Enhancement Course-V			
BAG657A	Digital Society [0-2-0]	BAG657C	Spread sheets for Engineers
BAG657B	Fundamental of Virtual Reality ARP Development	BAG657D	Introduction Augmented Reality

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Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their helphe/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

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(Effective from the academic year 2023-24)

VIISEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BAG701	Dairy and Food Engineering		3	0	2		03	50	50	100	4
2	IPCC	BAG702	Irrigation & Drainage Engineering		3	0	2		03	50	50	100	4
3	PCC	BAG703	Post-Harvest Processing of Horticultural Crops		4	0	0		03	50	50	100	4
4	PEC	BAG714x	**Professional Elective Course**		3	0	0		03	50	50	100	3
5	OEC	BAG755x	**Open Elective Course**		3	0	0		01	50	50	100	3
6	PROJ	BAG786	**Major Project Phase-II**		0	0	12		03	100	100	200	6
										400	**300**	**700**	**24**

Professional Elective Course

BAG714A	Remote Sensing and GIS Applications	BAG714C	Food Plant Design and Management
BAG714B	Bio-energy Systems: Design and Applications	BAG714D	Precision Agriculture and System Management

Open Elective Course

BAG755A	Solar Photovoltaic System	BAG755C	Fundamentals of Urban Planning
BAG755B	Principles of Agronomy & Soil Science	BAG755D	Generation of Energy through Waste

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII

or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21XXP75): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.

(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.

(iii) To impart flexibility and adaptability.

(iv) To inspire team working.

(v) To expand intellectual capacity, credibility, judgment and intuition.

(vi) To adhere to punctuality, setting and meeting deadlines.

(vii) To install responsibilities to oneself and others.

(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work

shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

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VIII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	BAG801x	**Professional Elective (Online Courses)**		3	0	0		03	50	50	100	3
2	OEC	BAG802x	**Open Elective (Online Courses)**		3	0	0		01	50	50	100	3
3	INT	BAG803	**Internship (Industry/Research) (14 - 20 weeks)**		0	0	12		03	100	100	200	10
										200	**200**	**400**	**16**

Professional Elective Course (Online courses)

BAG801A	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems	BAG801C	Novel Technologies For Food Processing And Shelf Life Extension
BAG801B	Instrumentation and Process Control in Food Industry	BAG801D	Machine Learning For Soil And Crop Management

Open Elective Courses (Online Courses)

BAG802A	An Introduction to Artificial Intelligence	BAG802C	Machine Learning
BAG802B	Finite Element Method	BAG802D	Artificial Intelligence: Knowledge Representation And Reasoning

L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship

Note: VII and VIII semesters of IV years of the program

Swapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester**.**

- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

Please note: If any clarifications / suggestions please email to **sbhvtuso@yahoo.com**

Basics Concepts and Applications of Agrochemicals		Semester	III
Course Code	BAG301	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**		

Course Objectives:

- To understand the basic concepts of agrochemicals and their applications in agriculture.
- To study naturally occurring and synthetic chemical agents used for protecting crops in field as well as in storage.
- To understand the role of naturally occurring crop protecting chemical agents in fostering organic farming.
- To understand the impact of agrochemicals on environmental, animal, and human health
- To understand the regulatory mechanism of agrochemicals at national and international levels
- To acquire necessary basic knowledge on agrochemicals so as to evolve engineering strategy for their optimal and judicial applications in field as well as storage conditions, based on integrated learning outcomes from other courses.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.

Exploring information from research publications and regulatory documents

Module-1

Naturally Occurring Crop Protection Agents

Economic loss of agricultural produce due to pest problems: insects, diseases, rodents and weeds; Sources and utility of naturally occurring insecticides, bactericides, fungicides, nematicides, rodenticides; Role of naturally occurring pesticides in fostering organic farming; Working principles of botanical insecticides such as natural pyrethroids, nicotine, rotenone, neem and karanj; Pest control properties of plant hormones, phytoalexins and essential oils; Advantage and limitations of naturally occurring crop protection agents; juvenile hormones (JH), juvenile hormone mimics and anti-JH; chemosterilants, insect antifeedants, insect attractants and repellents; microbial pesticides and biocontrol agents.

Module-2

Synthetic Crop Protection Agents

History, scope and principles of chemical insect control; Synthetic insecticides, bactericides, fungicides, nematicides, rodenticides, weedicides; Classification of major groups of insecticides (organo-chlorine, organo-phosphorus, organo-carbamates, synthetic pyrethroids, neonicotinoids), fungicides (inorganics, dithiocarbamates, OP's, phenols, quinines, carboxamides, azoles, methoxyacrylates); Mode of action of different groups of insecticides, fungicides and nematicides; Chitin synthesis inhibitors, insecticide synergists, and fumigants; Plant growth regulators – auxins, gibberellins, cytokinins, ethylene, abscisic acid; Brassinolides;

Module-3

Chemicals used for storage and preservation

Major storage pests of economic importance causing damage during storage of food grains; Strategies involving storage bags, storage structures, and storage conditions; Pesticides and fumigants used in controlling insects and rodents during storage; Chemicals used for preserving freshness and promoting ripening in vegetables and fruits,respectively

Module-4

Agrochemical Formulations

Basic concepts of pesticide formulation - classification, solid and liquid formulations; preparation, properties, uses; controlled release formulations; Formulants - carriers/ diluents, surfactants, encapsulants, binders, anti-oxidants, stabilizers; Application - devices and quality of deposits; Types of spray appliances, seed treatment and dressing; nanotechnology in crop protection, Tools to develop and measure nanoparticles. Basic concepts of fertilizer formulations: enhancing fertilizer use efficiency and reducing environmental pollutions

Module-5

Agrochemicals – Regulation and Quality Control

Production, consumption and trade statistics of pesticides and fertilizers; banned and restricted pesticides, registration and quality control of insecticides; Laws, Acts and Rules governing registration and regulations of agrochemical production and use; key provisions of the Insecticides Act (1968), Environmental Protection Act (1986). Food Safety and Standards Act, WHO, FAO, CODEX and national/international guidelines.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Understand the basic concepts of agrochemicals and their applications in agriculture.
- Understand naturally occurring and synthetic chemical agents used for protecting crops in field as well as in storage.
- Understand the role of naturally occurring crop protecting chemical agents in fostering organic farming.
- Understand the impact of agrochemicals on environmental, animal, and human health
- Understand the regulatory mechanism of agrochemicals at national and international levels
- Acquire necessary basic knowledge on agrochemicals so as to evolve engineering strategies for their optimal and judicial applications in field as well as storage conditions, based on learning outcomes from other courses

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:
Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:
Books

1. **"Agrochemicals and Pest Management"** by T.V. Sathe. Daya Publishing House (2003)

ISBN: 8170353092, 9788170353096

2. "**Agrochemicals and Sustainable Agriculture**" By N.K. Roy. Associated Publishing Company (2021). **ISBN:** 9788186580110
3. "**Sittig's Handbook of Pesticides and Agricultural Cheamicals**" EdittedBy Stanley A. Greene and Richard P. Pohanish. Elsevier (2005). ISBN: 978-0-8155-1516-6
4. "**Agrochemicals**" By Singh Ranjit. LAP Lambert Academic Publishing. ISBN: 9786139851997
5. "The Complete Technology Book on Pesticides, Fungicides, Herbicides (Agrochemicals) with Formulae, manufacturing Process, Machinery and Equipment Details" By Himadri Panda. 2nd Revised Edition. Published by NIIR Project Consultancy Services (2022), ISBN: 9788195577538
6. "**A textbook of Fertilizers**" By Deepak Ranjan Biswas. New India Publishing Agency, New Delhi.

"**Pesticide Regulation Handbook**" By Greene Jan. Taylor and Francis Ltd, ISBN: 9781315896366, 9781315896366

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

FUNDAMENTALS OF AGRICULTURE & CROP PRODUCTION TECHNOLOGY (IPCC)		Semester	III
Course Code	BAG302	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- Imparting knowledge on different crops, crop nutrition and growth
- Describing crop-water relations in association to crop growth and development
- Illustrating crop management, cropping pattern and weed management
- Imparting the fundamentals of crop production technology of crops
- Providing knowledge on the importance and practices followed in growing crops

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Videodemonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such asevaluating, generalizing, and analysing information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

MODULE-1

Agronomy, its definition, scope and role of Agronomist. Tillage-objectives of tillage, types of tillage, tillage implements and factors affecting tillage, Effect of tillage on soil and crop growth. Tilth: its definition, characteristics and ideal tilth, Modern concepts of tillage, minimum, zero and stubble mulch tillage, importance of puddling. Conventional tillage practices and their effects, modern tillage practices and their advantages;

MODULE-2

Seed, its definition, characteristics of quality seed, seed treatment and its objectives. Seed dormancy, causes of seed dormancy and multiplication, stages of seed. Effect of plant population on growth and yield, Planting geometry viz., solid, paired and skipped row planting.

Importance of manures and fertilizers and its classification. Methods and time of application of manures, fertilizers andgreen manuring. Nutrient use efficiency and factors affecting nutrient use efficiency.

Scheduling of Irrigation and Fertilizers: Irrigation schedules for different crops in different soils and agro-climatic regions,fertigations, irrigation methods. Plant Protection Measures- Pesticides, types of weedicides and insecticides available tocontrol different weed flora, pests and diseases and their mode of action.

MODULE-3

Weeds, its definition, characteristics of weeds, merits and demerits of weeds, classification of weeds, meaning of crop weed competition and its period in different crops. Principles and methods of weed management viz., cultural, mechanical, chemical, biological weed control methods and integrated weed management. Classification of herbicides. Crop harvesting, signs of maturity in different field crops, Physiological and crop maturity, Method of harvesting.

MODULE-4

Introduction: Concepts in crop production; geographical distribution of crops and cropping systems; economic importance. Crop Classification: Cereals, pulses, oilseeds, fiber crops, forage crops, medicinal and aromatic crops and horticultural crops.

Cropping Systems for Major Agro-Ecological Regions: Detailed descriptions of rice based cropping

systems, sugarcane based cropping systems, cotton based cropping systems, pulses and oilseeds based cropping systems, their suitability in different agro-ecological regions. Crop rotation, its definition, principles and advantages of crop rotation.
MODULE-5
Modern Techniques of Raising Field and Horticultural Crops Techniques of nursery raising, method of planting, fertilization, irrigation scheduling, weed control, and other practices to optimize yield, economic evaluations. **Crop Growth Assessment**: Crop, growth parameters and their measurements.

PRACTICAL COMPONENT OF IPCC*(May cover all / major modules)*

Sl.NO	Experiments
1	Identification of crops, seeds, fertilizers, pesticides & Tillage implements
2	Effect of sowing depth on germination and seedling vigour
3	Study of yield contributing characters and yield estimation
4	Seed germination and viability test
5	Numerical exercises on fertilizer requirement
6	Plant Population and water requirement
7	Use of tillage implements (reversible plough, one way plough, harrow, leveller, seed drill)
8	Study of soil moisture measuring devices
9	Measurement of field capacity, bulk density and infiltration rate
10	Measurement of irrigation water
11	Study of crop varieties and agronomic experiments at experimental farm
12	Morphological description of Kharif season crops (rice).

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:

- Express knowledge gained on the principles of agronomy
- Recognize the various nutrients and their effects on plant health
- Plan irrigation measures for plant growth and development
- Manage weeds in a field
- Plan for sustainable agricultural production
- Apply scientific methods and tools in field preparation and for designing cropping
- Comprehend the fundamentals of crop production of cereals
- Decide on the crops, fertilizers and irrigation measures for production of pulses
- Plan for sustainable crop production of oilseeds
- Explain the techniques involved in crop production of fibre and forage crops
- Correlate parameters involved in crop cultivation and practices of crop cultivation

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be

deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

5. The question paper will have ten questions. Each question is set for 20 marks.
6. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
7. The students have to answer 5 full questions, selecting one full question from each module.
8. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Books

1. Crop production and field experimentation by V.G. Vaidya, K.R. Sahastrabudhe and V.S. Khuspe. ContinentalPrakashan, Vijaynagar, Pune.
2. Hand book of Agriculture, ICAR Publication.
3. Modern techniques of raising field corps by Chidda Singh. Oxford and IBH Publishing Co. Ltd., Bangalore.
4. Principles of Agronomy by Sankaran S. and V.T. SubbiahMudliyar, 1991. The Bangalore Printing and Publishing Co.Ltd., Bangalore.
5. Agronomy by S.C. Panda, 2006. Agribios Publication, New Delhi.
6. Crop Production and Management by Y.B. Moranchan. Oxford and IBH Publishing Co. Ltd., Bangalore.
7. Principles of Agronomy by S.R. Reddy, Kalyani Publishers, Ludhiana, India.
8. Principles of Crop Production by Martin J.H. and Leonard W.H. the Mac Million Company, New York – 1962.
9. Scientific Crop Production (Vol. I and II). Thakur C. Metropolitan Books Co. Pvt. Ltd., New Delhi.
10. Fundamentals of Agronomy. Gopal Chandra De. 1980. Oxford and IBH Publishing Co. Ltd., Bangalore
11. Singh, Chidda "Modem technique of raising of field crops". Oxford and IBH Publishing Company Pvt. Ltd., 1994.
12. Suresh Singh Tomar, YagyaDev Mishra and Shailendra Singh Kushah. 2018. Production Technology of Rabi Crops.Biotech books, New Delhi, India.
13. Rajendra Prasad. 2017. Textbook of field crops production, Volume 1 and 2 (Foodgrain crops & Commercial Crops).ICAR, India.
14. ingh, R.P., Reddy, P.S. and Kiresur, V.(eds.). "Efficient Management of Dryland Crops in India". Indian Society ofOilseed Research, DOR Rajendra Nagar, Hyderabad, 1997.
15. Joshi M. 2015. Textbook of Field Crops. Prentice Hall India Learning Private Limited, India.

Web links and Video Lectures (e-Resources):

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

https://www.youtube.com/watch?v=8ulpy_GFLDk

https://www.youtube.com/watch?v=NCp93xbSwWM

https://www.youtube.com/watch?v=60qVUwLP1s8

https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg3-chapter8-1.pdf

https://ecourses.icar.gov.in/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Field Experiments
- Mini Projects

Soil Mechanics, Surveying & Levelling		Semester	III
Course Code	BAG303	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- Appreciate basic concepts of soil mechanics as an integral part
- Comprehend basic engineering and mechanical properties of different types of soil.
- Model and measure strength-deformation characteristics of soils
- Familiar with Soil mechanics problems such as flow though soils
- Study about assessing stability of slopes and earth pressure on rigid retaining structures
- Understand the basic principles of Surveying
- Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.
- Employ conventional surveying data capturing techniques and process the data for computations.
- Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data onplane figures.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations andVideo demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such asevaluating, generalizing, and analyzing information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills

MODULE-1

Engineering Properties of Soils-Water content; Unit weight of soil; Specific gravity; Void ratio; Porosity; Degree of saturation; Functional relationships; Determination of index properties; Liquid limit; Plastic limit; Shrinkage limit; Plasticity index; Particle size distribution curve. Classification of Soils and Clay Mineralogy-Particle size classification; Textural classification; Indian standards classification; Soil structure;

Soil Hydraulics-Modes of occurrence of water in soils; Stress condition in soil; Permeability; Factors affecting permeability;Laboratory and field methods of determining permeability coefficients.

Elasticity Applied to Soils- State of stress at a point; Strain components; Stress distribution;

Pressure distribution diagrams; Newmark's influence charts; Contact pressure; Principal stresses and maximum shear.Compression and Compressibility

MODULE-2

Strength and Stability-Shear strength; Mohr circle of stresses; Measurement of shear strength; direct shear tests; Tri-axial compression test; Unconfined compression test; vane shear test; Pore pressure parameters; Active and passive earth pressures; Stability of slopes; Taylors stability number and stability curves;

Bearing Capacity of Soil; Rankine analysis; Terzaghi analysis; General and local shear failure; Mayerhoeff's analysis; Effect of water table on bearing capacity; Stabilization of Soil and Site Investigation-Introduction; Method of Stabilisation; Site exploration; Depth of exploration; Methods of site exploration; Soil samples and samplers.

MODULE-3

INTRODUCTION: Overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications. Distance measurement conventional symbols and methods; use of chain and tape, Electronic distance measurements, Meridians, Azimuths and Bearings, declination, computation of angle.

LEVELING AND CONTOURING: Concept and Terminology, Temporary and permanent adjustments method of leveling. Contouring: Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.

MODULE-4
COMPUTATION OF AREAS AND VOLUMES: Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits. THEODOLITE & TACHEOMETRIC SURVEYING Theodolite, description, uses and adjustments – temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite. Trigonometrical leveling, Traversing. Stadia and tangential methods of Tacheometry.
MODULE-5
INDTRODUCTION TO ADVANCED SURVEYING: Introduction to geodetic surveying, Total Station and Global positioning system, Introduction to Geographic information system (GIS) & Modern Instruments and its applications. Modern Surveying Instruments Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey. Aerial Photogrammetry Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problems), Ground Co-ordinates (simple problems), Relief Displacements (Derivation).

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Special gravity of soil solids
2	Grain size distribution
3	Atterberg Limits
4	Field density Test (Sand replacement method)
5	Permeability determination (constant head and falling head methods)
6	Direct shear test in cohesion-less soil
7	Unconfined compression test in cohesive soil
8	a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging. b) Setting out perpendiculars. Use of cross staff, optical square.
9	Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.
10	Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling).
11	To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale.
12	Measurement of horizontal angle by repetition and reiteration methods
13	Determination of horizontal distance to a base in accessible object using theodolite by single plane and double plane method.
14	To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.
15	Demonstration of Minor instruments like Clinometer, Ceylon Ghat Tracer, Box sextant, hand Level, Digital Planimeter and Pentagraph

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:

- Acquire an understanding of the procedures to determine properties of any type of soil, classify the soil based on its index properties.
- Able to determine permeability property of soils and acquires conceptual knowledge about stresses due toseepage and effective stress.
- Able to estimate seepage losses across hydraulic structures.
- Able to estimate shear strength parameters of different types of soils using
- the data of different shear tests and comprehend Mohr-Coulomb failure theory
- Ability to solve practical problems related to bearing capacity
- Able to plan and execute geotechnical site investigations for Hydraulic structures
- Possess a sound knowledge of fundamental principles Geodetics
- Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basicsurveying problems.
- Capture geodetic data to process and perform analysis for survey problems]
- Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50

marks and scaled down to **10 marks.**

- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scoredby the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Books

1. Soil Mechanics and Foundation Engineering Murthy, V.N.S UBS Publishers and Distributors, New Delhi. 1996
2. Soil Mechanics and Foundation Punmia, B.C New Delhi STD Book House, 1987 2017
3. Basic and Applied Soil Mechanics Gopalrajan and Rao, A.S.R. New Age International (P) Ltd., New delhi. 2000
4. Soil Mechanics T.W. Lambe and R.V. Whitman John Wiley & Sons. 1969
5. Geotechnical Engineering Donald P Coduto Phi Learning Private Limited, New Delhi.
6. Surveying (Vol – 1, 2 & 3) B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain Laxmi Publications (P) ltd., NewDelhi
7. Surveying (Vol – 1 & 2) Duggal S K Tata Mc-Graw Hill Publishing Co. Ltd New Delhi 2004
8. Elements of Plane Surveying Arthur R Benton and Philip J Taety McGraw Hill 2000
9. Surveying Vol 1, 2 & 3 Arora K R Standard Book House, Delhi, 2004

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Field Experiments
- Mini Projects

Mechanics of Materials & Machine		Semester	III
Course Code	BAG304	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	**Theory**		

Course objectives:

- To learn about simple stresses and strains and their applications.
- To learn how to find shear force and bending moment and construction of SFD & BMD
- To understand the concept of machines, mechanisms and to analyze a mechanism for displacement, velocityand acceleration at any point in a moving link.
- To understand the force-motion relationship in components subjected to external forces and analysis ofstandard mechanisms
- To understand the theory of gears and gear trains.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Videodemonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Adopt flipped classroom teaching method.
4. Adopt collaborative (Group Learning) learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such asevaluating, generalizing, and analysing information.

Module-1

Simple Stresses and Strains: Elasticity and plasticity – Types of stresses and strains – Hooke's law – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them

Module-2

Shear Force and Bending Moments: Types of supports – Types of beams – Shear force and bending moment diagrams for simply supported - Cantilever and over hanging beams with point loads, uniformly distributed load, uniformly varyingloads and couples – Relationship between shear force and bending moment.

Module-3

Introduction: Mechanisms and machines, Kinematic pairs-types, degree of freedom, Kinematic chains and their classification, Kinematic inversions,

Velocity and Acceleration analysis of planar mechanisms Graphical method: Velocity and Acceleration Analysis ofMechanisms Velocity and acceleration analysis of four bar mechanism, slider crank mechanism.

Module-4

Static force analysis: Static equilibrium, analysis of four bar mechanism, slider crank mechanism.

Dynamic force analysis: D'Alembert's principle, analysis of four bar and slider crank mechanism.

Flywheel: Introduction to Flywheel and calculation of its size for simple machines like punching machine, shearing machine

Spur Gears: Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear. **Gear Trains**: Simple gear trains, compound gear trains. Epicyclic gear trains.

Module-5

MACHINE DESIGN – Definition, Classification of machine design, General considerations in machine design, General procedure in machine design. Fundamental units, Mass and Weight, inertia, laws of motion, force, moment of force, couple mass density, torque, work, power and energy. **LEVERS** – Introduction, application of levers in

engineering practice, design of lever hand levers, foot lever, and cranked lever. Springs – Introduction, types of springs, material for helical springs, spring wire, terminology

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. The students would be able to understand the behaviour of materials under different stress and strainconditions.
2. Knowledge of mechanisms and their motion and the inversions of mechanisms
3. Analyse the mechanisms for static and dynamic equilibrium.
4. Carry out the balancing of rotating and reciprocating masses
5. Analyse different types of governors used in real life situation.
6. Various basic terms related to machine design aspect

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. R.S. Khurmi, Theory of Machines, Khanna Publishers, 2003.
2. S. S. Ratan, Theory of Machines, Tata McGraw Hill, 2nd Edition, 2005
3. Ghosh A. and Mallick A.K, Theory of Mechanisms and Machines, Affiliated East-West Press, 2nd Edition, 1988.
4. Thomas Bevan, Theory of Machines, CBS Publishers, 3rd Edition, 1984

J.S Rao. & R.V Dukkipati, Mechanism and Machine Theory, Newagepublishers, 2nd edition 1992

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
• Quizzes • Assignments • Seminars

BASIC WORKSHOP PRACTICE LAB		Semester	**III**
Course Code	BAGL305	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(0:0:2:0)	SEE Marks	50
Credits	01	Exam Hours	03
Examination nature (SEE)	Practical		

Course objectives:

- To identify tools, work material and measuring instruments useful for fitting, carpentry, Sheet metal workingand Smithy practice
- To handle tools and instruments and use them to prepare joints of specific shape and size

Sl.NO	**Experiments**
1	**Fitting:** Introduction, Various tools used in fitting shop- Holding tools; Marking and Measuring tools; Striking tools;Cutting tools; finishing tools
2	Preparation of Square fitting model in fitting shop
3	Preparation of V fitting model in fitting shop
4	**Carpentry:** Introduction, Timber, classification and characteristics; Various tools used in carpentry shop- Holding tools; Marking and Measuring tools; Striking tools; Planing tools; Cutting tools – saws and chisels
5	Preparation of T-Lap joint model in Carpentry shop
6	Preparation of Dove-tail Lap joint model in Carpentry shop
7	**Sheet metal working:** Introduction, Sheet metals used in metal work; Various tools used- Holding tools; Marking and Measuring tools;Striking tool – hammers and mallets; Snips; Stakes
8	Preparation of Open scoop model in Sheet metal shop
	Demonstration Experiments (For CIE)
9	Preparation of Rectangular tray model in Sheet metal shop
10	**Smithy:** Introduction, Principle of forging; Various tools used- Holding tools; Marking and Measuring tools; Striking tool –hammers; Flatters; Swage block; V-Block; Tongs, etc
11	To prepare S-Hook from a given round rod
12	To make a square rod from a given round rod

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. To select suitable tools and equipment to prepare joints using bench-work tools.
2. To produce joints using materials of specific shape and size by a suitable PO1,PO3, PO5, PSO1, set of operations and check the accuracy of shape and dimensions using suitable measuring tools..

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are**50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.

- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

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Information Technology for Land and Water Management		Semester	III
Course Code	BAG306A	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**		

Course objectives:

1. To existing system of information generation and organizations involved in the field of land and water management
2. Application and production of multimedia, Internet application tools and web technology.
3. To develop effective natural resource management by using GIS and GPS

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Videodemonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Adopt flipped classroom teaching method.
4. Adopt collaborative (Group Learning) learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such asevaluating, generalizing, and analysing information.

Module-1

Concept of Information Technology (IT) and its application potential. Role of IT in natural resources management. Existing system of information generation and organizations involved in the field of land and water management.

Module-2

Application and production of multimedia. Internet application tools and web technology. Networking system of information. Problems and prospects of new information and communication technology.

Module-3

Development of database concept for effective natural resources management. Application of remote sensing, geographic information system (GIS) and GPS.

Module-4

Rational data base management system. Object oriented approaches. Information system, decision support systems and expert systems. Agricultural information management systems - use of mathematical models and programmes.

Module-5

Application of decision support systems, multi sensor data loggers and overview of software packages in natural resource management. Video-conferencing of scientific information.

Course outcome (Course Skill Set)

1. By using an information technology, to generation and organization involved in the field of land and water management.
2. To development of database concept for effective natural resources management.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

Artificial Intelligence and Machine learning		Semester	III
Course Code	BAG306B	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**		

Course objectives:

1. Understands the basics of AI, history of AI and its foundations, basic principles of AI for problem solving
2. Explore the basics of Machine Learning & Machine Learning process, understanding data
3. Understand the Working of Artificial Neural Networks

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: What is AI, The foundation of Artificial Intelligence, The history of Artificial Intelligence, Intelligent Agents: Agents and Environments, Good Behaviour: The concept of rationality, the nature of Environments, the structure of Agents

Module-2

Problem solving by searching: Problem solving agents, Example problems, Searching for solutions, Uniformed search strategies, Informed search strategies, Heuristic functions

Module-3

Introduction to machine learning: Need for Machine Learning, Machine Learning Explained, and Machine Learning in relation to other fields, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications.

Understanding Data: What is data, types of data, Big data analytics and types of analytics, Big data analytics framework, Descriptive statistics, univariate data analysis and visualization

Module-4

Understanding Data: Bivariate and Multivariate data, Multivariate statistics, Essential mathematics for Multivariate data, Overview hypothesis, Feature engineering and dimensionality reduction techniques.

Basics of Learning Theory: Introduction to learning and its types, Introduction computation learning theory, Design of learning system, Introduction concept learning.

Similarity-based learning: Introduction to Similarity or instance based learning, Nearest-neighbour learning, weighted k- Nearest - Neighbour algorithm.

Module-5
Artificial Neural Network: Introduction, Biological neurons, Artificial neurons, Perceptron and learning theory, types of Artificial neural Network, learning in multilayer Perceptron, Radial basis function neural network, self-organizing feature map.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Design intelligent agents for solving simple gaming problems.
2. Have a good understanding of machine leaning in relation to other fields and fundamental issues and Challenges of machine learning
3. Understand data and applying machine learning algorithms to predict the outputs.
4. Model the neuron and Neural Network, and to analyze ANN learning and its applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Textbooks:

1. Stuart Russel, Peter Norvig: "Artificial Intelligence A Modern Approach", 3rd Edition, Pearson Education, 2015.
2. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford ,2021

Reference books:

1. Elaine Rich, Kevin Knight: "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009, ISBN-10: 0070087709
2. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, 1980, ISBN: 978-3-540-11340-9.

Web links and Video Lectures (e-Resources):

http://stpk.cs.rtu.lv/sites/all/files/stpk/materiali/MI/Artificial%20Intelligence%20A%20Modern%20Approach.pdf.

1. http://www.getfreeebooks.com/16-sites-with-free-artificial-intelligence-e books/https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_overview.htm
2. Problem solving agent:https://www.youtube.com/watch?v=KTPmo-KsOis.
3. https://www.youtube.com/watch?v=X_Qt0U66aH0&list=PLwdnzlV3ogoXaceHrrFVZCJKbm_laSHcH
4. https://www.javatpoint.com/history-of-artificial-intelligence
5. https://www.tutorialandexample.com/problem-solving-in-artificial-intelligence
6. https://techvidvan.com/tutorials/ai-heuristic-search/
7. https://www.analyticsvidhya.com/machine-learning/
8. https://www.hackerearth.com/practice/machine-learning/machine-learning-algorithms/mldecision-tree/tutorial/
9. https://www.javatpoint.com/unsupervised-artificial-neural-networks

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Real world problem solving: Demonstration of projects related to AI and ML.

Analog and Digital Electronics Circuit		Semester	III
Course Code	BAG306C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**		

Course objectives:

1. Explain the use of photo electronics devices, 555 timer IC, Regulator ICs and uA741
2. Make use of simplifying techniques in the design of combinational circuits.
3. Illustrate combinational and sequential digital circuits
4. Demonstrate the use of flipflops and apply for registers
5. Design and test counters, Analog-to-Digital and Digital-to-Analog conversion techniques.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

BJT Biasing: Fixed bias, Collector to base Bias, voltage divider bias Operational Amplifier Application Circuits: Peak Detector, Schmitt trigger, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-to-Voltage and Voltage-to-Current Converter, Regulated Power Supply Parameters, adjustable voltage regulator, D to A and A to D converter.

Module-2
Karnaugh maps: minimum forms of switching functions, two and three variable Karnaugh maps, four variable Karnaugh maps, determination of minimum expressions using essential prime implicants, QuineMcClusky Method: determination of prime implicants, the prime implicant chart, Petricks method, simplification of incompletely specified functions, simplification using map-entered variables
Module-3
Combinational circuit design and simulation using gates: Review of Combinational circuit design, design of circuits with limited Gate Fan-in, Gate delays and Timing diagrams, Hazards in combinational Logic, simulation and testing of logic circuits Multiplexers, Decoders and Programmable Logic Devices: Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices.
Module-4
Introduction to VHDL: VHDL description of combinational circuits, VHDL Models for multiplexers, VHDL Modules. Latches and Flip-Flops: Set Reset Latch, Gated Latches, Edge-Triggered D Flip Flop 3,SR Flip Flop, J K Flip Flop, T Flip Flop.
Module-5
Registers and Counters: Registers and Register Transfers, Parallel Adder with accumulator, shift registers, design of Binary counters, counters for other sequences, counter design using SR and J K Flip Flops.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Design and analyze application of analog circuits using photo devices, timer IC, power supply and regulator IC and op-amp.
2. Explain the basic principles of A/D and D/A conversion circuits and develop the same.
3. Simplify digital circuits using Karnaugh Map, and Quine-McClusky Methods
4. Explain Gates and flip flops and make us in designing different data processing circuits, registers and counters and compare the types.
5. Develop simple HDL programs

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Textbooks:

1. Charles H Roth and Larry L Kinney, Raghunandan G H Analog and Digital Electronics, Cengage Learning, 2019

Reference Books:

1. Anil K Maini, Varsha Agarwal, Electronic Devices and Circuits, Wiley, 2012.
2. Donald P Leach, Albert Paul Malvino & Goutam Saha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015.
3. M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008.
4. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008

Web links and Video Lectures (e-Resources):

1. Analog Electronic Circuits: https://nptel.ac.in/courses/108/102/108102112/
2. Digital Electronic Circuits: https://nptel.ac.in/courses/108/105/108105132/
3. Analog Electronics Lab: http://vlabs.iitkgp.ac.in/be/
4. Digital Electronics Lab: http://vlabs.iitkgp.ac.in/dec

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

Solid Waste And By-Product Utilization		Semester	III
Course Code	BAG306D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**		

Course objectives:

1. Appreciate basic concepts of by-products and waste generation in agricultural production and processing
2. Utilize the energy from direct combustion of solid waste
3. To convert solid waste into thermo-chemical and Bio-chemical
4. To manage the solid waste for bio-utilization
5. Effluent treatment and disposal of waste

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Videodemonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Adopt flipped classroom teaching method.
4. Adopt collaborative (Group Learning) learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such asevaluating, generalizing, and analysing information.

Module-1

Introduction to by-products and waste generation in agricultural production and processing:
By-products/waste, types of food by-product and waste, magnitude of by-products and waste in food production, magnitude of by-products and wastes in food processing
Waste management concepts: Waste characteristics, waste management and effluent treatment

Module-2

Direct combustion of solid waste: Proximate and ultimate analysis of biomass, theory of combustion, direct combustion of biomass as fuel in furnaces, operating conditions affecting design of furnace. Bales, operation of baler, briquettes, advantages and uses of briquettes.

Module-3

Thermo-chemical conversion of solid waste: Biomass gasification, gasification process mechanism, types of gasifier reactors, utilization of producer gas.
Bio-chemical conversion of solid waste: Biogas, biogas plants, classification of biogas plants, design of biogas plants, comparison among KVIC, Janta and Deenbandhu biogas plants, working of Deenbandhu biogas plant. Selection of proper size of biogas plant, utilization of biogas for cooking purpose. Utilization of biogas for lighting purposes and engine operation.

Module-4

Solid waste management: Methods of disposal solid waste, Vermin composting
Presence of typical chemicals: Microbiology of waste, bacteriological analysis of water, water borne diseases, insecticide, pesticide and fungicides residues.
Management of Pesticide Residues, equipment's for estimation of pesticide residue.

Module-5

Effluent treatment and disposal:
Parameters of effluent like temperature, pH, Oxygen demands (BOD, COD), fat oil and grease content, metal content, forms of phosphorous and sulphur in effluent. Treatment of effluent, steps for waste water treatment**,** sedimentation, coagulation, flocculation and floatation.
Characteristics of food processing waste water, trickling filters, rotating biological contractors. Oxidation ditches, activated sludge process, lagoons. Filtration, slow sand filter, rapid sand filter, disinfection of water

Course outcome (Course Skill Set)

At the end of this course, the student will be able to:

1. Understand the types and formation of by-products and waste, uses of different agricultural by-products.
2. Understand the concept, scope, maintenance of waste management and effluent treatment, Waste water contents and treatments and also familiar with microbiology of waste, ingredients like insecticide, pesticides & fungicides residues.
3. Understand utilization of waste in various industries, biomass as fuel, charcoal briquette, and generation of electricity using surplus biomass and remember producer gas generation.
4. Understand the design consideration of waste treatment and disposal of community & family size biogas plants, vermin-composting and pre-treatment of waste.
5. Familiar with the secondary treatments for food plant wastes, tertiary treatments, effluent treatment plants and environmental performance of food industry.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:
Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Markel, I.A. 1981. Managing Livestock Waste, AVI Publishing Co.
2. Pantastico, ECB. 1975. Post Harvest Physiology, Handling and utilization of Tropical and Subtropical fruits and vegetables, AVI Pub. Co.
3. Shewfelt, R.L. and Prussi, S.E. 1992. Post-Harvest Handling – A Systems approach, Academic Press Inc. USDA. 1992. Agricultural Waste Management Field Hand book. USDA, Washington DC.
4. Weichmann J. 1987. Post Harvest Physiology of vegetables, Marcel and Dekker Verlag. V.K. Joshi & S.K. Sharma. Food Processing Waste Management: Treatment & Utilization. New India Publishing Agency.
5. Vasso Oreopoulou and Winfried Russ (Edited). 2007. Utilization of By-products and Treatment
6. G.D. Rai Non-Conventional Energy Sources

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

Advanced Python Programming [0-0-2]		Semester	III
Course Code	BAGL358A	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	01	Exam Hours	01
Examination nature (SEE)	Practical		

Course objectives:

- To understand why Python is a useful scripting language for developers
- To read and write simple Python programs
- To learn how to identify Python object types.
- To learn how to write functions and pass arguments in Python.
- To use Python data structures –- lists, tuples, dictionaries.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Videodemonstrations or Simulations.
- Chalk and Talk method for Problem Solving.
- Adopt flipped classroom teaching method.
- Adopt collaborative (Group Learning) learning in the class.
- Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such asevaluating, generalizing, and analysing information.

Module-1

INTRODUCTION DATA, EXPRESSIONS, STATEMENTS:

Introduction: Creativity and motivation, understanding programming, Terminology: Interpreter and compiler, Running Python, The First Program; Data types: Int, float, Boolean, string, and list, variables, expressions, statements, Operators and operands.

Module-2

CONTROL FLOW, LOOPS:

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (ifelif-else); Iteration: while, for, break, continue, pass statement.

Module-3

FUNCTIONS AND STRINGS:

Functions: Function calls, adding new functions, definition and uses, local and global scope, return values. Strings: strings, length of string, string slices, immutability, multiline comments, string functions and methods;

Module-4

LISTS, TUPLES, DICTIONARIES:

Lists:List operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters, list comprehension; Tuples: tuple assignment, tuple as return value, tuple comprehension; Dictionaries: operations and methods, comprehension;

Module-5

REGULAR EXPRESSIONS, FILES AND EXCEPTION:

Regular expressions: Character matching in regular expressions, extracting data using regular expressions, Escape character Files and exception: Text files, reading and writing files, command line arguments, errors and exceptions, handling exceptions, modules.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Represent compound data using Python lists, tuples, Strings, dictionaries.
4. Read and write data from/to files in Python Programs

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Textbooks:

1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, CreateSpace Independent Publishing Platform, 2016. http://do1.dr chuck.com/pythonlearn/EN_us/pythonlearn.pdf
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2ndEdition, Green Tea Press, 2015. (Chapters 15, 16, 17) http://greenteapress.com/thinkpython2/thinkpython2.pdf

Reference books:

1. R. Nageswara Rao, "Core Python Programming", dreamtech
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
3. Python Programming , Reema theraja, OXFORD publication

Web links and Video Lectures (e-Resources):

1. https://www.w3resource.com/python/python-tutorial.php
2. https://data-flair.training/blogs/python-tutorials-home/
3. https://www.youtube.com/watch?v=c235EsGFcZs
4. https://www.youtube.com/watch?v=v4e6oMRS2QA
5. https://www.youtube.com/watch?v=Uh2ebFW8OYM
6. https://www.youtube.com/watch?v=oSPMmeaiQ68
7. https://www.youtube.com/watch?v=_uQrJ0TkZlc
8. https://www.youtube.com/watch?v=K8L6KVGG-7o

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Real world problem solving: Demonstration of projects developed using python language

Fundamentals of Virtual Reality		Semester	III
Course Code	BAG358B	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	01	Exam Hours	01
Examination nature (SEE)	Theory		

Course objectives:

- Describe how VR systems work and list the applications of VR.
- Understand the design and implementation of the hardware that enables VR systems to be built.
- Understand the system of human vision and its implication on perception and rendering.
- Explain the concepts of motion and tracking in VR systems.
- Describe the importance of interaction and audio in VR systems

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Videodemonstrations or Simulations.
- Chalk and Talk method for Problem Solving.
- Adopt flipped classroom teaching method.
- Adopt collaborative (Group Learning) learning in the class.
- Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such asevaluating, generalizing, and analysing information.

Module-1

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Module-2

Representing the Virtual World : Representation of the Virtual World, Visual Representation in VR, AuralRepresentation in VR and Haptic Representation in VR

Module-3

The Geometry of Virtual Worlds &The Physiology of Human Vision: Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.

Module-4
Visual Perception & Rendering : Visual Perception - Perception of Depth, Perception of Motion, Perception of Color,Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates
Module-5
Motion & Tracking : Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in theVirtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies
Course outcome (Course Skill Set) At the end of the course the student will be able to: CO1: Describe how VR systems work and list the applications of VR. CO2: Understand the design and implementation of the hardware that enables VR systems to be built. CO3: Understand the system of human vision and its implication on perception and rendering. CO4: Explain the concepts of motion and tracking in VR systems. CO5: Describe the importance of interaction and audio in VR systems.
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. **Continuous Internal Examination (CIE)** • For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks. • The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered • Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. • For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment. **Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.** **Semester End Examinations (SEE)** SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.
Suggested Learning Resources: **Books** 1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016 2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002 3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R

Sherman and Jeffrey DWill, Morgan Kaufmann, 2009.

Reference Books:

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
3. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.

Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

Web links and Video Lectures (e-Resources):

http://lavalle.pl/vr/book.html https://nptel.ac.in/courses/106/106/106106138/ https://www.coursera.org/learn/introduction-virtual-reality.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Course seminars

Spreadsheet for Engineers [0-0-2]		Semester	**III**
Course Code	BAGL358C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	50
Credits	01	Exam Hours	03
Examination nature (SEE)	**Practical**		

Course objectives:

- To create different plots and charts
- To compute different functions, conditional functions and make regression analysis
- To carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis
- To carryout matrix operations
- To Understand VBA and UDF
- To understand VBA subroutines and Macros
- To carryout numerical integration and solving differential equations using different methods

Sl.NO	**Experiments**
1	**Charting:** Create an XY scatter graph, XY chart with two Y-Axes, add error bars to your plot, create a combination chart
2	**Functions:** Computing Sum, Average, Count, Max and Min, Computing Weighted Average, Trigonometric Functions, Exponential Functions, Using The CONVERT Function to Convert Units
3	**Conditional Functions:** Logical Expressions, Boolean Functions, IF Function, Creating a Quadratic Equation Solver, Table VLOOKUP Function, AND, OR and XOR functions
4	**Regression Analysis:** Trendline, Slope and Intercept, Interpolation and Forecast, The LINEST Function, Multilinear Regression, Polynomial Fit Functions, Residuals Plot, Slope and Tangent, Analysis ToolPack.
5	**Iterative Solutions Using Excel:** Using Goal Seek in Excel, Using The Solver To Find Roots, Finding Multiple Roots, Optimization Using The Solver, Minimization Analysis, NonLinear Regression Analysis.
6	**Matrix Operations Using Excel:** Adding Two Matrices, Multiplying a Matrix by a Scalar, Multiplying Two Matrices, Transposing a Matrix, Inverting a Matrix and Solving System of Linear Equations.
7	**VBA User-Defined Functions (UDF):** The Visual Basic Editor (VBE), The IF Structure, The Select Case Structure, The For Next Structure, The Do Loop Structure, Declaring Variables and Data Types, An Array Function The Excel Object Model, For Each Next Structure.
8	**VBA Subroutines or Macros:** Recording a Macro, Coding a Macro Finding Roots by Bisection, Using Arrays, Adding a Control and Creating User Forms.
	Demonstration Experiments (For CIE)

9 10	Numerical Integration Using Excel: The Rectangle Rule, The Trapezoid Rule, The Simpson's Rule, Creating a User-Defined Function Using the Simpson's Rule.
11 12	Differential Equations: Euler's Method, Modified Euler's Method, The Runge Kutta Method, Solving a Second Order Differential Equation

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Create different plots and charts
- Compute different functions, conditional functions and make regression analysis
- Carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis
- Carryout matrix operations
- Understand VBA and UDF
- Understand VBA subroutines and Macros
- Carryout numerical integration and solving differential equations using different methods

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- McFedries PaulMicrosoft Excel 2019 Formulas And Functions Microsoft Press, U.S, 2019 Edition

Tools in Scientific Computing [0-0-2]		Semester	III
Course Code	BAGL358D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	50
Credits	01	Exam Hours	03
Examination nature (SEE)	**Practical**		

Course objectives:

- To create different plots and charts
- To compute different functions, conditional functions and make regression analysis
- To carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis
- To carryout matrix operations
- To Understand VBA and UDF
- To understand VBA subroutines and Macros
- To carryout numerical integration and solving differential equations using different methods

Sl.NO	Experiments
1	Familiarization of Scientific computing
2	Familiarization of Computing tool
3	Realization of Arrays and Matrices
4	Numerical Differentiation and Integration
5	Solution of Ordinary Differential Equations
6	Simple Data Visualization
7	Simple Data Analysis with Spreadsheets
8	Convergence of Fourier Series
	Demonstration Experiments (For CIE)
9	Coin Toss and the Level Crossing Problem
10	

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Describe the needs and requirements of scientific computing and to familiarize one programming language for scientific computing and data visualization.
- Approximate an array/matrix with matrix decomposition.
- Implement numerical integration and differentiation.
- Solve ordinary differential equations for engineering applications
- Realize how periodic functions are constituted by sinusoids
- Realize how periodic functions are constituted by sinusoids
- Simulate random processes and understand their statistics.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours
Suggested Learning Resources: • SCIENTIFIC COMPUTING LABORATORY MANUAL, Dept. Of Electronics and Communication Engineering, ICET

Assessment Details (both CIF and SFE)

THERMODYNAMICS & FLUID MECHANICS		Semester	IV
Course Code	BAG401	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

The course will enable the students to

- Acquire a basic understanding of properties of fluids and the measurement of pressure and fluid kinematics.
- Acquire a basic understanding of fundamentals fluid dynamics, and Benoulli's equation and flow meters.
- Acquire the basic concepts of flow through pipes and losses in pipe flows.
- Understand the basic concepts of flow over bodies and usefulness of dimensionless analysis.
- Acquire the fundamentals of compressible flow and the basic knowledge of working of CFD packages.
- Acquire the knowledge of simple fluid mechanics experimental setups and carry out the necessary analysis
  of these experiments
- Acquire knowledge experimental errors and the ability to estimate the experimental uncertainties.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different type of teaching methods to develop the outcomes through Power-Point Presentation and Video demonstration or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

Basic Concepts: Definitions of system, boundary, surrounding control volume. Types of thermodynamic systems, Properties of system, definitions for properties like pressure, volume, temperature, enthalpy, internal energy, density, with their units. State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium.

Work & Heat Transfer: Work transfer, Types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

Zeroth Law of Thermodynamics: Zeroth Law of Thermodynamics. Heat and temperature - concept of thermal equilibrium.

Module-2

First Law of Thermodynamics: First law of thermodynamics- simple problems on heat and work conversions in process and cycle. Limitations of First law of thermodynamics.

Second Law of Thermodynamics: Heat Engine, Refrigeration and Heat Pump. Statements of Second law and their equivalence, Reversibility and Irreversibility, availability and unavailability – concept of change in entropy.

Module-3

Introduction: Definition and properties, types of fluids, fluid pressure at a point in static fluid, variation of pressure, Pascals Law, (To be reviewed in class but not for examination)

Pressure- absolute, gauge, vacuum, pressure measurement by manometers and gauges, hydrostatic pressure on vertical plane surface submerged in liquid. Buoyance, centre of buoyancy and metacentre, Stability of

submerged body.

Fluid Kinematics: Introduction, methods of describing fluid motion, types of fluid flow. Continuity equation (simple problems), velocity and acceleration of fluid particle (simple problems), streamlines, pathlines and streaklines, strain rate, vorticity, velocity potencial function and stream function relation between stream function and velocity potential function and simple problems, Types of motion.

Module-4

Fluid Dynamics: Introduction, Forces acting on fluid in motion. The momentum equation, Moment of momentum equation, Euler's equation of motion along a streamline. Bernoulli's equation – assumptions and limitations (simple problems).

Fluid flow measurement: Venturimeters, orificemeters, pitot tube, rectangular and triangular notches and weirs (simple problems)

Viscous flow: Types of flow, Reynolds Experiments, Laminar flow through circular pipe, laminar flow between two parallel stationary plates, power absorbed in viscous flow in bearings (simple problems), Poiseuilli equcation for loss of head due to friction in pipes.

Module-5

Flow over bodies: Development of boundary layer, Lift and Drag, Flow around circular cylinders, spheres, aerofoils and flat plates, Streamlined and bluff bodies, boundary layer separation and its control.

Dimensional Analysis: Derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh method, Buckingham Pi-theorem, dimensionless numbers, similitude, types of similitude.

Compressible flows: Introduction, Thermodynamics realtions, Basic equcations of compressible flow, velocity sound or pressure wave in a fluid, match number

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

1. Understand the basic principles of fluid mechanics and fluid kinematics
2. Acquire the basic knowledge of fluid dynamics and flow measuring instruments
3. Understand the nature of flow and flow over bodies and the dimensionless analysis
4. Acquire the compressible flow fundamental and basics of CFD packages and the need for CFD analysis.
5. Conduct basic experiments of fluid mechanics and understand the experimental uncertainties.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Fox, R. W., Pitchard,P. J.,and McDonald, A. T., (2010), Introduction to Fluid Mechanics, 7thEdition, John Wiley & Sons Inc.
2. Cimbala, J.M., Cengel, Y. A. (2010),Fluid Mechanics: Fundamentals and Applications, McGraw-Hill
3. Frank M White., (2016), Fluid Mechanics, 8thEdition , McGraw-Hill

Additional References:

1. A text book of Fluid Mechanics and Hydraulic Machines, Dr. R K Bansal, Laxmi publishers
2. Fundamentals of Fluid Mechanics, Munson, Young, Okiishi & Hebsch, John Wiley Publicationss, 7th Edition

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-me22/
2. https://ocw.mit.edu/search/ocwsearch.htm?q=fluid%20mechanics
3. https://directory.doabooks.org/discover?query=Fluid+Mechanics&locale-attribute=en
4. http://elearning.vtu.ac.in/econtent/courses/video/CV/10CV35.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

TRACTOR & AUTOMOTIVE ENGINES		Semester	IV
Course Code	**BAG402**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory		

Course Objectives:

- The objective of this subject is to impart the knowledge of tractor engine components, working principles of IC engines, auxiliary systems, the combustion aspects of SI and CI engines in addition to the methods of improving performance.
- The students shall become aware on the latest developments in the field of IC engines like MPFI, CRDI etc. The student also shall apply the thermodynamic concepts in IC engines.
- Basic understanding of fuel properties and its measurements using various types of measuring devices
- Energy conversion principles, analysis and understanding of I C Engines will be discussed.
- Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.
- Exhaust emissions of I C Engines will be measured and compared with the standards.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.

Module-1 **8 HOURS**

Introduction about design and development of Agril. Tractors

Introduction, different types of tractors available in india/abroad and its importance in agriculture. Selection of engines available in the market and their performance.

Farm power – Introduction, sources of farm power, merits and demerits of different forms of power, status of farm power in India. Conventional and non conventional energy sources, classification of tractor and I.C engines,

Module-2 **8 HOURS**

Study of I.C engine – Introduction, Thermodynamic cycle, Principle and working of IC engine. Comparison of 2-stroke and 4-stroke engine cycles and CI and SI engines. Engine components.

Study of Engine Valve systems, valve mechanism and Valve timing diagram. Study of importance of air cleaning system. Study of types of air cleaners and performance characteristics of various air cleaners.

Module-3 **8 HOURS**

Study of fuel supply system. Study of fuels, properties of fuels, calculation of air-fuel ratio. Study of tests on fuel for SI and CI engines. Study of detonation and knocking in IC engines. Study of carburetion system, carburetors and their main functional components.

Study of fuel injection system – Injection pump, their types, working principles. Fuel injector nozzles – their types and working principle. Fuel filter. (Simple problems)

Module-4 **8 HOURS**

Study of governor – Introduction, principle of governors, classification of governing system. Governor regulation and governor hunting

Study of lubrication system – Introduction, lubricating oil tests, types and functional components of governors. Study of lubricants – physical properties, additives and their application.

Study of cooling system – need, cooling methods and main functional components. Study of need and type of thermostat valves. Additives in the coolant.

Module-5	8 HOURS
Study of ignition system of SI engines – Introduction, types of iginition system and their components. Meassurement of engine power – Terminology connected with engine power (simple problems)	

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Study of I.C. Engine parts and functions
2	Study of Working principle of Four stroke and Two stroke cycle I.C. Engine
3	Study of valve system and valve timing diagram
4	Determination of engine power
5	Study of Oil & Fuel system - determination of physical properties
6	Study of Air cleaning system
7	Study of Diesel injection system & timing
8	Study of Cooling system
9	Demonstration of working of governing system
10	Demonstration of working of Lubricating system
11	Demonstration of working of electrical and ignition system
12	Visit to engine manufacturer/ assembler/ spare parts agency**. (Optional)**

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Understand, discuss and describe the fundamentals and working of IC engine
- Apply their knowledge and identify the working mechanism of different components of IC engine.
- Analyse the problems in using right amount of fuel and lubricants for better efficiency and economy
- Evaluate and understand the heat engine balance of engine for maintaining at right temperature for different type of work
- Apply and understand ignition system and problems faced during starting of ignition system
- Apply and understand governing system and problems faced during running of governing system
- Perform experiments to determine the properties of fuels and oils.
- Conduct experiments on engines and draw characteristics.
- Test basic performance parameters of I.C. Engine and implement the knowledge in industry
- Identify exhaust emission, factors affecting them and exhibit his competency towards preventive maintenance of IC Engine

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

- **The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component**.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

1. Jagdishwar Sahay. 2015. Elements of Agricultural Engineering. Standard Publishers, New Delhi
2. Jain SC and CR Rai., 2008. Farm Tractor Maintenance and Repair. Standard Publishers, New Delhi
3. Jain, S.C., and Rai, C.R. (1984). Farm Tractor - Maintenance and Repair. Tata Mc Graw- Hill Publishing Company Ltd, New Delhi.
4. Liljedahl John, B., Casleton Walter, M., Turnquist Paul, K., and Smith David, W. (1951). Tractors and Their Power Units, . John Wiley & Sons, New-York.
5. Donnel Hunt. Farm Power Machinery and management. Iowa State University Press, Ames, USA.
6. Gill Paul, W., Smith James, H., and Ziurys Eugene, J. (1967). Fundamentals of Internal Combustion Engines. Oxford & IBE Publishing Company, New Delhi.
7. Gupta, R.B., and Gupta, B.K. (1987). Tractor Mechanic, Theory, Maintenance and Repair. Sathya Prakashan and Tech India Publications, New Delhi.
8. Mathur, M.L., and Sharma, R.P. (1994). A Course in Internal Combustion Engines. Danpat Rai & Sons, Delhi.
9. Gill Paul, W., Smith James, H., and Ziurys Eugene, J. (1967). Fundamentals of Internal Combustion Engines.

Oxford & IBE Publishing Company, New Delhi.
10. Gupta, R.B., and Gupta, B.K. (1987). Tractor Mechanic, Theory, Maintenance and Repair. Sathya Prakashan and Tech India Publications, New Delhi.
11. Jain, S.C., and Rai, C.R. (1984). Farm Tractor - Maintenance and Repair. Tata Mc Graw- Hill Publishing Company Ltd, New Delhi.
12. Nakra C.P., 2009. Farm Machines and Equipments. Dhanpat Rai Publishers, New Delhi
13. Neil Southorn, Tractors, 1995. Operation, Performance and Maintenance, Inkata Press Australia.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

AGRICULTURAL PROCESS ENGINEERING			
Course Code	**BAG403**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(4:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory		

Course Objectives:

- To train the students on unit operations of agricultural process engineering
- To acquaint with the engineering properties of agricultural materials
- Enable the students to understand the concepts of cleaning of cereals, size reduction and rice milling

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1 **8 HOURS**

Physical characteristics of different food grains: fruits and vegetables – importance, Shape and size – criteria for describing shape and size, Roundness and sphericity – Volume and density – Specific gravity – Bulk density Porosity – surface area.

Rheology – basic concepts, ASTM standard definition of terms, Rheological Properties – Force deformation behavior, stress and strain behavior, Visco elasticity – time effects, Rheological models - Kelvin and Maxwell models, electrical equivalence of mechanical models.

Module-2 **8 HOURS**

Frictional Properties: Friction in agricultural materials – measurement – rolling resistance – angle of internal friction and angle of repose, Aerodynamics of agricultural products – drag coefficient and terminal velocity.

Electrical properties – Di electrical properties, Thermal Properties – specific heat – thermal conductivity-thermal diffusivity. Application of engineering properties in handling and processing equipment.

Module-3 **8 HOURS**

Theory of separation: Types of separators, Cyclone separators, Size of screens applications, Separator based on length, width and shape of the grains, specific gravity, density, Air-screen grain cleaner principle and types, Design considerations of air screen grain cleaners, Sieve analysis-particle size determination, Ideal screen and actual screen– effectiveness of separation and related problems, Pneumatic separator, Cleaning and separation equipment's.

Module-4 **8 HOURS**

Scope and importance of crop processing: Principles and methods of food processing- cleaning and grading of cereals, Size reduction –principle of comminution/ size reduction, mechanisms of comminution of food, particle shape, average particle size, Characteristics of comminuted products, crushing efficiency, Determination and designation of the fineness of ground material, screen analysis, Empirical relationships (Rittinger_s, Kick_s and Bond_s equations), Work index, energy utilization, Size reduction equipment – Principal types, crushers (jaw crushers, gyratory, smooth roll), Hammer mills, Attrition mills, Burr mill, Tumbling mills, Action in tumbling mills, Size reduction equipment –Ultra fine grinders (classification hammer mills, colloid mill), Cutting machines.

Module-5 **8 HOURS**

Milling - Rice milling: Principles and equipments, Paddy parboiling methods and equipment, Wheat milling, Milling of Pulses, wet millig, dry milling and milling efficiency. Theory of filtration, Rate of filtration, Applications, Constant rate filtration and Constant–pressure filtration derivation of equation, Filtration equipment, Plate and frame filter press, Rotary filters and tubular filters.

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Preparation of flow charts and layout of a food processing plant
2	Mixing index and study of mixers
3	Determination of fineness modulus and uniformity index
4	Determination of mixing index of a feed mixer
5	Determination of the efficiency of cyclone separator
6	Tutorial on use of psychometric chart
7	Tutorial on power requirement in size reduction of grain using Ratzinger's law, Kicks law and Bond's law
8	Performance evaluation of hammer mill and attribution mill.
9	Separation behaviour in pneumatic separation

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Be proficient in the scope of the process engineering and the use of processing machinery
- Understand the physical properties, rheological properties and frictional properties of agricultural materials
- Summarising the thermal properties, electrical properties and the terms related to the machine design aspects
- Some of the basic concepts related to cleaning and size reduction equipments
- To acquaint the students with the milling of rice, parboiling technologies and milling of pulses and oil seeds
- Understand the filtration equipments

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous

evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.

- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

- **The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component**.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

1. Unit Operations of Agricultural Processing, Sahay KM and Singh KK 1994, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Post Harvest Technology of Cereals, Pulses and oil seeds, Chakraverty A 1988. Oxford and IBH Publishing Co. Ltd., Calcutta.
3. Unit Operations of Chemical Engineering, McCabe WL, Smith JC and Harriott P 2017 McGraw-Hill Book Co., Boston.
4. Transport Processes and separation Process Principle, Geankoplis C J 2015 Prentice-Hall Inc., New Jersey.
5. Unit operations in Food processing, Earle R L 1983. Pergamon Press, New York
6. file:///C:/Users/DELL/Downloads/AlabmanualonAgriculturalProcessingandStructures.pdf
7. Post Harvest Technology of Cereals, Pulses and oil seeds, Chakraverty A 1988. Oxford and IBH Publishing Co. Ltd., Calcutta.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

MACHINE DRAWING AND GD & T		Semester	IV
Course Code	BAGL404	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2*:0	SEE Marks	50
Credits	01	Exam Hours	03
Examination nature (SEE)	Practical		
* One additional hour may be considered wherever required			

Course objectives:

- To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings.
- To make drawings using orthographic projections and sectional views
- To impart knowledge of thread forms, fasteners, keys, joints, couplings and clutches.
- To understand and interpret drawings of machine components leading to preparation of assembly drawings manually and using CAD packages.

Module 1 (only for CIE) **01 Sessions**

Review of basic concepts of Engineering Visualization

Geometrical Dimensioning and Tolerances (GD&T): Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards followed in industry.

Module 2 (only for CIE) **02 Sessions**

Sections of Simple and hollow solids: True shape of sections.

Module 3 (only for CIE) **03 Sessions**

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External) square and Acme. Sellers thread, American Standard thread, Helicoil thread inserts

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly), simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, countersunk head screw, grub screw, Allen screw

Rivets Keys: Parallel key, Taper key, Feather key, Gib-head key and Woodruff key.

Module 4 **03 Sessions**

Assembly of Joints, couplings and clutches (with GD&T) using 2D environment

Joints: Like Cotter joint (socket and spigot), knuckle joint (pin joint).

Couplings: Like flanged coupling, universal coupling

Module 5 **05 Sessions**

Assembly of Machine Components (with GD&T) using 3D environment

(Part drawings shall be given)

1. Bearings
2. Valves
3. Safety Valves
4. I.C. Engine components
5. Lifting devices
6. Machine tool components
7. Pumps

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

CO1: Interpret the Machining and surface finish symbols on the component drawings.

CO2: Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.

CO3: Illustrate various machine components through drawings

CO4: Create assembly drawings as per the conventions.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks) and that for SEE minimum passing mark is 35% of the maximum marks (18 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

- CIE shall be evaluated for max marks 100. Marks obtained shall be accounted for CIE final marks, reducing it by 50%.
- CIE component should comprise of
    - Continuous evaluation of Drawing work of students as and when the Modules are covered.
    - At least one closed book **Test** covering all the modules on the basis of below detailed weightage.

Weightage for Test and Continuous evaluation shall be suitably decided by respective course coordinators.

Module	**Max. Marks weightage**	**Evaluation Weightage in marks**	
		Computer display & printout	**Preparatory sketching**
Module 1	10	05	05
Module 2	15	10	05
Module 3	25	20	05
Module 4	25	20	05
Module 5	25	25	00
Total	**100**	**80**	**20**

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

- The duration of SEE is 03 hours**. Questions shall be set worth of 3 hours**
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.
- SEE shall be conducted and evaluated for maximum marks 100. Marks obtained shall be accounted for SEE final marks, reducing it to 50 marks.
- Question paper shall be set jointly by both examiners and made available for each batch as per schedule. **Questions are to be set preferably from Text Books.**
- Evaluation shall be carried jointly by both the examiners.
- Scheme of Evaluation: *To be defined by the examiners jointly and the same shall be submitted to the university along with question paper.*
- One full question shall be set from Modules 3 and 4 as per the below tabled weightage details. ***However, the student may be awarded full marks, if he/she completes solution on computer display without sketch***.

Suggested Learning Resources:

Books:

- K L Narayana, P Kannaiah, K Venkata Reddy, "Machine Drawing", New Age International, 3rd Edition. ISBN-13: 978-81-224-2518-5, 2006
- N D Bhatt , "Machine Drawing", Charotar Publishing House Pvt. Ltd.,50th Edition, ISBN-13: 978-9385039232, 2014

TRACTOR SYSTEMS AND CONTROLS		Semester	IV
Course Code	BAG405A	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

The course will enable the students to

- Acquire a basic understanding the concepts of transmission system in a tractor, major functional systems, Gearing theory, principle of operation, gear box types, functional requirements.
- Understand the study of brake system, familiarization with the hydraulic system adjustments and Study of tractor mechanics.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different type of teaching methods to develop the outcomes through Power-Point Presentation and Video demonstration or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

Study of need for transmission system in a tractor. Transmission system – types, major functional systems. Study of clutch – need, types, functional requirements, construction and principle of operation. Familiarization with single plate, multi-plate, centrifugal and dual clutch systems.

Module-2

Study of Gear Box – Gearing theory, principle of operation, gear box types, functional requirements, and calculation for speed ratio. Study of differential system – need, functional components, construction, calculation for speed reduction. Study of need for a final drive.

Module-3

Study of Brake system – types, principle of operation, construction, calculation for braking torque. Study of steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors. Study of Hydraulic system in a tractor – Principle of operation, types, main functional components, functional requirements.

Module-4

Familiarization with system the Hydraulic adjustments and ADDC. Study of tractor power outlets – PTO. PTO standards, types and functional requirements. Introduction to traction. Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device. Study of wheels and tyres – Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids.

Module-5

Study of tractor mechanics – forces acting on the tractor. Determination of CG of a tractor. Determination and importance of moment of inertia of a tractor. Study of tractor static equilibrium, tractor stability especially at turns. Determination of maximum drawbar pull. Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety. Introduction to tractor testing. Deciphering the engine test codes

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

1. Analyze functions of power transmission system and clutch system.
2. Discus Gear Box – Gearing theory, principle of operation, gear box types.
3. Apply principle of operation, construction, calculation for braking torque.
4. Familiarization with system the Hydraulic adjustments and ADDC
5. Analyze the importance of moment of inertia of a tractor. Study of tractor static equilibrium, tractor stability especially at turns.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books

1. Liljedahl J B and Others. Tractors and Their Power Units.
2. Rodichev V and G Rodicheva. Tractors and Automobiles.

Reference Books:

1. C.B.Richey. Agricultural Engineering Handbook.
2. John Deere. Fundamentals of Service Hydraul
3. Singh Kirpal. Automobile Engineering – Vol I.
4. Heitner Joseph. Automotive Mechanics: Principles and Practices

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

Industrial Instrumentation		Semester	IV
Course Code	**BAG405B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:
The course will enable the students to

- To introduce the measurement techniques of force, torque and speed.
- To introduce the measurement techniques of acceleration, Vibration and density
- To introduce the measurement Viscosity, Humidity and moisture.
- To introduce the temperature measurement techniques
- To introduce the pressure measurement techniques

Teaching-Learning Process (General Instructions)
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different type of teaching methods to develop the outcomes through Power-Point Presentation and Video demonstration or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

MEASUREMENT OF FORCE, TORQUE AND SPEED - Different types of load cells: Hydraulic, Pneumatic, Strain gauge, Magneto-elastic and Piezoelectric load cells – Different methods of torque measurement: Strain gauge, Relative angular twist. Sped measurement: Capacitive tacho, Drag cup type tacho, D.C and A.C tacho generators – Stroboscope.

Module-2

MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY -Accelerometers: LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers – Mechanical type vibration instruments – Seismic instruments as accelerometer – Vibration sensor – Calibration of vibration pickups – Units of density and specific gravity – Baume scale and API scale – Densitometers: Pressure type densitometers, Float type densitometers, Ultrasonic densitometer and gas densitometer. Power station, Calculation of energy through photovoltaic power generation and cost economics.

Module-3

MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE -Viscosity: Saybolt viscometer – Rotameter type and Torque type viscometers – Consistency Meters – Humidity: Dry and wet bulb psychrometers – Resistive and capacitive type hygrometers – Dew cell – Commercial type dew meter. Moisture: Different methods of moisture measurements –Thermal Conductivity and Capacitive sensors, Microwave, IR and NMR sensors, Application of moisture measurement – Moisture measurement in solids.

Module-4

TEMPERATURE MEASUREMENT - Definitions and standards – Primary and secondary fixed points – Different types of filed in system thermometers – Sources of errors in filed in systems and their compensation – Bimetallic thermometers – IC sensors – Thermocouples: Laws of thermocouple, Fabrication of industrial thermocouples, Reference junctions compensation, Signal conditioning for thermocouple, Commercial circuits for cold junction compensation, Response of thermocouple, Special techniques for measuring high temperature using thermocouple – Radiation fundamentals – Radiation methods of temperature measurement – Total radiation pyrometers – Optical pyrometers – Two colour radiation pyrometers – Fiber optic sensor for temperature measurement – Thermograph, Temperature switches and thermostats – Temperature sensor selection, Installation and Calibration.

Module-5

PRESSURE MEASUREMENT -Units of pressure – Manometers: Different types, Elastic type pressure gauges: Bourdon tube, Bellows, Diaphragms and Capsules – Electrical methods: Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor-Resonator pressure sensor – Measurement of vacuum: McLeod gauge, Thermal conductivity gauge, lionization gauges, Cold cathode type and hot cathode type – Pressure gauge selection, installation and calibration using dead weight ester.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

1. Understand Principles and working of Viscosity, Humidity, Moisture, temperature, pressure, flow and level measuring Instruments.
2. Calibrate temperature, flow , level and Pressure measuring devices
3. Apply measurement of Viscosity, Humidity, Moisture, temperature , pressure, flow and level in Industrial Applications
4. Select and install Industrial instruments for various applications
5. Understand various Electrical type Industrial Instruments

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books.

1. Doebelin, E.O. and Manik, D.N., "Measurement systems Application and Design", 6thMcGraw-Hill Education Pvt. Ltd,2011.
2. A.K. Sawhney and PuneetSawhney, "Mechanical Measurements and Instrumentation and Control", DhanpatRai & Co. (P) Limited, 2015

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

Non-Conventional Energy Resources		Semester	IV
Course Code	**BAG405C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

The course will enable the students to

- Awareness about renewable Energy Sources and technologies.
- Adequate inputs on a variety of issues in harnessing renewable Energy.
- Recognize current and possible future role of renewable energy sources.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different type of teaching methods to develop the outcomes through Power-Point Presentation and Video demonstration or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

RENEWABLE ENERGY (RE) SOURCES - Importance of renewable sources of energy. Concept and limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of renewable energy sources with non renewable sources.

Module-2

Solar Energy: Energy available from Sun, Solar radiation data, solar energy conversion into heat through, Flat plate and Concentrating collectors, different solar thermal devices, Principle of natural and forced convection drying system, Solar Photo-voltaic: p-n junctions. Solar cells, PV systems, Stand alone, Grid connected solar power station, Calculation of energy through photovoltaic power generation and cost economics.

Module-3

Wind Energy: Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Windmill rotors, Determination of torque coefficient, Induction type generators, Working principle of wind power plant.

Module-4

Biomass Energy - Introduction-Biomass resources –Energy from Bio mas: conversion process - Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

Module-5

Other Energy Sources - Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell :Principle of working- various types – construction and applications. Energy

Storage System- Hybrid Energy Systems.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

1. Ability to create awareness about renewable Energy Sources and technologies.
2. Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.
3. Ability to recognize current and possible future role of renewable energy sources.
4. Ability to explain the various renewable energy resources and technologies and their applications.
5. Ability to understand basics about biomass energy.
6. Ability to acquire knowledge about solar energy

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

5. The question paper will have ten questions. Each question is set for 20 marks.
6. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
7. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. G. D Rai, Non-Conventional Energy Sources, Kanna Publishers.
2. Joshua Earnest, Tore Wizeliu, 'Wind Power Plants and Project Development', PHI Learning Pvt. Ltd, New Delhi, 2011.
3. D.P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.
4. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.

Additional References:

1. A.K.Mukerjee and Nivedita Thakur," Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011
2. Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.
3. Chetan Singh Solanki, " Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2011

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

Robotics and Automation		Semester	IV
Course Code	**BAG405D**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

The course will enable the students to

- Awareness about renewable Energy Sources and technologies.
- Adequate inputs on a variety of issues in harnessing renewable Energy.
- Recognize current and possible future role of renewable energy sources.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different type of teaching methods to develop the outcomes through Power-Point Presentation and Video demonstration or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

Definitions- Robots, Robotics; Types of Robots- Manipulators, Mobile Robots-wheeled & Legged Robots, Aerial Robots; Anatomy of a robotic manipulator-links, joints, actuators, sensors, controller; open kinematic vs closed kinematic chain; degrees of freedom; Robot configurations-PPP, RPP, RRP, RRR; features of SCARA, PUMA Robots; Classification of robots based on motion control methods and drive technologies; 3R concurrent wrist; Classification of End effectors - mechanical grippers, special tools, Magnetic grippers, Vacuum grippers, adhesive grippers, Active and passive grippers, selection and design considerations of grippers in robot.

Module-2

Robot Kinematics Direct Kinematics- Rotations-Fundamental and composite Rotations, Homogeneous coordinates, Translations and rotations, Composite homogeneous transformations, Screw transformations, Kinematic parameters, The Denavit-Hartenberg (D-H) representation, The arm equation, direct kinematics problems (upto 3DOF) Inverse kinematics- general properties of solutions, Problems (upto 3DOF) Inverse kinematics of 3DOF manipulator with concurrent wrist (demo/assignment only) Tool configuration Jacobian, relation between joint and end effector velocities.

Module-3

Trajectory planning Tasks Path planning Trajectory Planning. Joint space trajectory planning- cubic polynomial, linear trajectory with parabolic blends, trajectory planning with via points; Cartesian space planning, Point to point vs continuous path planning. Obstacle avoidance methods- Artificial Potential field, A* algorithms.

Module-4

Manipulator Dynamics Lagrange's formulation – Kinetic Energy expression, velocity Jacobian and Potential Energy expression, Generalised force, Euler-Lagrange equation, Dynamic model of planar and spatial serial robots upto 2 DOF, modelling including motor and gearbox.

Robot Control - The control problem, Single axis PID control-its disadvantages, PD gravity control, computed torque control. Simulation of simple robot-control system-Matlab programming for control of robots(demonstration/assignment only)

Module-5

Industrial Applications - Material handling, welding, Spray painting, Machining. Case study for robotic applications including robot selection considerations for a typical industrial ROBOTICS & AUTOMATION application- number of axes, work volume, capacity & speed, stroke &reach, Repeatability, Precision and Accuracy, Operating environment. forge – the robotic configuration for pick and place robot, spot welding robot in a car manufacturing industry, peg in hole assembly. Applications in the medical, mining, space, defence, security, domestic, entertainment.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

1. Familiarise with anatomy, specifications and types of Robots
2. Obtain forward and inverse kinematic models of robotic manipulators
3. Plan trajectories in joint space & Cartesian space and avoid obstacles while robots are in motion
4. Develop dynamic model and design the controller for robotic manipulators
5. Choose appropriate Robotic configuration and list the technical specifications for robots used in different applications
6. Familiarise with different types of mobile robots, kinematic models, motion control and sensors for mobile robots

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks. .
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Robert. J. Schilling , "Fundamentals of robotics – Analysis and control", Prentice Hall of India 1996.
2. Introduction to Robotics (Mechanics and control), John. J. Craig, Pearson Education Asia 2002.
3. Introduction to Robotics by S K Saha, Mc Graw Hill Education
4. R K Mittal and I J Nagrath, "Robotics and Control", Tata McGraw Hill, New Delhi,2003.
5. Ashitava Ghosal, "Robotics-Fundamental concepts and analysis", Oxford University press.
6. Robotics Technology and Flexible Automation, Second Edition, S. R. Deb
7. Introduction to Autonomous Mobile Robots, Siegwart, Roland, Cambridge, Mass. : MIT Press, 2nd ed.

Additional References:

1. Sicilliano, Khatib , "Handbook of Robotics", Springer
2. John J. Craig, Introduction to Robotics – Mechanics and Control
3. Kevin M. Lynch, Frank C. Park, Modern Robotics Mechanics, Planning and Control

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

Simulation and Analysis using Ansys workbench		Semester	IV
Course Code	**BAGL456A**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	14 sessions	Total Marks	100
Credits	01	Exam Hours	03
Examination nature (SEE)	Practical		

Course objectives:

- Analyzing the force and stress in mechanical components.
- Analyzing deflection in mechanical components.
- Analyzing thermal stress of mechanical components.
- Analyzing heat transfer in mechanical components.
- Analyzing the vibration of mechanical components.

Sl.NO	Experiments
1	Study of Basics in ANSYS
2	Stress analysis of a plate with a circular hole
3	Stress analysis of rectangular L bracket
4	Stress analysis of cantilever beam
5	Stress analysis of simply supported beam
6	Stress analysis of fixed beam
7	Stress analysis of an axi-symmetric component
8	Thermal stress analysis of a 2D component
	Demonstration Experiments (For CIE)
9	Conductive heat transfer analysis of a 2D component
10	Convective heat transfer analysis of a 2D component
11	Mode frequency analysis of cantilever beam
12	Mode frequency analysis of simply supported beam

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Find out the effect of force and impact of stress on the mechanical components.
- Calculate the deflection occurring on the mechanical components.
- Get a detailed understanding of the thermal stress creation and its mechanism of spreading in mechanical components.
- Gain knowledge regarding the mechanism of heat transfer in mechanical components.
- Find out the vibration effects on mechanical components.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Economics for Engineers		Semester	IV
Course Code	**BAG456B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	01	Exam Hours	1
Examination nature (SEE)	Theory		

Course objectives:

- To adequate the knowledge of dynamic environment of economic calculations and principles through the prism of engineering.
- The subject endeavours to provide them with the tools to optimize profits, minimize costs, analyze various scenarios, forecast fluctuations in business cycles, and more.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

Economic Decisions Making – Overview, Problems, Role, Decision making process.

Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits. Case Study - Price and Income Elasticity of Demand in the real world

Module-2

Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.

Module-3

Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis.

Module-4

Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. Case Study – Competition in the Advertise Segment in India

Module-5

Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Describe the principles of economics that govern the operation of any organization under diverse market conditions
2. Comprehend macroeconomic principles and decision making in diverse business set up
3. Explain the Inflation & Price Change as well as Present Worth Analysis
4. Apply the principles of economics through various case studies

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
3. John A. White, Kenneth E.Case,David B.Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.Paneer Seelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

Web links and Video Lectures (e-Resources):

- www.finmin.nic.in , www.rbi.org.in , www.planningcommission.nic.in

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

Introduction to Data Analytics		Semester	IV
Course Code	**BAGL456C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	14 sessions	Total Marks	100
Credits	01	Exam Hours	03
Examination nature (SEE)	Practical		

Course objectives:

- Gather sufficient relevant data, conduct data analytics using scientific methods, and make appropriate and powerful connections between quantitative analysis and real-world problems.
- Demonstrate a sophisticated understanding of the concepts and methods; know the exact scopes and possible limitations of each method; and show capability of using data analytics skills to provide constructive guidance in decision making.
- Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
- Show substantial understanding of the real problems; conduct deep data analytics using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.
- Write an insightful and well-organized report for a real-world case study, including thoughtful and convincing details.
- Make better business decisions by using advanced techniques in data analytics.

Sl.NO	Experiments
1	Data Analytics Overview
2	Importance of Data Analytics
3	Types of Data Analytics
4	Descriptive Analytics
5	Diagnostic Analytics
6	Predictive Analytics
7	Prescriptive Analytics
8	Benefits of Data Analytics
	Demonstration Experiments (For CIE)
9	Data Visualization for Decision Making
10	Data Types, Measure Of central tendency, Measures of Dispersion
11	Graphical Techniques, Skewness & Kurtosis, Box Plot
12	Descriptive Stats and Sampling Funnel, Sampling Variation, Central Limit Theorem, Confidence interval

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Student will understand what data are, how they are collected, the role of metadata in understanding a given set of data, and how to assess the quality/reliability of data.
2. Student will have intermediate proficiency in the acquisition and organization of data.
3. Students will demonstrate intermediate proficiency in the visualization of data to communicate information and patterns that exist in the data.
4. Students will be able to use at beginning level of proficiency the tools of statistics and machine learning to ask questions of and explore patterns in data.
5. For a given exploration of data, students will be able to communicate both in writing and verbally the limitations of data, the methods of acquisition, the interpretation of visualized data, and the results of statistical analysis.
6. In the context of data analysis, students will be able to reflect on the ethics of the questions asked of data, the methods of acquiring the data, the mode of data analysis/visualization, and the rhetoric used in communicating findings with data.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

HUMAN ENGINEERING AND SAFETY		Semester	IV
Course Code	**BAG456D**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(1:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	01	Exam Hours	01
Examination nature (SEE)	Theory		

Course Objectives:

- To acquaint and equip with the ergonomic aspects in the design of farm machinery and equipment and safety aspects of human subjects.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

Human factors: Human factors in system development – concept of systems. Basic processes in system development, performance reliability, human performance. Information input process.

Module-2

Displays: Visual displays, major types and use of displays, auditory and tactual displays. Speech communications

Module-3

Biomechanics: Biomechanics of motion, types of movements, Range of movements, strength and endurance, speed and accuracy, human control of systems. Human motor activities, controls, tools and related devices.

Module-4

Anthropometry and Atmospheric conditions: Anthropometry - arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution.

Module-5

Safety regulations: Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting, Power tiller and tractor & trailer operation etc.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Equip with the ergonomic aspects in the design of farm machinery and equipment
2. Equip with the safety aspects of human subjects.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester

2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. Bridger, R.S. Introduction to ergonomics, 1995. McGraw Hill, INC, New York.
2. Charles D Reese. Accident / incident prevention techniques, 2001. Taylor and Francis, London.
3. Gavrielsalvendy,. Hand book of human factors and ergonomics,1997. John Wileyand sons, INC, New York.
4. Kromer, K.H.E. Ergonomics, 2001. Prentice hall, Upper saddle river, NJ 07458.
5. William D. McArdle. Exercise physiology, 1991. LEA andFEBIGER, London.

Web links and Video Lectures (e-Resources):

- http://www.osha.gov/SLTC/ergonomics
- http://www.ergonomicsusa.com
- http://www.masterytech.com/productpage.php?product_id=clmimsdt
- http://www.samaras-assoc.com/ergonomics.htm
- http://www.ergonomics4schools.com/lzone/anthropometry.htm
- http://www.brianmac.co.uk/biomechanics.htm
- http://www.d.umn.edu/~mlevy/CLASSES/.../esat3300_intro.htm
- http://www.websters-dictionary-online.org/wo/work+physiology.html
- http://www.ufv.ca/faculty/kpe/.../physiology%203r/workphysio3.ppt
- http://www.chiroweb.com/archives/18/07/06.html
- http://www.brianmac.co.uk/oxdebit.htm
- http://www.osha.gov/SLTC/heatstress
- http://www.plantstress.com/Articles/heat_i/heat_i.htm
- http://www.hoptechno.com/book41.htm
- http://www.tuolumnejpa.org/Cold%20Stress.pdf
- http://www.ginmiller.com/gmf06/articles/.../RPE_talk_test.html
- http://www.cdc.gov/physicalactivity/everyone/.../exertion.html
- http://www.laxpart161.com/en/noise_effects_LAX.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

BIOLOGY FOR ENGINEERS		Semester	IV
Course Code	**BBOK407**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of biodesign principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students develop the interdisciplinary vision of biological engineering

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical/hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' participation through audio-video based content creation for the syllabus (as assignments).
7. Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
8. Students' seminars (in solo or group) /oral presentations.

Module-1

BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE): Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

Module-2

HUMAN ORGAN SYSTEMS AND BIO DESIGNS - 1 (QUALITATIVE): Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye).Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).

Module-3

HUMAN ORGAN SYSTEMS AND BIO-DESIGNS - 2 (QUALITATIVE): Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine).Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis).

Module-4

NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE): Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

Module-5

TRENDS IN BIOENGINEERING (QUALITATIVE): Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Selfhealing Bioconcrete (based on bacillus spores,

calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

1. Elucidate the basic biological concepts via relevant industrial applications and case studies.
2. Evaluate the principles of design and development, for exploring novel bioengineering projects.
3. Corroborate the concepts of biomimetics for specific requirements.
4. Think critically towards exploring innovative biobased solutions for socially relevant problems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016 • Blood Substitutes, Robert Winslow, Elsevier, 2005

Web links and Video Lectures (e-Resources):

- VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource
- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Group Discussion of Case studies
- Model Making and seminar/poster presentations
- Design of novel device/equipment like Cellulose-based water filters, Filtration system mimicking the kidney, Bioremediation unit for E-waste management, AI and ML based Bioimaging

Universal Human Values Course		**Semester**	**IV**
Course Code	**BUHK408**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(1:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	01	Exam Hours	01
Examination nature (SEE)	Theory		

Course Objectives:

This introductory course input is intended:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

This course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. The course is in the form of 20 lectures (discussions)
3. It is free from any dogma or value prescriptions.
4. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation – the whole existence is the lab and every activity is a source of reflection.
5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous selfevolution.
6. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

Module-1

Introduction to Value Education (4 hours)

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Module-2

Harmony in the Human Being (4 hours)

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Module-3

Harmony in the Family and Society (4 hours)

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Module-4

Harmony in the Nature/Existence (4 hours)

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Module-5

Implications of the Holistic Understanding – a Look at Professional Ethics (4 hours)

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Course outcome (Course Skill Set)

1. By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
2. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

   Therefore, the course and further follow up is expected to positively impact common graduate attributes like:
   1. Holistic vision of life
   2. Socially responsible behaviour
   3. Environmentally responsible work
   4. Ethical human conduct
   5. Having Competence and Capabilities for Maintaining Health and Hygiene

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

4. First test at the end of 5th week of the semester

5. Second test at the end of the 10th week of the semester
6. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

3. First assignment at the end of 4th week of the semester
4. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

-READINGS:

Text Book and Teachers Manual

a. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
b. The Teacher‟s Manual
Teachers‟ Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome’s report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

- Value Education websites, https://www.uhv.org.in/uhv-ii, http://uhv.ac.in, http://www.uptu.ac.in
- Story of Stuff, http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Agricultural Engineering

Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC/BSC	BAG301	Basics Concepts and Applications of Agrochemicals	TD-PSB	3	0	0		03	50	50	100	3
2	IPCC	BAG302	Fundamentals of Agriculture & Crop Production Technology	TD: PSB	3	0	2		03	50	50	100	4
3	IPCC	BAG303	Soil Mechanics, Surveying & Levelling	TD: PSB	3	0	2		03	50	50	100	4
4	PCC	BAG304	Mechanics of Materials & Machine	TD: PSB	3	0	0		03	50	50	100	3
5	PCCL	BAGL305	Basic Workshop Practise Lab	TD: PSB	0	0	2		03	50	50	100	1
6	ESC	BAG306x	ESC/ETC/PLC	TD: PSB:	3	0	0		03	50	50	100	3
7	UHV	BSCK307	**Social Connect and Responsibility**	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	BAG358x	Ability Enhancement Course/Skill Enhancement Course - III		If the course is a Theory				01	50	50	100	1
					1	0	0						
					If a course is a laboratory				02				
					0	0	2						
9	MC	BNSK359	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK359	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK359	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.K :This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC)			
BAG306A	Information Technology for Land and Water Management	BAG306C	Analog and Digital Electronics Circuit
BAG306B	Artificial Intelligence and Machine learning	BAG306D	Solid Waste And By-Product Utilization
Ability Enhancement Course – III			
BAGL358A	Advanced Python Programming [0-0-2]	BAGL358C	Spreadsheet for Engineers [0-0-2]
BAG358B	Fundamentals of Virtual Reality [0-2-0]	BAGL358D	Tools in Scientific Computing [0-0-2]

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.