Faculty of Engineering & Technology

Syllabus

for

Bachelor of Technology (B. Tech.)

in

Agriculture Engineering

(Program Code: ET0141AG)

(2022-23)

Approved by the Academic Council vide resolution no 44.03 and dated 30.09.2022

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1. INTRODUCTION

The quality of technical education should be improved in such a manner that engineering graduates are able to compete globally in terms of their knowledge and skills and serve for the society and nation. And for this purpose, Learning Outcome-based Curriculum Framework (LOCF) is developed.

Incorporation of Learning Outcome-based Curriculum Framework (LOCF) in the Graduate program like B.Tech.Makes it student-centric, interactive and outcome-oriented to achieve well-defined aims, objectives and goals.The learning outcomes are attained by students through development of skills acquired during the program of study by providing them practical exposure. Program learning outcomes will include subject-specific skills and generic skills, including transferable global skills and competencies. It would also focus on knowledge and skills that prepare students for further study, employment and society development. LOCF help ensure comparability of learning levels and academic standards across colleges/universities.

At present, the goal of technical education may be achieved using the following measures:

i. Curriculum reform based on learning outcome-based curriculum framework (LOCF).
ii. Improving learning environment and academic resources.
iii. Elevating the quality of teaching and research.
iv. Involving students in discussions, problem-solving and out of box thinking about various ideas and their applicability, which may lead to empowerment and enhancement of the social welfare.
v. Motivating the learners to understand various concepts of their educational program keeping in view the regional context.
vi. Enabling learners to create research atmosphere in their colleges/ institutes/ universities.
vii. Teach courses based on Choice Based Credit System (CBCS).

2. LEARNING OUTCOME-BASED APPROACH TO CURRICUtLUM PLANNING

The Bachelor of Technology (B. Tech.) degree is awarded to the students on the basis of knowledge, understanding, skills, values and academic achievements. Hence, the learning outcomes of this program are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for knowledge.

The course for B. Tech. is designed according to outcome based approach in the light of graduate attributes, description of qualifications, courses and program learning outcomes. It may lead to all round development and delivery of complete curriculum planning. Hence, it provides specific guidelines to the learners to acquire sufficient knowledge during this program.

The program has been planned in such manner that there is scope of flexibility and innovation in

i. Modifications of prescribed syllabi.
ii. Teaching-learning methodology.

iii. Assessment technique of students and knowledge levels.

iv. Learning outcomes of courses.

v. Addition of new elective courses subject to availability of experts in colleges/institutes/universities across the country.

2.1. Nature and Extent of Undergraduate Program

As a part of effort to enhance employability of engineering graduates the outcomes based curriculum are very essential in present day perspective. Therefore, higher education degrees must formulate Graduate Attributes (GAs), qualification descriptors, learning outcomes and course learning outcomes which will help in curriculum planning and development in the form of design and delivery of courses. The overall formulation of the degree program must equip learner to have competencies to provide deliverables to the industry.

2.2. Aims of undergraduate program (B. Tech.)

The overall aims of B. Tech. program are to:

i. Create deep interest in Practical learning.Develop broad and balanced knowledge and understanding of definitions, concepts and principles.

ii. Familiarize the students with suitable tools related to designing, modeling etc.

iii. Enhance the ability of learners to apply the knowledge and skills acquired by them during the program to solve specific problems of their courses.

iv. Provide learners sufficient knowledge and skills enabling them to undertake higher studies in technical field.

v. Encourage the students to develop a range of generic skills helpful in employment, internships and social activities.

2.3. Motive behind curriculum planning and development

The committee considered and discussed the following factors for LOCF for the graduates:

1) Framing of syllabi
2) Learners attributes
3) Qualification descriptors
4) Program learning outcomes
5) Course learning outcomes
6) Necessity of having elective courses
7) Academic standards

3. Program Educational Objectives (PEOs):

The program educational objectives are set in line with Institutional and Departmental mission statements. The program educational objectives of Bachelor of Technology is to produce engineers who later take the responsibility of engineering professionals and researchers with following qualities:

PEO1. Apply basic knowledge of mathematics, principles of physics and chemistry, and interdisciplinary engineering for the design and development.

PEO2. Demonstrate the application of exploration practices and engineering principles through development of innovative tools that are beneficial in production.

PEO3. Exhibit skills of design and construct machineries based on requirement and need of Technology operations.

PEO4. Exhibit strong, independent learning, analytical and problem solving skills with special emphasis on design, communication, and ability to work in teams.

PEO5. To have successful career as engineering professional or a researcher through lifelong learning in the field of Bachelor of Technology.

4. Graduation Attributes (GAs)

The graduate attributes in B. Tech. are the summation of the expected course learning outcomes mentioned in the end of each course. Some of them are stated below.

GA1: Discipline-specific Knowledge: Capability of demonstrating comprehensive knowledge of B. Tech. program and understanding of core branch so that it forms a foundation for a graduate program of study.

GA2: Critical Thinking & Analytical Reasoning: Ability to employ critical thinking in understanding the concepts relevant to the various branches of engineering.Ability to analyze the results and apply them in various problems appearing in different streams.

GA3: Problem Solving: Capability to solve problems by using research-based knowledge and research methods including innovative thinking, design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

GA4: Research-related skills: To develop a sense of inquiry and capability for asking relevant and intelligent questions, problem identification, synthesizing and articulating; ability to recognize and establish cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish Hypotheses, predict cause- and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

GA5: Usage of Modern Tools (Information/digital literacy): To create, select, and apply appropriate techniques, resources, and modern science and IT tools including prediction and modeling to complex science activities with an understanding of the limitations.

GA6: Social Responsibilities: Ability to work with contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

GA7: Self-directed learning with environment: Ability to work independently and doin-depth study of various problems and requirements of society with natural available resources which leads to sustainable development.

GA8. Moral and ethical awareness/reasoning: Ability to identify unethical behavior such as falsification or misrepresentation of data and adopting objective, unbiased and truthful actions in all aspects of their program.

GA9. Leadership Readiness/Qualities: Capability for mapping out the tasks in a team or an organization, self-motivating and inspiring team members to engage with the team objectives/vision; and using management skills to follow the mapped path to the destination in a smooth and efficient way.

GA10: Communication skills:

a. Ability to communicate various concepts of technical education effectively using practical approach and their geometrical visualizations.

b. Ability to use courses as a precise language of communication in other branchesof human knowledge.

c. Ability to resolve unsolved problems and requirements of industries and societies.

d. Ability to show the importance of their technical knowledge as precursor to various scientific developments since the beginning of the civilization.

GA11: Project Management and Finance: Ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

GA12: Lifelong learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

5. QUALIFICATION DESCRIPTORS (QDs)

The qualification descriptor suggests the generic outcomes and attributes to be obtained while obtaining the degree of B. Tech. The qualification descriptors indicate the academic standards on the basis of following factors:

1. Level of knowledge
2. Understanding
3. Skills
4. Competencies and attitudes
5. Values.

These parameters are expected to be attained and demonstrated by the learners after becoming graduates in this program. The learning experiences and assessment procedures should be so designed that every graduate may achieve the program learning outcomes with equal opportunity irrespective of the class, gender, community and regions. Each graduate in engineering should be able to:

i. Demonstrate fundamental systematic knowledge and its applications. It should also enhance the subject specific knowledge and help in creating jobs in various sectors.

ii. Demonstrate educational skills in areas of their program.

iii. Apply knowledge, understanding and skills to identify the difficult/unsolved problems in courses of their program and to collect the required information in possible range of sources and try to analyze and evaluate these problems using appropriate methodologies.

iv. Apply one’s disciplinary knowledge and skills in newer domains and uncharted areas.

v. Identify challenging problems and obtain well-defined solutions.

vi. Exhibit subject-specific transferable knowledge relevant to job trends and employment opportunities.

6. PROGRAM OUTCOMES (POs)

Students graduating with the B. Tech. degree should be able to acquire with following POs

PO1. Engineering knowledge: Apply the knowledge of Agriculture, mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Mapping of Graduate Attributes (GAs) and Program Outcomes (POs):

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PO1	■											
PO2		■										
PO3			■									
PO4				■								
PO5					■							
PO6						■						
PO7							■					
PO8								■				
PO9									■			
PO10										■		
PO11											■	
PO12												■

7. PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1 Developing innovative processes, products, and technologies to meet the challenges in agriculture and farming practices.

PSO2 Analyzing and identifying complex agricultural problems and formulating ethical solutions use the principles of agricultural science, engineering, and business.

8. TYPES OF COURSES:

1. Courses in a program may be of four kinds: Core, Elective, Ability Enhancement and Skill Enhancement.

a) Core Course:-

There may be a Core Course in every semester. This is the course which is to be compulsorily studied by a student as a requirement to complete the program in a said discipline of study.

b) Elective Course:-

Elective course is a course which can be chosen from a pool of papers. It may be

1) Supportive to the discipline of study
2) Providing an expanded scope
3) Enabling an exposure to some other discipline/domain

4) Nurturing student's proficiency/skill.

An Elective Course may be 'Discipline Centric/Specific' & Generic Elective

Discipline Centric/Specific Elective (DSE): Elective courses offered under the main discipline/subject of study are referred to as Discipline Centric/Specific.

Generic/Open Elective (GE): An elective course chosen from an unrelated discipline/subject is called Generic/Open Elective. These electives will be focusing on those courses which add generic proficiency of students.

- Principle of Electronic Communication
- Micro and Smart System Technology
- Optimization Techniques
- Soft Computing
- Robotics and control
- Simulation Modeling and Analysis

c) Ability Enhancement Compulsory Courses (AECC):-

AECC courses are based upon the content that leads to knowledge enhancement, for example: English Communication, Environment Science/ Studies, etc.

d) Skill Enhancement Courses (SEC):-

SEC Courses provide value based and/or skill based knowledge and may content both Theory and Lab/Training/Field Work. The main purpose of these courses is to provide students life- skills in hands- on mode so as to increase their employability

2. List of Course

a) Program Core Course:-

Fluid Mechanics and Open Channel Hydraulics

Fundamental of Renewable Energy Sources

Watershed Hydrology

Soil Mechanics

Tractor and Automotive Engines

Irrigation Engineering and Sprinkler and Micro Irrigation Systems

Soil and Water Conservation Engineering

Theory and Design of Machines

Farm Machinery and Equipment –I

Building Construction and Cost Estimation

Tractor Systems and Controls

Post Harvest Engineering of Cereals, Pulses and Oilseeds

Watershed Planning and management

Groundwater, Wells and Pumps

Renewable Power Sources

Engineering Properties of Agricultural Produce

Farm Machinery and Equipment –II
Food Packaging Technology
Water Harvesting and Soil Conservation Structures
Drainage Engineering
Tractor and Farm machinery Operation and Maintenance
Dairy and Food Engineering
Bio Energy Systems: Design and Applications
Design of Structures
08 weeks Experiential Learning on campus (Student READY)
Educational Tour
Entrepreneurship and Business Management

b) Elective Course:-

c) Ability Enhancement Compulsory Courses (AECC):-
ANANDAM (IN ALL SEMESTERS)

d) Skill Enhancement Courses (SEC):-
Professional Skills
Leadership and Management Skills

Computation of Workload and Credits:

Lecture (L)	:	1 Credit = 1 Theory period of one hour duration
Tutorial (T)	:	1 Credit = 1 Tutorial period of one hour duration
Practical (P)	:	1 Credit = 1 Practical period of two hour duration

9. PROGRAM STRUCTURE B. Tech. (Agriculture Engineering)

PROGRAM STRUCTURE B. Tech. (Common for All) Batch 2022-26

Semester - I

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC101	Engineering Mathematics-I	Core	30	70	100	3	1	-	4
BTBSC102	EngineeringPhysics	Core	30	70	100	3	1	-	4
BTHSMC103	CommunicationSkills (Jeevan Kaushal-I)	AECC	30	70	100	2	-	-	2
BTESC104	Programming forProblemSolving	SEC	30	70	100	3	-	-	3
BTESC 105	BasicCivilEngineering	Elective	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC106	EngineeringPhysics Lab	Core	30	20	50	-	-	1	1
BTHSMC107	LanguageLab	SEC	30	20	50	-	-	1	1
BTESC108	ComputerProgrammingLab	SEC	30	20	50	-	-	1	1
BTESC 109	BasicCivilEngineeringLab	Elective	30	20	50	-	-	1	1
BTESC110	ComputerAided EngineeringGraphics	SEC	30	20	50	-	-	1	1
BTSODECA11	Social Outreach, Discipline &ExtraCurricular Activities		**50**		50	-	-	-	1
BTBSC 112	ANANDAM	AECC	**50**	**50**	100	**1**		**1**	2
	Total		**400**	**500**	**900**	**14**	**2**	**6**	**23**

Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	EngineeringMathematics-II	Core	30	70	100	3	1	-	4
BTBSC 202	EngineeringChemistry	Core	30	70	100	3	1	-	4
BTHSMC203	HumanValues	AECC	30	70	100	2	-	-	2
BTESC204	BasicMechanicalEngineering	SEC	30	70	100	2	-	-	2
BTESC205	Basic Electrical Engineering	Elective	30	70	100	2	-	-	2
BTHSMC206	Environment Studies	AECC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC 207	EngineeringChemistryLab	Core	30	20	50	-	-	1	1
BTHSMC208	HumanValues Activities	AECC	30	20	50	-	-	1	1
BTESC209	ManufacturingPracticesWorkshop	SEC	30	20	50	-	-	1	1
BTESC210	Basic Electrical Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC211	ComputerAidedMachineDrawing	SEC	30	20	50	-	-	1	1
BTSODECA212	Social Outreach, Discipline & ExtraCurricular Activities		50	-	50	-	-	-	1
BTBSC 213	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**430**	**570**	**1000**	**15**	**2**	**6**	**24**

Students have to undergo in house practical summer training of 15 days at the end of II semester and will be assessed in III semester in Training –I (BTAGPSI 308).

SECOND YEAR B.Tech.

SEMESTER - III

S.No.	Category	Course Code.	Course Title	Marks				Credits		
				Ex.	Int	P	Th	T	P	Total
1	BSC	BTAGBSC 301	Mathematics-III	70	30	-	2	1	0	3
2	ESC	BTAGESC 302	Strength of Materials	50	30	20	2	0	1	3
	BSC	BTAGBSC 303	Fundamentals of Agriculture	50	30	20	2		1	3
3	PCC	BTAGPCC 304	Fluid Mechanics and Open Channel Hydraulics	50	30	20	2	0	1	3
4	ESC	BTAGESC305	Heat Transfer, Refrigeration and Air Conditioning	50	30	20	2	0	1	3
5	PCC	BTAGPCC 306	Fundamental of Renewable Energy Sources	50	30	20	2	0	1	3
6	PCC	BTAGPCC 307	Watershed Hydrology	50	30	20	1	0	1	2
7	PSI	BTAGPSI 308	Training- I		50	50	0	0	1	1
8		BTAGSODECA309	Social Outreach, Discipline & Extra Curricular Activities	50			1	0	0	1
9	AECC	BTAGAECC 310	ANANDAM	50		50	1	0	1	2
10		NC	NSS/NCC/NSO/Yoga/Scout	-		-	-	-	-	-
			Total	**470**	**260**	**220**	**16**	**1**	**7**	**24**
				950						

SEMESTER - IV

S.No.	Category	Course No.	Course Title	Marks			Credit			
				Th.	Int	P	Th.	T	P	Total
1	ESC	BTAGESC 401	Surveying and Leveling	50	30	20	1	0	2	3
2	PCC	BTAGPCC 402	Soil Mechanics	50	30	20	2	0	1	3
3	ESC	BTAGESC 403	Auto CAD application	-	60	40	0	0	2	2
4	PCC	BTAGPCC 404	Tractor and Automotive Engines	50	30	20	2	0	1	3
5	ESC	BTAGESC 405	Web Designing and Internet Applications	50	30	20	1	0	1	2
6	PCC	BTAGPCC 406	Irrigation Engineering and Sprinkler and Micro Irrigation Systems	50	30	20	2	0	1	3
7	PCC	BTAGPCC407	Soil and Water Conservation Engineering	50	30	20	2	0	1	3
8	PCC	BTAGPCC 408	Theory and Design of Machines	70	30	-	2	0	0	2
9		BTAGSODECA409	Social Outreach, Discipline & Extra Curricular Activities	50			1	0	0	1
10	AECC	BTAGAECC 410	ANANDAM	50		50	1	0	1	2
11		NC	NSS/NCC/NSO/Yoga/Scout[1]	-		-	-	-	-	-
			Total	**470**	**270**	**210**	**13**	**0**	**19**	**24**
				950						

Note: Students have to undergo a practical training of four weeks at the end of IV semester during summer break for which the assessment will be made at the beginning of the next semester **in** Skill Development Training- I (Student READY) Registration Only (BTAGPSI 509)

THIRD YEAR B.Tech

SEMESTER - V

S.No	Category	CourseNo.	CourseTitle	Marks			Credit		
				Ex	Int.	P	Th	P	Total
1	PCC	BTAGPCC 501	Farm Machinery andEquipment–I	50	30	20	2	1	3
2	PCC	BTAGPCC 502	Building Construction andCostEstimation	70	30	-	2	0	2
3	PCC	BTAGPCC 503	Tractor Systems andControls	50	30	20	2	1	3
4	PCC	BTAGPCC 504	Post Harvest Engineering of Cereals, Pulses, Oilseeds	50	30	20	2	1	3
5	PCC	BTAGPCC 505	Watershed Planning andManagement	50	30	20	1	1	2
6	PCC	BTAGPCC 506	Groundwater, Wells andPumps	50	30	20	2	1	3
7	PCC	BTAGPCC 507	RenewablePowerSources	50	30	20	2	1	3
8	PCC	BTAGPCC 508	EngineeringPropertiesofAgriculturalProduce	50	30	20	1	1	2
9	PSI	BTAGPSI 509	Skill Development Training- I (Student READY) Registration Only		50	50	0	5	5
10		BTAGESODECA510	Social Outreach, Discipline & Extra Curricular Activities	-		50	1	0	1
11	AEC C	BTAGAECC511	Professional Skills	50	30	20	2	0	2
12	AEC C	BTAGAECC 512	ANANDAM	50		50	2	0	2
		NC	NSS/NCC/NSO/Yoga/Scout[1]			-	-	-	0
			Total	**520**	**320**	**310**	**19**	**12**	**31**
				1150					

SEMESTER - VI

S. No.	Cate-gory	CourseNo.	CourseTitle	Marks			Credit		
				Ext	Int	P	Th.	P	Total
1	PCC	BTAGPCC 601	Farm Machinery andEquipment–II	50	30	20	2	1	3
2	PCC	BTAGPCC 602	Food Packaging Technology	50	30	20	2	1	3
3	PCC	BTAGPCC 603	Water Harvesting and Soil Conservation Structures	50	30	20	2	1	3
4	PCC	BTAGPCC 604	Drainage Engineering	50	30	20	1	1	2
5	PCC	BTAGPCC 605	Tractor and Farm Machinery Operation and Maintenance	-	30	70	0	2	2
6	PCC	BTAGPCC 606	Dairy and Food Engineering	50	30	20	2	1	3
7	PCC	BTAGPCC 607	Bio-energy Systems: Design and Applications	50	30	20	2	1	3
8	PCC	BTAGPCC 608	Design of structures	50	30	20	2	0	2
9		BTAGSODECA609	Social Outreach, Discipline & Extra Curricular Activities	-		50	1	0	1
10	AECC	BTAGAECC 610	ANANDAM	50		50	2	0	2
		NC	NSS/NCC/NSO/Yoga/Scout[1]			-	-	-	-
			Total	**400**	240	310	**16**	**8**	**24**
				950					

Note:

Students have to go for Skill Development Training II in summer break June-July after VI Semester (Student READY) and will be assessed in VII sem in Skill Development Training- II (Student READY) (BTAGPSI 701)

SEMESTER - VII

S.No.	Category	Course No.	StudentREADY									
			(Rural and Entrepreneurship Awareness Development Yojana)									
			CourseTitle	Marks			Hours/Week			Credit		
				Ext	Int	P	L	T	P	Th.	P	Total
1	PSI	BTAGPSI 701	Skill Development Training- II (Student READY)		50	50				0	5	5
2	PCC	BTAGPCC 702	08 Weeks Experiential Learning On Campus***** (Student READY)		50	50				0	10	10
3	PSI	BTAGPSI 703	08 Weeks Industrial Attachment/Internship ****** (Student READY)		50	50				0	10	10
4	PCC	BTAGPCC 704	Educational Tour (Registration only)		50	50				0	2	2
5		BTAGSODECA705	Social Outreach, Discipline & Extra Curricular Activities	-		50	0	0	0	1	0	1
6	AECC	BTAGAECC 706	Leadership and Management Skills	30		70	2	0	0	2	0	2
7	AECC	BTAGAECC 710	ANANDAM	50		50	1	0	1	2	0	2
			Total	80	200	370	3		1	**5**	**27**	**32**
			Educational Tour duringWinter/Januarybreak									

*****The experiential learning is intended to build practical skills and entrepreneurship among thegraduates with aim to deal with work situations and for better employability and self employment. Itwill involve setting-upof model plans for food processing and value addition for productdiversification, setting up of workshops for manufacturing, operation and maintenance of farmmachinery and equipment, maintenance and custom hiring of farm machinery and equipment.Exposure to Renewable Energy Technologies & Processes.Exposure to Planning, Designing &Estimations of Soil & Water Conservation Measures &Watershed Management.

**The students will be required to have hands-on-experience at progressive farms, research institutions, manufacturing or agro-processing industries and in rural areas.

VIII-SEMESTER

S. No.	Category —	Student READY							
		(Rural and Entrepreneurship Awareness Development Yojana)							
		Course No.	Course Title	Marks			Credit		
				Ext	Int	P	Th.	P	Total
1	PEC	BTAGPEC 801	Elective Course*(PEC)	50	30	20	2	1	3
2	PEC	BTAGPEC 802	Elective Course*(PEC)	50	30	20	2	1	3
3	OE	BTAGOE 803	Open Elective** (OE)	50	30	20	2	1	3
4	PCC	BTAGPCC 804	Entrepreneurship Development and Business Management	50	30	20	2	1	3
5	PSI	BTAGPSI 805	Project Planning and Report Writing (StudentREADY)		50	50	0	10	10
6		BTAGSODECA806	Social Outreach, Discipline & Extra	-		50	1	0	1
7	AECC	BTAGAECC 807	ANANDAM	50		50	2	0	2
			Total	250	170	230	11	14	25

*Student will have to opt any two elective courses of 03 credits each (shall be offered by engineering and technology departments of the University.

**Student will have to opt any one course of 03 credit (shall be offered by the other engineering streams of the universityfor agricultural engineering stream students.

List of Electives (BTAGPEC801):-

S.No.	Cate-gory		Course Title	Marks			Hours/Week			Credit	
		CourseNo.		Ext	Int	P	L	T	P	Th.	P
1	PEC	BTAGPEC 801	Food Quality andControl	50	20	30	2	0	2	2	1
2	PEC	BTAGPEC 801	Food Plant Design and Management	50	20	30	2	0	2	2	1
3	PEC	BTAGPEC 801	Agricultural Structures and Environmental Control	50	20	30	2	0	2	2	1
4	PEC	BTAGPEC 801	Development of Processed Products	50	20	30	2	0	2	2	1
5	PEC	BTAGPEC 801	Process Equipment Design	50	20	30	2	0	2	2	1
6	PEC	BTAGPEC 801	Post Harvest Engineering of Horticulture Crops	50	20	30	2	0	2	2	1
7	PEC	BTAGPEC 801	Floods and Control Measures	50	20	30	2	0	2	2	1
8	PEC	BTAGPEC 801	Wasteland Development	50	20	30	2	0	2	2	1
9	PEC	BTAGPEC 801	Remote Sensing and GIS Applications	50	20	30	2	0	2	2	1
10	PEC	BTAGPEC 801	Management of Canal Irrigation System	50	20	30	2	0	2	2	1
11	PEC	BTAGPEC 801	Minor Irrigation and Command Area Development	50	20	30	2	0	2	2	1
12	PEC	BTAGPEC 801	Landscape Irrigation Design and Management	50	20	30	2	0	2	2	1

List of Electives: BTAGPEC802

13	PEC	BTAGPEC 802	Plastic Applications in Agriculture	50	20	30	2	0	2	2	1
14	PEC	BTAGPEC 802	Mechanics of Tillage and Traction	50	20	30	2	0	2	2	1
15	PEC	BTAGPEC 802	Farm Machinery Design and Production	50	20	30	2	0	2	2	1
16	PEC	BTAGPEC 802	Tractor Design and Testing	50	20	30	2	0	2	2	1
17	PEC	BTAGPEC 802	Hydraulic Drive and Controls	50	20	30	2	0	2	2	1
18	PEC	BTAGPEC 802	Precision Agriculture and System Management	50	20	30	2	0	2	2	1
19	PEC	BTAGPEC 802	Human Engineering and Safety	50	20	30	2	0	2	2	1
20	PEC	BTAGPEC 802	Precision Farming Techniques for Protected Cultivation	50	20	30	2	0	2	2	1
21	PEC	BTAGPEC 802	Pesticide Application and Equipment	50	20	30	2	0	2	2	1
22	PEC	BTAGPEC 802	Photovoltaic Technology and Systems	50	20	30	2	0	2	2	1
23	PEC	BTAGPEC 802	Waste and By-products Utilization	50	20	30	2	0	2	2	1

Open Electives to be offered in 8th Semester

S.No.	Offering Department	CourseCode	Course Title	Marks			Hours/Week			Credit	
				Ext	Int	P	L	T	P	Th.	P
1	Civil Engineering	BTAGOE 803	Waste Management in Urban Area	50	20	30	2	0	2	2	1
2	ComputerSc. Engg	BTAGOE 803	Management Information System	80	20	0	3	0	0	3	0
3	Civil Engineering	BTAGOE 803	Advance Surveying	50	20	30	2	0	2	2	1
4	Mechanical Engineering	BTAGOE 803	Entrepreneurship and Management	50	20	30	2	0	2	2	1
5	Electronics &CommEngg.	BTAGOE 803	Fundamentals of Electronics in Agriculture	50	20	30	2	0	2	2	1
6	Electrical Engineering	BTAGOE 803	Power Converters	80	20	0	3	0	0	3	0

Note:

- A student is required to obtain min. 40% marks in individual paper to pass.
- The total credit of B.Tech. (Ag) Programme is 207. However, the minimum credit required for award of degree shall be 201.
- The credit relaxation will be applicable only on the elective course from different semester (i.e. the student can opt out only elective subject).
- Out of the total credits, 20% of the credits may be earned by the student through MOOCs (SWAYAM, NPTEL, Coursera etc.). However, the choice of online courses to be approved in advance by Dean/ HoD and Coordinator SWAYAM keeping in view the latest guidelines of the UGC/ respective regulatory body guidelines.

BTBSC101: Engineering Mathematics-I

Course Objectives:

- To familiarize the prospective engineers with techniques in calculus, multivariate analysis and differential equations.
- To equip the students with standard concepts and tools at an intermediate to advanced level
- To understand Vector Calculus with three important theorems.

Course Content:

Unit I: Differential Calculus:

Partial derivatives, directional derivatives, total derivative, Jacobians and properties. Leibnitz's Rule of differentiation under integral sign. Maxima And Minima , saddle points; Method of Lagrange multipliers,

Unit II: Integral Calculus:

Improper integrals (Beta and Gamma functions), Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals (Cartesian), change of order of integration Change of variables (Cartesian to), areas and volumes by double integration, Triple integrals (Cartesian), Simple applications

Unit III: Differential Equations:

First Order and First degree ordinary differential equations: Linear and Bernoulli's equations, Exact equations, Linear Differential Equations of Higher order with constant coefficients.

Unit IV: Differential equations with variable Coefficients:

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy- Euler equation; Power series solutions including Legendre differential equation and Bessel differential equations.

Unit V: Vector Calculus:

Scalar line integrals, vector line integrals, scalar surface integrals, surface integrals, Theorems of Green, Gauss and Stokes.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwinkreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. F201
3. Veerarajan T., Engineering Mathematics for firstyear, Tata Mc Graw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata Mc Graw Hill New Delhi, 11th Reprint, 2010.
5. N.P. Baliand Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

Course Outcomes:

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

CO1:	Apply the Concepts of the differential calculus.
CO2:	Understand the calculation and Applications of Multi variable integrals.
CO3:	Understand and apply the concept of differential equations with constant coefficients.
CO4:	Understand and apply the concept of differential equations with variable coefficients and power series.
CO5:	Understand and apply the concept of vector calculus.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO1, CO2, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTBSC102: Engineering Physics

Course Objective:

- To understand the concepts of interference, Diffraction and Polarization.
- To know about wave particle duality.
- To know applications of Optical fibre.
- To know applications of Lasers in Science, engineering and medicine.
- To know classification of Solid.

Course Contents:

Unit I: Wave Optics

Newton's Rings, Michelson's Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg's Law.

Unit II: Quantum Mechanics

Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrodinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrodinger's Equation: Particle in one dimensional and three dimensional boxes.

Unit III: Coherence and Optical Fibers

Spatial and temporal coherence: Coherence length; Coherence time and 'Q' factor for light, Visibility as a measure of Coherence and spectral purity, Optical fiber as optical wave guide, Numerical aperture; Maximum angle of acceptance and applications of optical fiber.

Unit IV: Laser

Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.

Unit V: Material Science & Semiconductor Physics

Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermi dirac distribution function and Fermi energy, Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications.

References:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptaon NPTEL

Course Outcomes:

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

CO1:	Enhance the basic skills required to understand, develop, and design various engineering applications involving Wave Optics.
CO2:	Understand Quantum Mechanics and apply them to diverse engineering problems.
CO3:	Analyze the nature of light propagation in guided medium for engineering applications and study in Coherence and Optical Fibers.
CO4:	Describe different Laser problems.
CO5:	Describe Material Science & Semiconductor Physics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	-	H	-	M	-	-	-	-	L	H	M
CO2	L3	H	H	H	H	-	M	-	-	-	-	-	-	M	M
CO3	L4	M	L	M	-	L	-	L	-	-	-	-	-	H	H
CO4	L2	H	M	H	H	M	-	M	L	-	L	-	L	H	M
CO5	L2	H	M	H	H	M	-	M	L	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO1, CO2, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTHSMC103 Communication Skills

Course Objectives:

- To identify common communication problems that may be holding learners back
- To identify what their non-verbal messages are communicating to others
- To understand role of communication in teaching-learning process
- To learn to communicate through the digital media
- To understand the importance of empathetic listening

Course Contents

Unit I **Listening**

Techniques of effective listening, Listening and comprehension, Probing questions, Barriers to listening

Unit II **Speaking and Non-verbal communication**

Speaking: Pronunciation, Enunciation, Vocabulary, Fluency, Common Errors

Meaning of non-verbal communication, Introduction to modes of non-verbal communication, Breaking the misbeliefs, Open and Closed Body language, Eye Contact and Facial Expression

Hand Gestures, Do's and Don'ts, Learning from experts, Activities-Based Learning

Unit III **Reading**

Techniques of effective reading, Gathering ideas and information from a given text: Identify the main claim of the text, Identify the purpose of the text, Identify the context of the text, Identify the concepts mentioned, Evaluating these ideas and information: Identify the arguments employed in the text, Identify the theories employed or assumed in the text, Interpret the text: To understand what a text says, To understand what a text does, To understand what a text means.

Unit IV **Writing and different modes of writing**

Clearly state the claims, Avoid ambiguity, vagueness, unwanted generalisations and oversimplification of issues, Provide background information, Effectively argue the claim, Provide evidence for the claims, Use examples to explain concepts, Follow convention, Be properly sequenced, Use proper signposting techniques, Be well structured: Well-knit logical sequence, Narrative sequence, Category groupings, Different modes of Writing: E-mails, Proposal writing for Higher Studies, Recording the proceedings of meeting: Any other mode of writing relevant for learners

Unit V **Digital Literacy and Effective use of Social Media**

Role of Digital literacy in professional life: Trends and opportunities in using digital technology in workplace, Internet Basics, Introduction to MS Office tools: Paint, Office, Excel, PowerPoint

Introduction to social media websites, Advantages of social media, Ethics and etiquettes of social media, How to use Google search better, Effective ways of using Social Media, Introduction to Digital Marketing

Text Books:

1. Sen Madhucchanda (2010), *An Introduction to Critical Thinking*, Pearson, Delhi
2. Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC

Suggested Readings:

1. Public Speaking, Michael Osborn and Suzanne Osborn, Biztantra
2. Handbook of Practical Communication Skills-Chrissie Wrought, published by Jaico Publishing House.

Course Outcomes:

COs	Statement
	After completion of this course, students will be able to:
CO1	Adapt effective listening skills
CO2	1. Learn and demonstrate effective speech.
CO3	Learn and demonstrate effective reading skills
CO4	2. Know and practice effective writing skills
CO5	Understand and recognize the importance of digital literacy and social media

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	**L**	**M**	**L**	**-**	**-**	**-**	**-**	**M**	**H**	**H**	**M**	**-**	**-**	**-**
CO2	L3	**H**	**M**	**L**	**L**	**-**	**M**	**-**	**M**	**M**	**H**	**M**	**-**	**-**	**-**
CO3	L3	**-**	**H**	**M**	**M**	**-**	**L**	**-**	**-**	**M**	**H**	**M**	**-**	**-**	**-**
CO4	L3	**M**	**M**	**M**	**M**	**-**	**L**	**-**	**-**	**-**	**H**	**L**	**-**	**-**	**L**
CO5	L2	**L**	**L**	**M**	**L**	**M**	**-**	**-**	**-**	**L**	**M**	**-**	**-**	**-**	**L**

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO4,CO5
CD3	Seminars	CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4
CD5	Industrial visit	CO5

BTESC104: Programming for Problem Solving

Course Objective:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

Course Contents:

Unit I: Fundamentals of Computer:

Stored program architecture of computers, Storage device- Primarymemory, and Secondary storage, Random, Direct, Sequential access methods.

Unit II: Concepts of High-level, Assembly and Low-level languages, Representing algorithms through flowchart and pseudo code.

Unit III: Number system:

Data representations, Concepts of radix and representation of numbers in radix r with special cases of r=2, 8, 10 and 16 with conversion from radix r1 to r2, r's and (r-1)'s complement, Binary addition, Binary subtraction, Representation of alphabets.

Unit IV: C Programming:

Problem specification, flow chart, data types, assignment statements, input output statements, developing simple C programs, If statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement.

Unit V: Development of C programs using

Arrays, functions, parameter passing ,recursion, Programming in C using these statements, Structures, files, pointers and multi file handling.

Text / Reference Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes:

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

CO1:	Know and understand the conventions of Fundamentals of Computer.
CO2:	Represent algorithms through flowchart and pseudo code.
CO3:	Learn Number system and apply these skills in developing new products.
CO4:	Understand and learn C Programming.
CO5:	Comprehend the Development of C programs using- Arrays, functions.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom's Level**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**P0 11**	**PO 12**	**PSO1**	**PSO2**
CO1	L2	H	H	M	-	M	L	-	-	-	-	-	L	H	M
CO2	L2	H	H	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L3	H	L	M	L	M	L	-	-	-	L	-	L	H	H
CO4	L2	M	H	L	M	H	-	-	-	-	M	-	M	H	M
CO5	L2	M	H	H	M	H	-	-	-	-	M	-	M	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTESC 105: Basic Civil Engineering

Course Objective:

- To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
- To provide students the significance of the Civil Engineering Profession in satisfying societal needs.

Course Contents:

Unit I **Introduction to objective, scope and outcome the subject**
Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

Unit II **Buildings** Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

Unit III **Transportation** Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures

Unit IV **Surveying** Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying, Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling: Instrument used, Object of leveling, Methods of leveling in brief, and Contour maps.

Unit V **Environment**
Environmental Pollution, Environmental Acts and Regulations**,** Air & Noise Pollution: Primary and Secondary air pollutants, Harmful effects of Air Pollution, Control of Air Pollution. Noise Pollution, Harmful Effects of noise pollution, control of noise pollution, Global warming& Climate Change, Ozone depletion, Green House effect

TEXTBOOKS:

1. Gopi, S., Basic Civil Engineering, Pearson Publishers
2. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
3. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
4. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

References Books:

1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
3. McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
4. Minu, S., Basic Civil Engineering, Karunya Publications

Course Outcomes:

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

CO1:	Illustrate the fundamental aspects of Civil Engineering.
CO2:	Understand the scope of civil engineering.
CO3:	Explain the concepts of surveying for making horizontal and vertical measurements.
CO4:	Describe plan and set out of a building, also illustrate the uses of various building materials and explains the method of construction of different components of a building.
CO5:	Understand the modes of Traffic and Road Safety and Road Safety Measures

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	-	-	-	-	M	L	-	-	-	-	M	M	M
CO2	L2	H	M	M	L	-	M	L	-	-	L	-	L	M	M
CO3	L2	M	H	M	L	H	-	H	-	-	L	-	L	L	L
CO4	L2	M	H	M	L	H	-	H	-	-	L	-	L	M	M
CO5	L2	M	M	L	H	M	L	-	H	-	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO5
CD5	Industrial visit	CO3, CO4, CO5

BTBSC106: Engineering Physics Lab

Course Objective:

- To understand the concepts of interference.
- To know about wavelength of light.
- To know about depletion layer and band gap of semiconductor.
- To know dispersion of light through prism.
- To understand the concept of magnetic field.

LIST OF EXPERIMENTS:

1. To determine the wave length of sodium light by Newton's Ring.
2. To determine the wave length of monochromatic light with the help of Fresnel's Biprism.
3. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.
7. To study the charge and discharge of a condenser and hence determine the time constant for which both current and voltage graphs are to be plotted.
8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fibre.
10. To study the variation of magnetic field at the center of coil using tangent galvanometer.

Course Outcomes:

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

CO1:	Understand the usage of common Ammeter, Voltmeter and Multimeter.
CO2:	Deep learning of optical phenomenon such as Interference, diffraction and dispersion of light.
CO3:	Understand the usage of common electrical measuring instruments.
CO4:	Gain knowledge about the concept of optical fiber and Laser.
CO5:	Understand the usage of optical instruments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	-	H	-	M	-	-	H	-	L	H	L
CO2	L4	H	H	-	H	-	M	-	-	-	-	-	-	M	M
CO3	L2	M	L	-	-	L	-	L	-	-	L	-	-	M	L
CO4	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M
CO5	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO1,CO2, CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTHSMC107: Language Lab

Course Objective:

- To understand concepts of basic English language fundamentals.
- To understand the communication skills.
- To develop Dialogue Writing and Listening comprehension.

Detailed Syllabus

1. Phonetic Symbols and Transcriptions.
2. Extempore.
3. Group Discussion.
4. Dialogue Writing.
5. Listening comprehension.

Course Outcomes:

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

CO1:	Understand the Phonetic Symbols and Transcriptions.
CO2:	Understand the skills required in Extempore.
CO3:	Improve their communication skills for Group Discussion.
CO4:	Improve their technical communication skills.
CO5:	Understand Dialogue Writing and Listening skills.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	-	-	-	H	M	-	-	-	H	-	M	H	M
CO2	L2	M	-	-	-	-	M	-	-	H	H	-	L	M	L
CO3	L6	M	-	-	-	-	M	-	-	H	H	-	M	M	L
CO4	L6	M	-	-	-	M	M	-	-	-	H	-	M	M	M
CO5	L2	M	-	-	-	M	M	-	-	M	H	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	-

BTESC 108: Computer Programming Lab

Course Objective(s):

- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

LIST OF EXPERIMENTS:

1. To learn about the C Library, Preprocessor directive, Input-output statement.
2. Programs to learn data type, variables, If-else statement
3. Programs to understand nested if-else statement and switch statement
4. Programs to learn iterative statements like while and do-while loops
5. Programs to understand for loops for iterative statements
6. Programs to learn about array and string operations
7. Programs to understand sorting and searching using array
8. Programs to learn functions and recursive functions
9. Programs to understand Structure and Union operation
10. Programs to learn Pointer operations
11. Programs to understand File handling operations
12. Programs to input data through Command line argument

Course Outcomes:

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

CO1:	Learn about the C Library, Preprocessor directive, Input-output statement.
CO2:	Learn data type, variables, and conditional statement.
CO3:	Learn about array and string operations.
CO4:	Understand File handling operations.
CO5:	Learn programs related to C Programming and apply them to solve real world problems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	-	-	M	L	-	-	-	L	-	L	M	L
CO2	L2	H	H	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L2	H	L	M	L	M	L	-	-	-	L	-	L	H	M
CO4	L2	M	H	L	M	H	L	L	-	-	L	-	M	H	M
CO5	L3	M	H	H	M	H	M	L	-	-	M	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC 109: Basic Civil Engineering Lab

Course Objective(s):

- To Introduce The Various Activities Regarding Measurement And Leveling
- To Water Supply Procedure And Various Discharge And Pressure Measuring Apparatuses

LIST OF EXPERIMENTS:

1. Linear Measurement by Tape:
   a) Ranging and Fixing of Survey Station along straight line and across obstacles.
   b) Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of lines using Surveyor's and Prismatic compass
3. Levelling: Using Tilting/ Dumpy/ Automatic Level
   a) To determine the reduced levels in closed circuit.
   b) To carry out profile levelling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

Course Outcomes:

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

CO1:	Conduct survey and collect field data.
CO2:	Review field notes from survey data.
CO3:	Interpret survey data and compute areas and volumes.
CO4:	Describe Total station and measurement
CO5:	Describe various water fittings and find out the various fluids properties

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	L	L	L	H	M	L	-	L	L	-	M	H	M
CO2	L2	H	M	M	M	-	M	L	-	L	M	-	L	M	L
CO3	L4	M	H	M	H	H	M	H	-	L	H	-	L	L	H
CO4	L2	M	H	M	H	H	M	H	-	L	H	-	L	-	M
CO5	L2	M	M	L	H	M	M	-	-	L	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC110: Computer Aided Engineering Graphics

Course Objectives:

- To Increase ability to communicate with people
- To learn to sketch and take object dimensions.
- To learn to take data and transform it into graphic drawings.

Introduction: Principles of drawing, lines, type of lines, usage of Drawing instruments, lettering, Conic sections including parabola, hyperbola, Rectangular Hyperbola (General method only); Scales-Plain, Diagonal and Vernier Scales.

Projections of Point & Lines: Position of Point, Notation System, Systematic Approach for projections of points, front view & Top view of point, Position of straight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs, Line inclined to one RP and parallel to the other, Line inclined to Both the RPs, Traces of a line (One drawing sheet, one assignment in sketch book).

Projection of Planes: Positions of planes, Terms used in projections of planes, plane parallel to RP, plane inclined to one RP and perpendicular to the other RP, plane perpendicular to Both the RPs, plane Inclined to Both the RPs, True shape of the plane, Distance of a point from plane, Angle between two planes.

Projections of Regular Solids: frustum and truncated solids, those inclined toboth the Planes-Auxiliary Views.

Section of Solids: Theory of sectioning, section of prisms and cubes, section ofpyramids and Tetrahedron section of Cylinders, section of cones, section ofspheres (One drawing sheet, one assignment in sketch book)

Overview of Computer Graphics: Covering theory of CAD software [such as: Themenu System, Toolbars (standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of lines, Planes, Simple and compound Solids.

Course Outcomes:

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

CO1:	Know and understand the conventions and the method of engineering drawing.
CO2:	Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.
CO3:	Know the Theory of sectioning and Section of Solids.
CO4:	Comprehend the theory of projection.
CO5:	Improve their drawing skill in the form of Computer Graphics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	L	L	-	-	L	M	-	L	L	M
CO2	L4	H	M	L	M	L	L	-	-	-	M	-	L	L	M
CO3	L1	H	M	L	M	L	L	-	-	L	M	-	L	L	L
CO4	L2	H	H	M	H	L	L	-	-	L	H	-	M	M	M
CO5	L2	H	M	M	M	L	L	-	-	L	M	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	CO5

BTSODECA111: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

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

CO1:	Develop their self-confidence, leadership qualities, and their responsibilities towards the community.
CO2:	Have an impact on academic development, personal development, and civic responsibility
CO3:	Understand the value of Social Work.
CO4:	Understand the Significance of Discipline in student's Life
CO5:	Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC 112: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

SEMESTER-II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	Engineering Mathematics-II	Core	30	70	100	3	1	-	4
BTBSC 202	Engineering Chemistry	Core	30	70	100	3	1	-	4
BTHSMC203	Human Values	AECC	30	70	100	2	-	-	2
BTESC204	Basic Mechanical Engineering	SEC	30	70	100	2	-	-	2
BTESC205	Basic Electrical Engineering	SEC	30	70	100	2	-	-	2
BTHSMC206	Environment Studies	AECC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC 207	Engineering Chemistry Lab	Core	30	20	50	-	-	1	1
BTHSMC208	Human Values Activities	AECC	30	20	50	-	-	1	1
BTESC209	Manufacturing Practices Workshop	SEC	30	20	50	-	-	1	1
BTESC210	Basic Electrical Engineering Lab	SEC	30	20	50	-	-	1	1
BTESC211	Computer Aided Machine Drawing	SEC	30	20	50	-	-	1	1
BTSODECA212	Social Outreach, Discipline & Extra Curricular Activities		50	-	50	-	-	-	1
BTBSC 213	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	**2**
	Total		**430**	**570**	**1000**	**15**	**2**	**6**	**24**

BTBSC201: Engineering Mathematics-II

Course Objective:

- To provide detailed of **matrices** which is applied for solving system of linear equations and useful in various fields of technology.
- To understand the course is an introduction to partial differential equations.
- To understand the various numerical methods and techniques used to find solutions to differential equations and linear programming problems.

Course Content:

Unit I: **Partial Differential Equations –**Linear Partial differential equations of First order, Lagrange's Form, Non Linear Partial Differential equations of first order, Charpit's method, Standard forms. Separation of variables method to solve the simple problems in Cartesian coordinates.

Unit II: **Linear Algebra:** Vectors and Matrices, Addition and Multiplication, Norms, Linear Independence, Linear Transformation, Bases, Dimensions, Inner Product, Rank, Inverse, Orthogonality, Matrix factorizations, Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations.

Unit III: Linear Algebra: Rank of matrix System of linear equations; Symmetric, skew symmetric and orthogonal matrices; Eigen values and Eigen vectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Unit IV: Numerical Methods: Finite differences, Relation between operators, Methods to solve algebraic and transcendental equations, numerical methods to solve ordinary differential equations, finite difference methods, Finite element method.

Unit V: **Linear Programming Problems:** Linear Programming Problems, Graphical Approach, simplex method, Assignment and Transportation problems

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9thEdit ion, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

Course Outcomes:

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

CO1:	Determine the solutions to partial differential equations.
CO2:	Understand the concepts of vector space and linear transformations.
CO3:	Understand and to solve the matrices, Rank of a matrix, Eigen values and Eigen vectors, System of linear equations.
CO4:	Use various numerical methods and techniques to solve algebraic and differential equations.
CO5:	Understand and to solve linear programming problems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

BTBSC202: Engineering Chemistry

Course Objective:

- To acquire the knowledge about impurities in water, their determination and purification.
- To learn about different types of fuel and lubricant and their applications.
- To gain the basic knowledge, applications and control methods of corrosion.
- To get the knowledge of preparation and significance of explosives, cement, refractories and glass.
- To get the knowledge of organic reaction mechanism and their uses with different types of drugs

Course Contents:

Unit I: Water

Common impurities, hardness, determination of hardness by complexometric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Priming and Foaming, Boiler corrosion and Caustic embrittlement Water softening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process. Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.

Unit II: Organic Fuels

Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

Unit III: Corrosion and its control

Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Unit IV: Engineering Materials

Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. Glass: Definition, Manufacturing by tank furnace, significance of annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification, Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.

Unit V: Organic reaction mechanism and introduction of drugs

Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol

Suggested Text / Reference Books

1. Morrison R.T & Boyn R. N ; Organic Chemistry; Prentice Hall of India 1999
2. Lee J. D. ; Inorganic Chemistry ;Blackwell Science
3. Gopalan R., Venkappayya D., Nagarajan S. "Engineering Chemistry" Vikas Publishing House Pvt Ltd 2000.
4. Jain & Jain " Engineering Chemistry" Dhanpat Rai publishing company
5. Dara S. S. , " A Text Book of Engineering Chemistry" S. Chand and Company Ltd, 2008
6. Keeler J and Wolhess P, Why Chemical Reaction Happen Oxford Press.

Course Outcomes:

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

CO1:	Gain knowledge about impurities in water, their determination and purification.
CO2:	Understand organic fuels and various emerging new areas of organic chemistry.
CO3:	Learn about Corrosion and its control.
CO4:	Get knowledge about the chemistry of some Engineering Materials like Portland Cement.
CO5:	Understand and study Organic reaction mechanisms.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	H	-	M	-	-	-	-	-	-	M	-	H	M	M
CO2	L2	M	-	-	-	L	-	-	-	-	L	-	M	M	M
CO3	L1	M	-	-	-	-	-	-	-	-	L	-	M	M	L
CO4	L2	M	-	-	-	-	-	-	-	-	L	-	M	H	M
CO5	L2	M	-	-	-	-	-	-	-	-	-	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO5

BTHSMC203: Human Values

Course Objective:

- To Know the basic guidelines, content and Process for Value Education
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

Course Contents:

Unit I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, Self Exploration – its content and process; 'Natural Acceptance' and Experiential Validation, Continuous Happiness and Prosperity- Human Aspirations, Right understanding, Relationship and Physical Facilities, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Unit II: Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha Understanding the Body as an instrument of 'I', Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

Unit III: Understanding Harmony in the Family and Society- Harmony inHuman-Human Relationship

Understanding harmony in the Family, Understanding values inhuman-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) , meaning of Vishwas; Difference between intention and competence, meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals ,Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family.

Unit IV: Understanding Harmony in the Nature and Existence – Whole existence as Coexistence

Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting Units in allpervasive Space. Holistic perception of harmony at all levels of existence

Unit V: Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values

Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers. Case studies related to values in professional life and individual life.

Suggested Text / Reference Books

1. Gaur R.R., Sangal R. and. Bagaria, G.P: ”A Foundation Course in Human Values Professional Ethics,” Excel Books, 2010.
2. Sadri S & Sadri, J Business Excellence Through Ethics & Governance, 2ndedition, 2015.
3. Mathur, U C CorporateGovernance and business ethics,MacMillan India Ltd, 2009.
4. Baxi, C V: Corporate Governance, Excel Books, 2009
5. Sadri S, Sinha A K and Bonnerjee, P: Business Ethics: concepts and cases, TMH, 1998.

Course Outcomes:

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

CO1:	Understand and analyze Basic Guidelines, Content and Process for Value Education.
CO2:	Understand Harmony in the Human Being - Harmony in Myself.
CO3:	Understand Harmony in the Family and Society- Harmony in Human-Human Relationship.
CO4:	Understand Harmony in the Nature and Existence – Whole existence as Coexistence.
CO5:	Understand of Harmony on Professional Ethics. Natural acceptance of human values.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	L	L	M	H	L	M	-	L	M	M
CO2	L2	-	-	-	-	-	L	M	M	M	M	-	L	M	M
CO3	L2	-	-	-	-	-	L	M	H	L	M	-	L	M	L
CO4	L2	-	-	-	-	L	L	L	M	M	L	L	H	M	M
CO5	L2	L	-	-	-	-	M	M	H	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	

BTESC 204: Basic Mechanical Engineering

Course Objectives:

- To Increase ability to understand machine working
- To Learn to understand fundamentals of mechanical systems
- To Learn to make different mechanical aspects of engineering

Course Contents:

Unit I: Fundamentals:

Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology. Steam Boilers classification and types of steam boilers and steam turbines. Introduction and Classification of power plants.

Unit II: Pumps and IC Engines:

Applications and working of Reciprocating and Centrifugal pumps. Introduction, Classification of IC Engines, Main Components of IC Engines, Working of IC Engines and its components.

Unit III: Refrigeration and Air Conditioning:

Introduction, classification and types of refrigeration systems and air-conditioning. Applications of refrigeration and Air-conditioning.

Unit IV: Transmission of Power:

Introduction and types of Belt and Rope Drives, Gears.

Unit V: Primary Manufacturing Processes: Metal Casting Process: Introduction to Casting Process, Patterns, Molding, Furnaces. Metal Forming Processes: Introduction to Forging, Rolling, Extrusion, Drawing. Metal Joining Processes: Introduction to various types of Welding, Gas Cutting, Brazing, and Soldering.

Text Books:

- Agarwal C M, Agarwal Basant “Basic Mechanical Engineering” 2019

Reference Books

- Shanmugam G, Ravindran S “Basic Mechanical Engineering” TMH Publication , 2019
- Bansal R K “Basic Mechanical Engineering” Laxmi Publication 2019

Course Outcomes:

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

CO1:	Know and understand the Fundamentals of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology.
CO2:	Understand the Refrigeration and Air Conditioning.
CO3:	Understand the Applications and working of Reciprocating and Centrifugal pumps.
CO4:	Know the Transmission of Power through Belt and Rope Drives, Gears.
CO5:	Understand of Primary Manufacturing Processes.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M
CO2	L2	H	M	L	M	L	-	L	-	-	M	-	L	M	M
CO3	L2	H	L	L	L	M	-	-	-	-	L	-	L	M	M
CO4	L2	H	L	L	L	L	-	L	-	-	L	-	L	M	M
CO5	L2	M	L	L	L	-	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3,
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTESC205: Basic Electrical Engineering

Course Objective:

- To understand the basic concept of Electrical engineering instruments for engineering applications.
- To understand the basic electrical engineering parameters and their importance.
- To understand the concept of various laws and principles associated with electrical systems.
- To develop the knowledge to apply concepts in the field of electrical engineering, projects and research.

Course Contents:

Unit I: DC Circuits:

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Series-Parallel circuits, Node voltage method, Mesh current method, Superposition, The venin's, Norton's and Maximum power transfer theorems.

Unit II: AC Circuits:

Representation of sinusoidal waveforms, peak and r.m.s values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase AC circuits consisting of R, L,C, RL, RC and RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Unit III: Transformers:

Ideal and practical transformer, EMF equation, equivalent circuit, losses in transformers, regulation and efficiency.

Unit IV: Electrical Machines:

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Starting and speed control of induction motor, single phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited DC motor. Construction and working of synchronous generators.

Unit V: Power Converters:

Semiconductor PN junction diode and transistor (BJT).Characteristics of SCR, power transistor and IGBT. Basic circuits of single phase rectifier with R load, Single phase Inverter, DC-D Cconverter.

Suggested Text / Reference Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Course Outcomes:

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

CO1:	Apply basic skills for designing various instruments for engineering applications.
CO2:	Determine error in laboratory measurements and techniques used to minimize such error.
CO3:	Gain knowledge regarding the various laws and principles associated with electrical systems.
CO4:	Understand electrical machines and apply them for practical problems.
CO5:	Understand the concepts in the field of electrical engineering, projects and research.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	M	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L5	L	M	H	M	L	-	-	-	-	M	-	M	M	M
CO3	L1	M	H	H	H	-	-	-	-	-	H	-	M	M	M
CO4	L2	H	L	M	L	-	-	-	-	-	L	-	L	H	M
CO5	L2	M	H	H	H	-	-	-	-	-	H	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4, CO5
CD5	Industrial visit	CO5

BTHSMC206: Environmental Studies

Course Objective:

- To understand the basics of ecosystem and environment
- To understand about different types of pollution.
- To learn about waste, energy sources and sustainable energy.

Course Contents:

Unit-I **Basics of Environment:** Components and types of ecosystem, Structure and functions of ecosystem, Energy flow in ecosystem .Type and levels of Biodiversity, Values, Causes of extension, and Conservation methods of biodiversity.

Unit-II **Pollution:** Types of Pollutants, air pollution, harmful effects of air pollution, control of air pollution, water pollution, harmful effects of water pollution, control of water pollution, noise Pollution harmful effects of noise pollution, control of noise pollution, radioactive pollution, harmful effects of radioactive pollution, control of radioactive pollution.

Unit-III **Solid Waste Management:** Classification of solid waste, Collection, transportation, treatment, and disposal methods of solid waste, economic recovery of solid waste.

Unit-IV **Renewable Energy Sources:** Introduction, renewable sources of energy: solar energy, wind energy, energy from ocean, energy from biomass, geothermal energy and nuclear Energy.

Unit-V **Issues of Environment:** Sustainable development**,** water conservation, environmental education, environmental acts. Types of disasters, their causes, impact and preventive measures.

Recommended Books:

1. A.K. De, Environmental Chemistry, Wiley Eastern Ltd.
2. D.K. Sinha, Towards Basics of Natural Disaster Reduction, Research co Book Center, Delhi.
3. M.N. Rao and H.V.N.Rao, Air Pollution, Tata McGraw-Hill, ISBN-13 978-0-07-451871-7, 2013.
4. Ranjeeta Soni, Environmental Studies and Disaster management New India Publication Agency (NIPA), New Delhi, ISBN: 978-93-91383-02-2, October 2021.
5. R.C. Gaur, Basic Environmental Engineering New Age International Publication.

Course Outcomes

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

CO1:	To understand the basic concepts and components of ecosystem and environment. Ecosystem Links between environmental components and their role.
CO2:	To understand the basic concepts of pollution and their sources and effects and to apply the control technologies related pollutions.
CO3:	To understand the types of wastes and their generation sources and to also know disposal technologies of waste and reuse and recycle of the waste.
CO4:	To know the concepts of renewable energy resources and their types and create the various applications of renewable resources and current potentials of energy resources.
CO5:	To understand the concept of sustainable development and create the methods for water conservation and apply the disaster control technologies.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments,Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	-	L	H	-	-	M	H	H	-	-	M	-	L
CO2	L3	H	H	H	H	H	H	H	M	H	M	M	H	H	H
CO3	L2	H	H	H	M	H	H	M	M	H	L	M	M	H	H
CO4	L6	L	L	H	L	H	H	H	L	M	L	H	H	M	H
CO5	L3	L	H	H	L	M	H	H	M	L	H	H	H	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2,CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4

BTBSC 207: Engineering Chemistry Lab

Course Objective:

- To understand the method for the determination of hardness in water and purification process.
- To understand about different types of volumetric analysis.
- To learn about properties of lubricant oil.
- To Synthesize a small drug molecule and analyse a salt sample

List of Experiments:

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help of K2Cr2O7 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture
7. Proximate analysis of Coal
8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 at different temperature
10. Synthesis of Aspirin/ Paracetamol

Course Outcomes:

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

CO1:	Understand the method for the determination of hardness in water and purification process.
CO2:	Understand about different types of volumetric analysis.
CO3:	Learn about properties of lubricant oil.
CO4:	Synthesize a small drug molecule and analyse a salt sample
CO5:	Determine quantitative estimation of dissolve chemicals in water.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	H	M	-	M	-	-	L	-	-	M	-	-	M	L
CO2	L1	L	H	M	H	-	-	L	-	-	H	-	-	M	M
CO3	L1	M	L	H	L	L	-	M	-	-	L	-	L	M	M
CO4	L3	L	L	H	L	L	-	L	-	-	L	-	L	M	L
CO5	L3	L	L	H	L	L	-	L	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/ LCD projectors/ OHP projectors	-
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets / Experiments	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTHSM208: Human Values Activities

Course Objective:

- To Understand the basic guidelines, content and process for value education.
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

Course Contents:

PS 1:

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your salient achievements and shortcomings in your life? Observe and analyze them.

PS 2:

Now-a-days, there is a lot of talk about many technogenic maladies such as energy and material resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmade problems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opinion? On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats to human happiness and peace - what could be the way out in your opinion?

PS 3:

1. Observe that each of us has the faculty of 'Natural Acceptance', based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our 'Natural Acceptance' and may a time it is also clouded by our strong per-conditioning and sensory attractions). Explore the following:
   (i) What is Naturally Acceptable' to you in relationship the feeling of respect or disrespect for yourself and for others?
   (ii) What is 'naturally Acceptable' to you - to nurture or to exploit others? Is your living in accordance with your natural acceptance or different from it?
2. Out of the three basic requirements for fulfillment of your aspirations – right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

PS 4:

List down all your important desires. Observe whether the desire is related to Self (I) the Body. If it appears to be related to both, visualize which part of it is related to Self (I) and which part is related to Body.

PS 5:

1. a. Observe that any physical facility you use, follows the given sequence with time: Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable
   b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment!
2. List down all your important activities. Observe whether the activity is of 'I' or of Body or with the participation of both or with the participation of both 'I' and Body.
3. Observe the activities within 'i'. Identify the object of your attention for different moments (over a period of sy 5 to 10 minutes) and draw a line diagram connecting these points. Try observe the link between any two nodes.

PS 6:

1. Chalk out some programs towards ensuring your harmony with the body – in terms of nurturing, protection and right utilization of the body.
2. Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases.

PS 7:

Form small groups in the class and make them carry out a dialogue focusing on the following eight questions related to 'TRUST';

1a. Do I want to make myself happy?

2a. Do I want to make the other happy?

3a. Does the other want to make himself/herself happy?

4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

1b. Am I able to always make myself happy?

2b. Am I able to always make the other happy?

3b. Is the other able to always make himself/herself happy?

What is the answer?

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate yourself and others on the basis of intention/competence.

PS 8:

1. Observe, on how many occasions, you are able to respect your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.
2. Also, observe whether your feeling of respect is based on treating the other as you would treat yourself or on differentiations based on body, physical facilities or belieds.

PS 9:

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.
2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to values in a difficult situation.

PS 10:

List down some common Units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each Unit with other orders.

PS 11:

Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study. Also indicate the areas which are being either over-emphasized or ignored in the present context.

PS 12:

Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values. If so, how should one proceed in this direction from the present situation?

PS 13:

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

PS 14:

The course is going to be over now. It is time to evaluate what difference in your thinking it has made. Summarize the core massage of this course grasped by you. How has this affected you in terms of;

a. Thought

b. Behavior

c. Work and

d. Relization

What practical steps are you able to visualize for the transition of the society from its present state.

Project:

Every student required to take-up a social project e.g. educating children in needy/weaker section, services in hospitals, NGO's and other such work i.e. social work at villages adopted by respective institute/ college.

Course Outcomes:

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

CO1:	Analyze Basic Guidelines, Content and Process for Value Education.
CO2:	Understanding Harmony in the Human Being - Harmony in Myself.
CO3:	Understand Harmony in the Family and Society- Harmony in Human-Human Relationship. Recollect and narrate an incident in your life.
CO4:	Understand Harmony in the Nature and Existence – Whole existence as Coexistence. Summarize the core massage of this course grasped by you.
CO5:	List ac and Implicate the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L4	-	-	-	-	L	L	M	H	L	M	-	L	M	L
CO2	L2	-	-	-	-	-	L	M	M	M	M	-	L	M	M
CO3	L2	-	-	-	-	L	L	M	H	L	M	-	L	M	M
CO4	L2	-	-	-	-	L	L	L	M	M	L	L	H	M	L
CO5	L1	-	-	-	-	L	M	M	H	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTESC 209: Manufacturing Practices Workshop

Course Objectives:

- To discuss the modules include training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood and other metal pieces.
- To develop machining skills in students.

Carpentry Shop

1. T – Lap joint
2. Bridle joint

Foundry Shop

3. Mould of any pattern
4. Casting of any simple pattern

Welding Shop

5. Lap joint by gas welding
6. Butt joint by arc welding
7. Lap joint by arc welding
8. Demonstration of brazing, soldering & gas cutting

Machine Shop Practice

9. Job on lathe with one step turning and chamfering operations

Fitting and Sheet Metal Shop

10. Finishing of two sides of a square piece by filing
11. Making mechanical joint and soldering of joint on sheet metal
12. To cut a square notch using hacksaw and to drill a hole and tapping

Course Outcomes:

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

CO1:	Describe cast different parts through Carpentry.
CO2:	Define control manufacturing via computers.
CO3:	Understanding use power tools and fitting tools.
CO4:	Knowledge of various welding operations
CO5:	Understanding different metallic and non-metallic objects.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	H	M
CO2	L2	H	M	L	M	M	-	-	-	-	M	-	L	M	L
CO3	L2	H	M	L	M	M	-	-	-	-	M	-	L	H	M
CO4	L2	H	M	L	M	M	-	L	-	L	M	-	L	H	M
CO5	L2	H	M	L	M	M	-	L	-	L	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTESC 210: Basic Electrical Engineering Lab

Course Objectives:

- To understand training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood and other metal pieces.
- To develop machining skills in students.

List of Experiments

1. Basic safety precautions. Introduction and use of measuring instruments –voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Transformers: Observation of the no-load current waveform on anoscilloscope. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
3. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate or brush arrangement), induction machine (squirrel cage rotor), synchronous (field winging - slip ring arrangement) and single-phase induction
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Course Outcomes:

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

CO1.	Adapt knowledge regarding the various laws and principles associated with electrical systems.
CO2:	Adapt knowledge regarding electrical machines and apply them for practical problems.
CO3:	Understand various types' Electrical Equipments.
CO4:	Understanding digital measuring equipments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	M	M	M	M	-	-	-	-	M	-	L	H	M
CO2	L3	L	M	H	M	M	-	-	-	-	M	-	M	M	M
CO3	L2	M	H	H	H	M	-	-	-	-	H	-	M	H	H
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	

BTESC 211: Computer Aided Machine Drawing

Course Objective:

- To design, develop and analyze simple linear and non linear computer based drawing.
- To identify and apply the suitable knowledge of computers to understand the shape and size of Drawing Objects.

Course Contents:

Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules of dimensioning.

Conversion of pictorial views into orthographic views: (1 drawing sheet)Introduction to orthographic prdcojection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing view problems covering Principles of Orthographic Projections.

Sectional views of mechanical components: (1 drawing sheet) Introduction, cutting plane line, type of sectional views-full section, half section, partial or broken section, revolved section, removed section, offset section, sectioning conventions-spokes, web rib, shaft, pipes, different types of holes, conventions of section lines for different metals and materials.

Fasteners and other mechanical components: (Free hand sketch) Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints. Riveted joints, rivets and riveting, type of rivets, types of riveted joints etc. Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type, flange, andpin type flexible coupling. Other components: Welded joints, belts and pulleys, pipes and pipe joints, valves etc.

Overview of Computer Graphics: (2 drawing sheets) Covering theory of CAD software such as: The menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Command Line (Where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple and compound Solids.

Course Outcomes:

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

CO1:	Understand the conventions and the method of engineering drawing.
CO2:	Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.
CO3:	Adapt theory of sectioning and Section of Solids.
CO4:	Classify the theory of projection.
CO5:	Understand drawing skill in the form of Computer Graphics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	L	M
CO2	L4	H	L	H	L	L	-	-	-	-	L	-	L	L	L
CO3	L3	H	H	H	H	L	-	-	-	-	H	-	L	L	M
CO4	L4	H	M	H	M	L	-	-	-	L	M	-	L	M	L
CO5	L2	H	M	H	M	L	-	-	-	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	-----

BTSODECA212: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

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

CO1:	Develop their self-confidence, leadership qualities, and their responsibilities towards the community.
CO2:	Have an impact on academic development, personal development, and civic responsibility
CO3:	Understand the value of Social Work.
CO4:	Understand the Significance of Discipline in student's Life
CO5:	Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC213: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

SEMESTER - III

S.No.	Category	Course Code.	Course Title	Marks			Credits			
				Ex.	Int	P	Th	T	P	Total
1	BSC	BTAGBSC 301	Mathematics-III	70	30	-	2	1	0	3
2	ESC	BTAGESC 302	Strength of Materials	50	30	20	2	0	1	3
	BSC	BTAGBSC 303	Fundamentals of Agriculture	50	30	20	2		1	3
3	PCC	BTAGPCC 304	Fluid Mechanics and Open Channel Hydraulics	50	30	20	2	0	1	3
4	ESC	BTAGESC305	Heat Transfer, Refrigeration and Air Conditioning	50	30	20	2	0	1	3
5	PCC	BTAGPCC 306	Fundamental of Renewable Energy Sources	50	30	20	2	0	1	3
6	PCC	BTAGPCC 307	Watershed Hydrology	50	30	20	1	0	1	2
7	PSI	BTAGPSI 308	Training- I		50	50	0	0	1	1
8		BTAGSODECA309	Social Outreach, Discipline & Extra Curricular Activities	50			1	0	0	1
9	AECC	BTAGAECC 310	ANANDAM	50		50	1	0	1	2
10		NC	NSS/NCC/NSO/Yoga/Scout	-		-	-	-	-	-
			Total	**470**	**260**	**220**	**16**	**1**	**7**	**24**
				950						

BTAGBSC 301: MATHEMATICS–III

Course Objective:

1. To equipped with various modern Numerical techniques and using these techniques .

2. To introduce with the Laplace , and apply them to solve differential equations.

Course Content:

Unit-I **Interpolation:** Finite differences, various difference operators and their relationships, factorial notation, Interpolation with equal intervals, Newton‟s forward and back ward interpolation formulae, Lagrange's interpolation formula for unequal intervals.

Unit-II Gauss forward and backward interpolation formulae, Stirling's and Bessel's central difference interpolation formulae .Numerical Differentiation: Numerical differentiation based on Newton's forward and backward, Gauss forward and backward interpolation formulae.

Unit-III **Numerical Integration:** Numerical integration by Trapezoidal, Simpson's rule.

Numerical Solutions of Ordinary Differential Equations: Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta methods.

Unit-IV **Laplace Transform:** Laplace transforms of elementary functions, Basic properties of Laplace transform, Initial value theorem, final value theorem and convolution property of Laplace transform, Inverse Laplace transforms, Applications of Laplace transform to solve ordinary differential equations.

Unit-V **Z-Transform:** Definition, properties and formulae, Convolution theorem, inverse Z-transform, application of Z-transform to difference equation.

TextBook/References

1. H.C.Saxena, *TextBook of Finite Differences and Numerical Analysis*, S.Chandand Co.
2. M.K.Jain, S.R.K.Iyengar and R.K.Jain, *Numerical Methods for Scientific and Engineering computation*, New Age International (P) Ltd.
3. N.P.Baliand Manish Goyal, *A Textbook of Engineering Mathematics*, Laxmi Publication Pvt. Ltd., New Delhi (VII Edition). S.P.Goyal and A.K.Goyal, *Integral Transforms*, Jaipur Publishing House, Jaipur.

Course Outcome:-

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

CO1	Apply the Interpolation methods.
CO2	Apply the Central interpolation methods and Differentiate numerically.
CO3	Integrate numerically and able to Solve the differential equations.
CO4	Understand the Laplace transforms theory and use this theory to solve ordinary differential equations.
CO5	Understand the Z- transforms theory and use this theory to solve difference equations.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTAGESC 302: STRENGTH OF MATERIALS

Objectives:

- To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads
- To calculate the elastic deformation occurring in various simple geometries for different types of loading

Course Contents:

Unit-I **Fundamentals:** Stress and strain, engineering properties, Saint – Venant's Principle. Stress strain diagrams, mechanical properties of materials, elasticity and plasticity. Shear stress and strain, pureshear, complementary shear. Poison‟s ratio, volumetric strain, bulk modulus of elasticity.Elastic constants and relation between elastic modulie.Linear elasticity and Hooke‟s law.Temperature stresses and effects. Stress and strain in axially loaded members.

Unit-II **Analysis of Stress and Strain:** Stress at a point, stress components. Stresses on inclined planes. Plane stress and strain. Mohr'scirclerepresentation of plain stress and strain. Principle stresses and strains, maximum shear stresses. Hooke'slawfor plain stress.Stresses in thin cylinder and special shells subjected to internal & external pressures.

Unit-III **Beam under Flexural Loads:** Bending moment and shear force, relation between load,Shear force and bending moment.Bending moment and shear force diagrams for simply supported, Canti lever and over hang beams under static loading of different types viz. point loads,Uniformly distributed loads,linearly varying loads, Pure bending. Theory of simple bending of initially straight beams. Flexural stresses in beams. Built up and composite beams. Shear stresses in beams of Rectangular, Circular and I-section. Shear formula, effect of shear strain.

Unit-IV **Torsion:** Torsion of solidandhollowcirculars hafts. Non - uniform torsion.

Columns: Buckling and stability, critical load. Euler‟s theory for initially straight column with different end conditions, equivalent length, Limitation of Eulor‟s formula. Rankine‟s formula. Column under eccentric loading. Secant, Perry‟sand Indian standard Formulae.

Practical

1. Study of Universal Testing Machine, its part and functions.
2. Operation of U.T.M, fixing of specimen for different testing.
3. Tensilete ston mild steel specimen of failure and computing, Stresses, % elongation, Contraction etc.
4. Compression test on timber.
5. Compression test on mild steel.

6. Compression test on concrete cube.
7. Determination of toughness test of mild steel, Brass and Aluminum by Charpy test.
8. Determination of toughness by Izod test for wood, Aluminum & Brass.
9. Study of torsion testing machine.
10. Performance of torsion test on circular shaft specimen.
11. Bending test on wood enbeamand determination of modulus of rupture.
12. Deflection test on wooden beam.

TextBooks/References

1. Junarkar S.B. and Shah H.J., „Mechanics of Structures‟ Vol.-I Charoter Publishing, Anand.
2. Punmia B.C. Strength of Materials and Mechanics of structures ‟, Vol-I, Standard Publisher distributors, New Delhi.
3. Fedinard L. Strength of Materials‟, Singer & Andrew Pytel‟.
4. Fenner Mechanics of Solids‟.
5. Davis H.E, Trophell, G.E. & Hanck, G.F.W. The Testing of Engineering Materials ‟, Mc Graw Hill.
6. Timoshenko, S.P. & Young, D.H., Strength of Materials ‟East West Press Limited.

Course Outcomes:

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

CO1:	Recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components
CO2:	**E**valuate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading
CO3:	Calculate Shear Force and Bending Moment diagrams for statically determinate beam due to concentrated load, uniformly distributed load, uniformly varying load and couple.
CO4:	Determine bending and shear stresses in machine elements.
CO5:	Determine beams subjected to concentrated load, uniformly distributed load, uniformly varying load and couple and also strain energy in members subjected to gradual, sudden and impact loads

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	H	H	H	M	-	-	-	-	L	-	L	H	M
CO2	L5	H	H	H	H	M	-	-	-	-	M	-	M	M	H
CO3	L3	H	H	H	H	M	-	-	-	-	M	-	M	M	M
CO4	L3	H	H	H	H	M	-	-	-	-	M	-	H	H	M
CO5	L3	H	M	H	M	H	-	-	-	-	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTAGBSC 303: FUNDAMENTALS OF AGRICULTURE

Course Objectives:

This course enables the Ag. Engg. Graduates to identify problematic soils and water and also basics of cereal and horticultural crop production.

Course Contents:

Unit-I **Soils:** Definition of soil, importants oil physical properties and their importance, soil in organic colloids, their composition, properties and origin of charge, ion exchange in soil and nutrient availability, soil organic matter, its composition and decomposition, effect on soil fertility, soil reaction; acid, saline and sodic soils, quality of irrigation water, essential plant nutrients, their functions and deficiency symptoms in plants, important in organic fertilizers and their mode of action in soils.

Unit-II **Agronomy:** Definition and scope of agronomy, classification of crops, effects of different weather parameters on crop growth and development. Soil-water-plant relationship and water requirement of crops, weeds and their control, crop rotation, cropping systems mono- cropping, double cropping, relay cropping and mixed cropping.

Unit-III Study of following crops with reference to soil and climate requirements,seedbed preparation, improved varieties, seed rate, time and method of sowing, manuring, fertilisation, inter cultural operations, weed control, irrigation, crop protection and their area, production and productivity in Rajasthan: Cereals-wheat, maize and bajra, Pulses- bengal gram, kharif pulses (greengram, blackgram, and cowpea), Oilseeds- groundnut and mustard. Introduction to cash crops- cotton, sugarcane and potato and fodder crop- berseem.

Unit-IV **Horticulture:** Scope of horticulture and vegetable crops, soil and climatic requirements for fruits, vegetable and floriculture crops, improved varieties, criteria for site selection, layout and planting methods, nursery raising and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post harvest practices, management of orchards, extraction and storage of vegetableseeds.Introduction to hi-tech horticulture.

Practicals

Soils:

1. Determination of electrical conductivity and pH of soil.
2. Estimation of organic carbon of soil.
3. Determination of bulk density.

4. Determination of particle density and computation of soil porosity.

Agronomy:

1. Identification of crops.
2. Identification of seeds of different crops.
3. Identification of weeds.
4. Fertilizer application methods.
5. Different weed control methods.
6. Judging maturity time for harvesting of kharif crops.

Horticulture:

1. Identification and description of important fruit, flower and vegetable crops.
2. Study of different vegetable cultivation tools.
3. Practices of training and pruning in some important crops.
4. Vegetative propagation methods.

TextBooks/references

1. D.K. Das. (2003). Introductory Soil Science, Kalyani Publishers, NewDelhi.
2. M.M. Rai. (1995). Principles of Soil Science, S.G. Wasani for M ac Millan IndiaLtd., New Delhi.
3. K.S. Yawalkar, J.P. Agarwal and S. Bokde. (1992). Manures andFertilizers.Mrs. KumudiniK.Yawalkar, Agri.Horti. Publishing House, 52, Bajaj Nagar -440001.
4. ArunKatyayan. (2002). Fundamentals of Agriculture, Kushal Publications and Distributors, A.3/4A, Trilochan Bazar, Varanasi-221001 (U.P.).
5. T.Y. Reddy and G.H.S. Reddi. (1992). Principles of Agronomy, Kalyani Publishers, New Delhi.
6. Chattopadhayay. (1999).Textbook of Horticulture.Vol.II.J.S.Bal.(1970).Fruit Production.Kalyani Publishers, New Delhi

Course outcome:

At the end of course, students will be able to

CO1:	Knowledge of rocks, minerals and soil formation.
CO2:	Define agriculture, its importance, present status, scope, future prospect and cropping seasons of India.
CO3:	Demonstrate an understanding of the composition, fertility and biology of soil and how they relate to good plant growth.
CO4:	Demonstrate a fundamental understanding of plant identification, propagation, orchard establishment, use and maintenance of plant material best suited for conventional and sustainable horticulture.
CO5:	Identify the research career opportunities in the horticulture industry as well as emerging trends.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	H	H		M	L	M	H	M	L	H	L	L	H	-
CO2	L2	H	M	L	-	L	-	M	-	M	H	-	-	M	H
CO3	L1, L3	M	H	H	-	H	-	M	L	H	M	L	-	H	H
CO4	L2	H	M	-	-	H	H	-	-	H	H	-	H	M	L
CO5	L4	H	M				L							M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO4, CO5

BTAGPCC 304: FLUID MECHANICS and OPEN CHANNEL HYDRAULICS

Course Objectives:

- To learn about the application of mass and momentum conservation laws for fluid flows
- To understand the importance of dimensional analysis
- To obtain the velocity and pressure variations in various types of simple flows

Course Contents:

Unit-I **Hydrostatics:**Fluid Properties, Measurement of liquid pressure. Pascal‟s law fluid pressure on plane and curved stationery surface, Centre of pressure, Principal applications (preliminary) in simple gales and tanks.

Unit-II **Fluid motion:** Type and patterns, velocity and acceleration of fluid, continuity equation, elementary concept of velocity potential. Stream function and flow nets. Euler‟s equation of motion, integration of Euler‟s equation to give Bernoulli‟s equation for incompressible fluids. Applications of Bernoulli‟s equation.

Unit-III **Flow through pipes:** Various types. Velocity distribution. Loss of head due to friction. Minor losses, hydraulic gradient, pipes in series and parallel.Discharge measurement in pipes Venturimeter, orificemeter.

Unit-IV **OpenChannelFlow:** Steady and uniform flow in open channel, Discharge formulae of Chezy, and Manning. Most economic section for rectangular, trapezoidal and circular channels.. Specific energy of flow. Alternate depths. Critical depth in prismatic channels. Discharge measurement in open channels by notches and weirs

Practicals

1. Study and use of pressure gauge.
2. Study and use of manometer.
3. Determination of CC fororifices.
4. Determination of Cd fororifices.
5. Calibration of aVenturimeter.
6. Calibration of V notch.
7. Calibration of Rectangular notch.
8. Determination of friction for pipe.
9. Velocity distribution in channel cross section.
10. Field visit.
11. Revision

Text Books / References

1. Jadish Lal, Hydraulics. (1986). Metro politan Book Co.Pvt. Ltd. ,Delhi.
2. P.N.Modi and S.M.Seth. (1995). Hydraulic and Fluid Mechanics, Standard Book House, Delhi-6.
3. R.K. Bansal. Fluid Mechanics & Machine.

Course Outcome:

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

CO1:	Demonstrate the knowledge of fluid properties.
CO2:	Analyze forces and pressure variations on submerged bodies.
CO3:	Analyze fluid flow pattern, characteristics and apply the same to solve general flow problems.
CO4:	Apply energy equations to determine fluid flow parameters.
CO5:	Apply the knowledge to solve problems relating to Open Channel flow.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L4	H	M	H	M	H	-	-	-	-	L	-	L	M	M
CO2	L5	H	M	H	M	M	L	L	-	-	L	-	L	M	L
CO3	L5	H	H	H	H	M	L	L	-	-	L	-	L	M	M
CO4	L3	H	H	H	H	H	L	L	-	-	L	-	L	H	M
CO5	L3	M	H	H	M	H	L	L	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4, CO5

BTAGESC305: HEAT TRANSFER, REFRIGERATION and AIR CONDITIONING

Course Objectives:

- To build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
- To impart knowledge to develop a product with the required qualityfor air conditioning

Course Contents:

Unit I Introductory concepts, modes of heat transfer, thermal conductivity of different materials, Conduction: General differential equation of conduction. One dimensional steady state conduction through plane & composite walls, tubes and spheres with out heat generation, critical thickness of insulation. Convection: free and forced convection.newton's law of cooling. Dimensional analysis of free and forced convection.

Unit II Introduction of Radiation, Absorptivity, reflectivity and transmissivity, Black body and monochromatic radiation, Planck's law, Wien‟s law, Kirchoff‟s law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor. Heat Exchangers: Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger effectiveness, and NTU method (Only for parallel and counter flow).

Unit III Second law of thermodynamics applied to refrigeration. Reversed Carnot cycle, coefficient of performance. Unit of refrigeration, vapour compression cycle and components, Compressors, expansion valves, evaporators and condensers Deviation of actual cycle from ideal cycle, Vapour absorption refrigeration system and components, Desirable properties of ideal refrigerant, Classification of refrigerants.

Unit IV Psychrometry, Thermodynamic properties of moist air, Psychrometric chartandits use, Elementary Psychrometry processes, by pass and sensible heat factor, Air washer, Design of Air Conditioning system, sensible and latent cooling load calculation.

Practicals

1. Measure thermal conductivity of insulating powders.
2. Study temperature distribution along the length of fininnatural convection.
3. Study temperature distribution along the length of finin forcedconvection.
4. Experiment on heat transfer in natural convection.
5. Determine emissivity of given surface.
6. Determinerate of heat transfer, LMTD and over all heat transfer coefficient for parallel flow heat exchanger.
7. Determinerate of heat transfer, LMTD and over all heat transfer coefficient for counter flow heat exchanger.

8. Determine COP of vapour compression refrigeration system.
9. Determine COP of heat pump.
10. Study Electro lux refrigerator.
11. Study of domestic refrigerator and
12. Study of on etonice plant.
13. Study of water cooler.
14. Study of air conditioner.
15. Study of vapour absorption system.

Texts / References

1. D.S.Kumar: Heat and MassTransfer, S K Kataria & Sons, Delhi.
2. J.P. Holman: Heat Transfer, Mc Graw Hill.
3. Y.A. Cengel,Heat teransfer,Mc Graw-Hill
4. F.P.Incropera and D.P.Dewitt: Fundamentals of Heat and Mass Transfer, Wiley.
5. S.Domkundwar: ACourse in Heat & MassTransfer, Dhanpat Rai & Sons, Delhi.
6. C.P.Arora: Refrigeration andAir-conditioning, TMH.
7. W.Stoecker: Refrigeration and Air-conditioning, Mc Graw Hill.
8. J.L.Threlkeld: Thermal Environmental Engineering, Prentice Hall.

Course Outcomes:

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

CO1	Formulate and analyze a heat transfer problem involving any of the three modes of heat transfer
CO2	Obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer
CO3	Illustrate the fundamental principles and applications of refrigeration and air conditioning system
CO4	Present the properties, applications and environmental issues of different refrigerants
CO5	Operate and analyze the refrigeration and air conditioning systems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L4	H	M	H	M	L	-	L	-	L	M	-	L	M	L
CO2	L3	H	M	H	M	L	-	L	-	-	M	-	L	M	M
CO3	L1	H	M	H	M	L	-	-	-	-	M	-	L	L	M
CO4	L2	H	H	H	H	L	-	L	-	-	H	-	L	M	L
CO5	L2	H	M	H	M	L	-	-	-	-	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTAGPCC 306: FUNDAMENTALS OF RENEWABLE ENERGY SOURCES

Course Objectives:

- Student will get to know various of Renewable Energy Sources
- Practical exposure to analyze basic parameters energy & its generation techniques

Course Contents:

Unit I 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.

Unit II **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, standal one, Grid connected solar power station, Calculation of energy through photo voltaic power generation and cost economics.

Unit III **Wind Energy:** Energy available from wind, Lift and drag forces. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Wind mill rotors, Determination of torque coefficient, Induction type generators, working principle of wind power plant.

Unit IV **Bio-energy:** Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs. Biogas: types of bio gas plants, bio gas generation, factors affecting biogas generation and usages; advantages and disadvantages of bio gas spent slurry.

Practical

1. Study of different types of solar cookers.
2. Study of Solar water heating system.
3. Study of Solar photovoltaic system.
4. Study of Natural convection solar dryer
5. Study of Forced convection solar dryer.
6. Study of Solar desalination unit.
7. Study of fixed dome biogas plants.
8. Study of floating drum biogas plants.
9. Study of biomass gasifiers.
10. Study of biomass improved cook- stoves.

SuggestedReadings

1. Rai,G.D.2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
2. Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi.
3. Khandelwal, K.C .& S. S. Mahdi. 1990. Biogas Technology- A Practical Hand book.
4. Rathore N.S. ,Kurchania A.K.,Panwar N.L. 2007. Non Conventional Energy Sources, Himanshu Publications.
5. Tiwari,G.N.and Ghoshal ,M.K.2005. Renewable Energy Resources: Basic Principles and Applications .Narosa Pub. House. Delhi.
6. Rathore N.S. ,Kurchania A.K.,Panwar N.L.2007. Renewable Energy, Theory and Practice, Himanshu Publications.

Course Outcomes:

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

CO1.	Understanding of renewable energy sources
CO2.	Knowledge of working principle of various energy systems
CO3.	Capability to carry out basic design of renewable energy systems
CO4.	Present utilization of renewable energy sources for both domestic and industrial applications
CO5.	Operate and analyze the rural energy needs.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	H	M	L	-	L	-	L	M	-	L	M	L
CO2	L1	H	M	H	M	L	-	L	-	-	M	-	L	M	M
CO3	L2	H	M	H	M	L	-	-	-	-	M	-	L	L	M
CO4	L2	H	H	H	H	L	-	L	-	-	H	-	L	M	L
CO5	L2	H	M	H	M	L	-	-	-	-	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTAGPCC 307: WATER SHED HYDROLOGY

Course Objective:

To give an exposure to the students about the climatic parameters & their analysis to study direct & indirect effect on agriculture scenario of particular area giving main focus on water availability, distribution of circulation.

Course Contents:

Unit-I Hydrologic cycle, precipitation and its forms, rainfall measurement andestimation of mean rainfall, frequency analysis of point rainfall. Mass curve, hyetograph, depth-area-duration curves and intensity-duration-frequency relationship.

Unit-II **Hydrologic processes:** Interception, infiltration. Runoff-Factors affecting, measurement, stage - discharge rating curve, estimation of peak runoff rate and volume, Rational method, Cook‟s method and SCS curve number method.

Unit-III **Geomorphology of watersheds:** Linear, aerial and relief aspects of watersheds-stream order, drainage density and stream frequency. Hydrograph-Components, base flow separation, unit hydrograph theory, S-curve, synthetic hydrograph, applications and limitations.

Unit-IV **Stream gauging:** Discharge rating curves, flood peak, design flood and computation of probable flood.

Practical

1. Visit to meteorological observatory and study of different instruments.
2. Design of raingauge network.
3. Exercise on intensity- frequency-duration curves.
4. Exercise on depth -area-duration and double mass curves.
5. Analysis of rainfall data and estimation of mean rainfall by different methods.
6. Exercise on frequency analysis of hydrologic data and destimation of missing data, test for consistency of rainfall records.
7. Exercise on computation of infiltration indices.
8. Computation of peak runoff and runoff volume by Cook ‟smethodandrational formula.
9. Computation of runoff volume by SCS curve number method.
10. Study of stream gauging instruments-current meter and stage level recorder.
11. Exercise on geomorphic parameters of watersheds.
12. Exercise on runoff hydrograph.
13. Exercise on unit hydrograph.
14. Exercise on synthetic hydrograph.
15. Exercise on flood routing.

Suggested Readings

1. Chow, V.T. D.R.Maidment and L.W.Mays.2010. Applied Hydrology, M c Graw Hill Publishing Co., NewYork.
2. Jaya Rami Reddy, P. 2011. A Text Book of Hydrology. University Science Press,New Delhi.
3. Linsley, R.K., M.A. Kohler, and J.L.H. Paulhus. 1984. Hydrology for Engineers. Mc Graw-Hill Publishing Co., Japan.
4. Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., New Delhi.
5. Raghunath, H.M. 2006. Hydrology: Principles Analysis and Design. Revised 2nd Edition, New Age International (P) Limited Publishers ,New Delhi.
6. Subramanya, K. 2008. Engineering Hydrology. 3rd Edition,Tata McGraw-Hill Publishing Co.,New Delhi.
7. Suresh, R.2005. Water shed Hydrology. Standard Publishers Distributors, Delhi.
8. Varshney, R.S.1986. Engineering Hydrology. Nem Chandand Brothers, Roorkee, U.P.

Course Outcomes:

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

CO1.	Understand important hydrological processes and their variability in space and time at the watershed scale.
CO2.	Apply measurements and external datasets into hydrological investigations in areas with limited data by collecting and analyzing data during laboratory assignments and the course project.
CO3.	Analyse hydrological and hydrochemical functioning of small watersheds can be altered by human and natural disturbance through comprehensive test questions and in-depth investigation of watershed response during the class project.
CO4.	Analyse types of hydrological models, advantages and limitations through laboratory investigations and answering integrative questions
CO5.	Creative the scientific method to study hydrological response to disturbance by quantifying water, solute, and energy fluxes using analytical methods and communicating those results effectively through written and verbal parts of the class project

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	H	M	L	-	L	-	L	M	-	L	M	L
CO2	L1	H	-	M	H	-	-	L	-	-	M	-	-	M	-
CO3	L2	-	-	H	M	L	-	-	-	-	M	-	L	L	M
CO4	L2	H	H	H	-	L	-	L	-	-	-	-	L	-	L
CO5	L2	H	-	H	M	L	-	-	-	-	M	-	-	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

SEMESTER - IV

S.No.	Cate-gory	Course No.	Course Title	Marks			Credit			
				Th.	Int	P	Th.	T	P	Total
1	ESC	BTAGESC 401	Surveying and Leveling	50	30	20	1	0	2	3
2	PCC	BTAGPCC 402	Soil Mechanics	50	30	20	2	0	1	3
3	ESC	BTAGESC 403	Auto CAD application	-	60	40	0	0	2	2
4	PCC	BTAGPCC 404	Tractor and Automotive Engines	50	30	20	2	0	1	3
5	ESC	BTAGESC 405	Web Designing and Internet Applications	50	30	20	1	0	1	2
6	PCC	BTAGPCC 406	Irrigation Engineering and Sprinkler and Micro Irrigation Systems	50	30	20	2	0	1	3
7	PCC	BTAGPCC407	Soil and Water Conservation Engineering	50	30	20	2	0	1	3
8	PCC	BTAGPCC 408	Theory and Design of Machines	70	30	-	2	0	0	2
9		BTAGSODECA409	Social Outreach, Discipline & Extra Curricular Activities	50			1	0	0	1
10	AECC	BTAGAECC 410	ANANDAM	50		50	1	0	1	2
11		NC	NSS/NCC/NSO/Yoga/Scout[1]	-		-	-	-	-	-
			Total	**470**	**270**	**210**	**13**	**0**	**19**	**24**
				950						

Note: Students have to undergo a practical training of four weeks at the end of IV semester during summer break for which the assessment will be made at the beginning of the next semester **in** Skill Development Training- I (Student READY) Registration Only (BTAGPSI 509)

SECOND YEAR B.TECH.(IVSEMESTER)

BTAGESC 401: SURVEYING AND LEVELING

Course Objective:

- To Prepare the student to plan and conduct field work and application of scientific methodology in handling field samples by using machine.
- To equip the candidate with the art, science and technology of cartography and applications of GIS in Mapping Resources. .
- To develop the skills in surveying and thematic mapping .
- To know about contour & its different method
- To know about Area calculation of regular boundaries

Course Contents:

Unit-I Description, construction and use of Theodolite, Temporary adjustments of Theodolite, Fixing, Centering, leveling and elimination of parallax.Various axesand their relationship.Measurement of Horizontal angle by Repetition and reiteration method.Measurement of vertical angle. Application of the odolite infield problem.Sources of error in the the odolite work.

Unit-II Principles of Tacheometric survey and its field application.Constants of tachometer. Staff held vertical and normal. Use of anallacticlens. Calculation of R.L.use of stadiawire.

Application of laser in surveying. Electronic distance measuring equipments.Total Stations and measurements of angles and R.L.calculation. Introduction of DGPS.

Unit-III Contours, contouring and their characteristics. Methods of contour surveying by Theodolite.Methods of contour surveying by Tachometer. Contour Drawing by different methods.

Unit-IV Area calculation of regular boundaries by mathematical formulas.Use of Trapezoidal and Simpson‟s formula, their limitation.Planimeter: Its construction use and theory, Area calculations, Use of zero circle and solution of numerical Problems.

Computation of volumes, Earth work calculations. Level, Two level and Three level sections.

Practicals

1. Conducting contour survey in different area their compilation.
2. Study of the odolite, fixing on stand and temporary adjustment, Permanent adjustment of the odolite and their checking.
3. Horizontal and vertical angle measurements by the odolite.
4. Problems of height and distance.
5. Use of tacheometer with inclined sight and staff held inclined.

6. Contouring by grid method.
7. Contouring by radial line method.
8. Contouring by spot level method.
9. Practice of contour plotting by various methods.
10. Use of planimeter, finding constants and calculation of areas of irregular boundaries.
11. Introduction of total station.
12. Gyroscopeanditsuse

TextBooks/ References

1. T.P. Kanetker & S.V.Kulkarni. (1990). Surveying and Leveling Vol.I & II PuneVidyarthi Griha, Prakashan, Pune–30.
2. B.C.Punmia.(1990).Surveying and Field work Vol.I &II Laxmi Publications, New De

Course Outcomes:

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

CO1	Solve mathematical problems using algebraic and trigonometric functions.
CO2	Design projects using visualization and current industry methods.
CO3	Demonstrate fundamental knowledge of the systems and processes used to construct the built environment.
CO4	Perform basic land surveying instruments and perform related calculations. Perform the basic concepts of highway design and subdivision design.
CO5	Practice professional and ethical responsibilities of the profession.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	-	M	L	M	M	-	L	M	M	-	M	M	H
CO2	L4	H	-	L	M	L	L	L	-	M	-	L	L		H
CO3	L1,L4	M	-	L	H	-	M	M	-	L	L	-	-	M	H
CO4	L6	M	-	-	L	M	L	L	-	-	M	L	L	M	L
CO5	L3	H	-	M	M	1	M	M	-	L	M	M	M		L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

BTAGPCC 402: SOIL MECHANICS

Course Objective:

- To understand the scope and outcome of the Geotechnical Engineering.
- To solve Compressibility and Consolidation of soil.
- To analyze the Bearing Capacity of Soils.
- To study the soil and its engineering propertirs.
- To determine different tests on soil.

Course Contents:

Unit-I Introduction of Soil Mechanics, field of Soil Mechanics. Phasediagram, physical and index properties of soil.

Unit-II Stress condition in soils, effective and neutral stress.

Shear strength, Mohr-Colomb failure theory. Determination of shear parameters by direct shear, Triaxialand unconfined compression test.

Unit-III **Compaction:** Compaction of Soil, standard, modified proctor test andJodhpur mini compaction test. Field compaction method and control.

Consolidation of soil: One dimensional consolidation, springanalogy, laboratory consolidation test.

Unit-IV **Earth pressure:** Plastic equilibrium in soils, active and passive state, Rankine‟s theory of earth pressure Active and passive earth pressure for cohesive soils, simple numerical exercises.

Bearing capacity: Definition, elementary concept of Rankine‟s and Terzaghi‟s analysis. Effect of water table.

Practicals

1. Sieve analysis of soils.
2. Hydrometer analysis for grain size distribution in soils.
3. Field density determination by sand replacement methods.
4. Field density determination by core cutter methods.
5. Determination of maximum dry density and optimum moisture content by:
   (a) Standard.
   (b) Mini compaction.
6. Determination of atterberg‟s limits of soils.
7. Unconfined compression test.
8. Shear box test.
9. Triaxial test.
10. Consolidation test.
11. Study and use of sampling equipments.
12. Field Visit.

TextBooks / References

1. Alam Singh. (1990). Soil Engg. Theory & Practice. Asia Publishing House (P) Ltd., New Delhi.
2. B.C.Punmia &A.K.Jain.(1996). Soil Mechanics & Foundations. Laxmi Publication Pvt.Ltd., Ansari road, Darya Ganj. New Delhi-110002

Course Outcomes:

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

CO1:	Students will understand the scope and outcome of the Geotechnical Engineering.
CO2:	To solve Compressibility and Consolidation of soil.
CO3:	Students will be able to understand the Soil and soil-mass.
CO4:	Students will be able to analyze the Bearing Capacity of Soils.
CO5:	To know the Planning of Investigations and Depth of exploration.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	L	L	-	L	L	M	L	L	L	-	-	M	H
CO2	L4	L	-	M	-	M	L	-	H	M	-	L	-		H
CO3	L2	M	-	L	M	L	-	L	-	H	L	M	L	M	H
CO4	L4	-	M	-	L	L	-	-	L	M	M	-	M	M	L
CO5	L3	-	M	-	L	M	L	L	M	L	L	L	L		L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTAGESC 403: AUTO CAD APPLICATION

Course Objectives:

- To understand procedure of integration between different manufacturing modules
- To acquire skills of design and drafting different aspect of production in digital era

Application of computers for design. CAD- Overview of CAD window –Explanation of various options on drawing screen. Study of draw and dimension tool bar. Practice on draw and dimension tool bar. Study of OSNAP, line thickness and format tool bar. Practiceon OSNAP, line thickness and format tool bar. Practice on mirror, off set and array commands. Practice on trim, extend, chamfer and fillet commands. Practice on copy, move, scale and rotate commands. Drawing of 2 D-drawing using draw toolbar. Practice on creating boundary, region, hatch and gradient commands. Practice on Editing polyline- PEDIT and Explode commands.Setting of view ports for sketched drawings.Printing of selected view ports in various paper sizes. 2D-drawing of machine parts with all dimensions and allowances. Foot step bearing and knuckle joint .Sectioning of foot step bearing and stuffing box.

Drawing of hexagonal, nut and bolt and other machine parts. Practice on 3-D commands-Extrusion and loft. Practice on 3-D commands-on sweep and press pull. Practice on 3-D Commands-revolving and joining. Demonstration on CNC machine and simple problems.

Practicals

1. Introduction to CAD LAB-1.
2. Line type, Dimensions and Drafting setting.
3. Use of Draw tool bar.
4. Use of drawing status bar.
5. Use of Modify tool bar.
6. Uses of Geometric constraints and Dimensional constraints.
7. Practice set using- trim, extend, fillet and chamfer commands.
8. Practice set using-Geometric constraints.
9. Practice set using – Dimensional constraints.
10. Practice set using- explode, boundary.
11. Practice set using- copy, mirror, and move commands.
12. Practice set using- polar array and rectangular array.
13. Practice set using- extrusion and loft.
14. Practice set using- revolving and joining.

TextBooks/ References

1. Steven Harring ton: Computer Graphics-A Programming Approach, McGraw Hill.
2. M.P.Groover and E.W.Zimmers: CAD/CAM-Computer Aided Design and Manufacturing, Prentice- Hall of India, New Delhi
3. Surendra Kumar and A.K.Jha: Technology of Computer Aided Design and Manufacturing CAD/CAM, Dhanpat Rai & Sons, Delhi.

Course Outcome:

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

CO1:	Describe CAD system components.
CO2:	Understand and use various drafting and drawing commands.
CO3	Draw 2-D drawings and use 3 D commands.
CO4:	Draw production drawings of simple machine components.
CO5:	Draw on 3-D Commands like revolving and joining

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	H	L	-	-	-	-	-	L	-	L	M	M
CO2	L3	H	L	M	L	L	-	-	-	-	L	-	L	L	M
CO3	L3	H	L	M	L	L	-	-	-	-	L	-	L	H	M
CO4	L6	H	L	M	L	L	-	-	-	-	L	-	L	L	L
CO5	L6	H	M	H	M	L	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2,
CD5	Industrial visit	CO3, CO4, CO5

BTAGPCC 404: TRACTOR AND AUTO MOTIVE ENGINES

Course Objective:

The students will be able to learn about different sources of farm power, construction and functioning of CIand SI engines, IC engine fuels, Coolants, anti freeze and anti corrosion materials.

Course Contents:

Unit-I **Sources of farm power:** Conventional and non-conventional energy sources.Classification of tractors and CI engines. Difference between CI and SI, Two stroke and four stroke engines. Status of tractor and power tiller industries in India. Review of thermodynamic principles of CI engines and deviation from ideal cycle. Simple numerical problems horse power calculation.

Unit-II **CI Engine systems:** Study of engine components their construction, operating principles and functions. Valves & valve mechanism. Fuel, intake and exhaust, ignition, starting and electrical systems.

Unit-III **IC engine fuels:** Properties & combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in IC engines, Simple numerical problems on fuel combustion.

Unit-IV Study of properties of coolants, anti freeze and anti-corrosion materials, lubricant types and study of their properties. Engine cooling and lubricating systems. Engine governing systems: centrifugal and pneumatic. Familiarization with the basics of engine testing.

Practical

1. Introduction to different systems of a CI engine; Engine parts and functions.
2. Valve system–study and adjustments.
3. Oil & Fuel- determination of physical properties.
4. Study of Air cleaning system.
5. Study of Fuel supply system of CI engine.
6. Study of cooling system: thermostat and radiator.
7. Study of lubricating system.
8. Study of Starting and electrical system of tractor.
9. Study of engine performance curves.
10. Visit to engine manufacturer /assembler/spare parts agency.

TextBooks\ References

1. Liljedahl, B.J., Turnquist, P.K.Smith, W.D. and Hoki Vaketo 1989. Tractor and their Power units. Jhon Wiley & Sons., New York.
2. Jones, F .R.-Farm Gas Engines & Tractors Mc. Grow Hill Book Company, New York.
3. Mosses & Frost–Farm Power, John Wiley & Sons, New York.
4. Rai & Jain–Farm Tractor Maintenance and repair, Tata McGraw Hill Publishing Co. Ltd., New-Delhi.
5. Mathur, M.L. and Sharma, R.P.Internal Combustion Engine, Dhanpat Rai & Sons, New Delhi.
6. Gupta, R.B. Auto mobile engineering, Satya Prakashan, New Delhi.

Course Outcomes:

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

CO1:	Recognize various sources of farm power and compare them
CO2:	Explain the working of IC Engines and their uses in modern equipments
CO3:	Describe various parts of tractors and evaluate the financial mechanism
CO4:	Estimate the capacity and requirements of using farm implements
CO5:	Explain the various implements used in agriculture farm for various purposes

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1, L5	L	-	-	H	-	M	-	-	-	-	-	M	-	L
CO2	L2,L3	-	M	L	H	-	M	-	-	-	-	-	-	L	-
CO3	L1, L5	-	-	L	-	-	M	-	L	-	-	-	-	-	L
CO4	L5	-	L	-	-	-	-	H	M	-	-	-	-	-	-
CO5	L2.L3	-	-	-	-	-	-	-	-	M	-	H	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars	CO1, CO3, CO4
CD4	Self- learning advice using internets	CO1, CO4, CO5
CD5	Industrial Visit / Field Visit	CO3,CO5

BTAGESC 405: WEB DESIGNING AND INTERNET APPLICATIONS

Course Objectives:

- Understand and implement the basics of Internet.
- Understand and implement the basics of web programming for designing web applications using HTML.
- Understand and implement the basics of web programming for designing web applications using Cascading Style Sheets.
- Understand and implement internet programming and internet use using java script and other common internet applications.

Course Contents:

Unit –I **Introduction to Internet:** Evolution of Internet, Introduction to Internet Protocol-TCP/ IP, UDP, HTTP, Secure Http (SHTTP), Internet Applications – Commerce on the Internet, Governance on the Internet, Impact of Internet on Society–Crime on /through the Internet. Internet Networks: LAN, MANWAN, Services on Internet (Definition and Functions) E-mail, WWW, Telnet, FTP, IRC and Search Engine.

Unit–II **Mark-up language- HTML:** Introduction, Basic Tags, Attributes, Heading, Formatting, Styles, Links, Images, Multimedia, Tables, Lists, Forms, Colors, Layout, Frames, Font, Head, Metatags, Overview of DHTML, Designing web pages using Dream weaver.

Unit–III **Cascading Style Sheets:** Introduction, Inline Styles, Embedded Style Sheets, Conflicting Styles, Linking External Style Sheets, Positioning Elements, Backgrounds, Elements Dimensions, Box Model and Text Flow, Media Types, Drop-Down, User Style Sheets, Document Object Model.

Unit–IV **Scripting and recent trends in Internet:** Introduction to JavaScript, Decision Making, Control Statements, Functions, Objects, Arrays, EventHandling. Creating Web Banners. Learning to use FTP, Uploading of Site. Introduction to database connectivity, Flash. Internet Phone, Internet Video, e-commerce, VoIP.

Practicals

1. Write a program to addall basic HTML tags.
2. Write a programto set background image in a frame.
3. Write a program to implement nested lists.
4. Write a program to implement table tag and its various attributes.
5. Write a program to create forms in HTML.
6. Write a program to implement various features of CSS.
7. Write a program to create popup boxes in Java Script.
8. Write a program to perform arithmetic operations using Java Script.

9. Write a program to implement in-built string functions in Java Script.
10. Develop static web site using various HTML features including validation of various user details using Java Script.

TextBooks/References

1. Internet for Every one, Alexis Leon and Mathews Leon, Vikas Publishing House Pvt.Ltd, New Delhi.
2. OLevel ModuleM1.2 Internet & web page designing, VK. Jain, B P B Publication, New Delhi.
3. Web Design the complete Reference, Thomas Powell, Tata Mc Graw Hill.
4. HTML and CSS The complete Reference, Thomas Powell, Tata Mc Graw Hill.
5. Java Script 2.0: The Complete Reference, Second Edition by Thomas Powell and Fritz Schneider

Course Outcomes:

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

CO1:	Understand and implement the basics of Internet.
CO2:	Understand and implement the basics of web programming for designing web applications using HTML.
CO3:	Understand and implement the basics of web programming for designing web applications using Cascading Style Sheets.
CO4:	Understand and implement internet programming and internet use using java script and other common internet applications.
CO5:	Knowledge about Positioning Elements, Backgrounds

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom Level**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	L	-	L	-	M	L	H	L	-	-	L	L	-	-
CO2	L1, L2	L	-	L	-	H	L	M	L	-	-	L	M	-	L
CO3	L3	L	-	L	-	M	L	L	L	-	-	L	L	-	-
CO4	L4, L5	H	L	H	M	M	M	-	-	L	M	-	M	-	L
CO5	L5	H	L	L	-	-	M	M	L	H	H	H	-	-	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3,CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4
CD5	Industrial visit	CO4, CO5

BTAGPCC 406: IRRIGATION ENGINEERING AND SPRINKLEAND MICRO IRRIGATION SYSTEMS

Course Objective:

To train the students and develop basic understanding of soil water plant relationship and select and design appropriate method of water application in varied situations and design of field specific Drip and Sprinkler Irrigation system, their proper operation and the maintenance.

Course Contents:

Unit-I Major and medium irrigation schemes of India, purpose of irrigation, source of irrigation water, present status of development and utilization of different water resources of the country; measurement of irrigation water: weir, flumes and orifices and other methods; open channel water conveyance system: design and lining of irrigation field channels, on farm structures for water conveyance, control & distribution; under ground pipe conveyance system: components and design.

Unit-II **Soil water plant relationship:** Soil properties influencing irrigation management, soil water movement, infiltration, soil water potential, soil moisture characteristics, soil moisture constants, measurement of soil moisture, moisture stress and plant response; water requirement of crops: concept of evapo transpiration (ET), measurement and estimation of ET

Unit-III Water and irrigation requirement of crops, depth of irrigation, frequency of irrigation, irrigation efficiencies; surface methods of water application: border, check basin and furrow irrigation- adaptability, specification and design considerations.

Unit-IV **Sprinkler irrigation:** Adaptability, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of lateral, sub-main and main pipe line, design steps; selection of pump and power unit for sprinkler irrigation system; performance evaluation of sprinkler irrigation system: uniformity coefficient and pattern efficiency;

Micro Irrigation Systems: Types-drip, spray, & bubbler systems, merits and demerits, different components; Design of drip irrigation system: hydraulics of drip irrigation system, maintenance of micro irrigation system: fertigation: advantages and limitations of fertigation.

Practical

1. Measurement of soil moisture by different soil moisture measuring instruments;
2. Measurement of irrigation water;
3. Measurement of infiltration characteristics; determination of bulk density, field capacity and wilting point;
4. Estimation of evapo transpiration;
5. Design of under ground pipe line system;
6. Estimation of irrigation efficiency;

7. Study of advance, recession and computation of infiltration opportunity time; infiltration by in flow- out flow method;
8. Evaluation of border irrigation method;
9. Evaluation of furrow irrigation method;
10. Evaluation of check basin irrigation method.
11. Study of different components of sprinkler irrigation system;
12. Design and installation of sprinkler irrigation system; cost economics of sprinkler irrigation system;
13. Study of different components of drip irrigation;
14. Design and installation of drip irrigation system;
15. Field visit to micro irrigation system and evaluation of drip system; cost economics of drip irrigation system.

Suggested Readings

1. Allen R.G., L.S .Pereira, D.Raes, M.Smith.1998. Crop Evapo transpiration guidelines for computing crop water requirement. Irrigation and drainage Paper56, FAO of United Nations, Rome.
2. Choudhary M.Land Kadam U.S2006. Micro irrigation for cash crops West ville Publishing House.
3. IsraelsenOW. And Hansen V.Eand Stringham G.E.1980. Irrigation Principles and Practice, John Wiley & Sons, Inc.USA.
4. Keller Jack and Bliesner RonD.2001. Sprinkle and Trickle Irrigation. Springer Science + business Media, New York.
5. Majumdar D. K. 2013. Irrigation Water Management Principles. PHI learning Private Limited New Delhi 2nd Edition.
6. Mane M.S and Ayare B.L. and Magar S.S. 2006. Principles of Drip Irrigation systems, Jain Brothers, New Delhi.
7. Mane M.S. and Ayare B.L. 2007. Principles of Sprinkler Irrigation systems, Jain Brothers, New Delhi.
8. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing House New Delhi.
9. Michael A.M, Shri mohan and KR Swaminathan. Design and evaluation of irrigation methods, (IARI Mono graph No.1). Water Technology Centre, IARI New Delhi.
10. Murthy VVN.2013. Land and Water management Engineering. Kalyani Publishers, New Delhi.

Course Outcome:

At the end of the course, a student will be able to –

CO1	Knowledge about irrigation systems and status of irrigation system in India
CO2	Knowledge aboutsoil properties influencing irrigation management
CO3	Discuss Water and irrigation requirement of crops
CO4	Knowledge about sprinkler and micro-irrigation systems
CO5	Knowledge about drip irrigation system

Course Delivery Methods (CD)

CD1	Lecture by use of boards / LCD projectors / OHP projectors
CD2	Tutorials / Assignments
CD3	Seminars
CD4	Self – Learning advice using internet
CD5	Industrial Visit / Field Visit

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course Outcome	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L6	M	-	L	H	L	M	-	L	H	M	L	H	H	M
CO2	L6	H	L	M	L	-	M	L	-	L	H	L	M	M	H
CO3	L2	L	M	-	H	L	L	-	H	M	L	M	L	M	-
CO4	L5	H	M	L	-	L	M	H	M	-	M	L	H	H	M
CO5	L5	H	M	M	L	-	-	M	M	H	-	H	-	L	M

H- High, M- Moderate, L- Low "-" for no correlation

Mapping between Cos and CD

CD	**Course delivery Method**	**Course Outcome**
CD1	Lecture by use of boards / LCD projectors/ OHP projectors	CO1, CO2, CO3
CD2	Tutorials / Assignments	CO3, CO5
CD3	Seminars	CO4, CO5
CD4	Self – Learning advice using internet	CO1, CO2, CO4
CD5	Industrial Visit / Field Visit	CO3,CO4

BTAGPSC 407: SOIL AND WATER CONSERVATION ENGINEERING

Course Objective:

To have understanding about the degradation of productive soil globally and its effect the reon, also to know about the causes about waters carcity and their solution to fight against theevil effects through soil and water conservation technologies.

Course Contents:

Unit-I **Soil erosion:** Introduction, causes and types - geological and acceleratederosion, agents, factors affecting and effects of erosion.Water erosion -Mechanics and forms - splash, sheet, rill, gully, ravine and stream bank erosion. Gullies-Classification, stages of development.

Unit-II **Soil loss estimation:** Universal soil loss equation (USLE) and modified USLE. Rain fall erosivity - estimation by KE>25 and EI_{30} methods. Soil erodibility - topography, crop management and conservation practice factors. Measurement of soil erosion - Runoff plots, soil samplers. Water erosion control measures - agronomical measures - contour farming, strip cropping, conservation tillage and mulching.

Unit-III **Engineering measures:** Bunds and terraces. Bunds-contour and graded bunds - design and surplussing arrangements. Terraces – level and graded broad base terraces, bench terraces - planning, design and layout procedure, contour stone wall and trenching. Gully and ravinereclamation-principles of gully control-vegetative measures, temporary structures and diversion drains.

Unit-IV **Grassed water ways and design:**

Wind erosion- Factors affecting, mechanics, soil loss estimation and control measures-vegetative, mechanical measures, wind breaks and shelter belts and stabilization of sand dunes.Land capability classification. Rate of sedimentation, silt monitoring and storage loss in tanks.

Practical

1. Study of different types and forms of water erosion.
2. Exercises on computation of rain fall erosivity index.
3. Computation of soil erodibility index in soil loss estimation.
4. Determination of length of slope (LS) and cropping practice (CP) factors for soil loss estimation by USLE and MUSLE.
5. Exercises on soil loss estimation/ measuring techniques.
6. Study of rain fall simulator for erosion assessment.
7. Estimation of sediment rate using Coshocton wheel sampler and multi-slot devisor.
8. Determination of sediment concentration through oven dry method.

9. Design and layout of contour bunds.
10. Design and layout of graded bunds.
11. Design and layout of broad base terraces.
12. Design and layout of bench terraces. Design of vegetative water ways.
13. Exercises on rate of sedimentation and storage loss in tanks.
14. Computation of soil loss by wind erosion. Design of shelterbelts and wind breaks for wind erosion control.

Visit to soil erosion sites and watershed project areas for studying erosion control and water conservation measures.

Suggested Readings

1. Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.
3. Mal, B.C. 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.
4. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4thEdition, Jain Brothers, New Delhi.
5. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
6. Norman Hudson. 1985. Soil Conservation. Cornell University Press, Ithaka, New York, USA.
7. Frevert, R.K., G.O. Schwab, T.W. Edminster and K.K.Barnes. 2009. Soil and Water Conservation Engineering, 4th Edition, John Wiley and Sons, New York.
8. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi

Course Outcome:

At the end of the course, a student will be able to understand –

CO1	Apply various methods of soil erosion and forms of water erosion, classification of gully control measures or structures.
CO2	Knowledge of soil loss equation and it can estimate long - term annual soil loss and guide conservationists on proper cropping, management, and conservation practices.
CO3	Demonstrate the contour strip cropping designed to minimize soil erosion and contour bunds which can save soils from erosion.
CO4	Understand the grassed waterways designed to move surface water across farmland without causing soil erosion and various water harvesting techniques.
CO5	Knowledge about soil loss estimation/ measuring techniques

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	M	-	M	M	H	M	-	M	M	-	M	H	M	H
CO2	L5	H	M	M	M	H	H	-	M	-	-	H	H	-	M
CO3	L4	H	H	H	H	H	M	M	M	-	-	M	H	L	H
CO4	L3	H	M	H	H	M	-	H	M	M	M	M	H	M	M
CO5	L6	H	H	H	M	M	-	-	M	M	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO5
CD3	Seminars	CO3,CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2,
CD5	Industrial visit / Field visit	CO4, CO5

BTAGPCC 408: THEORY AND DESIGN OF MACHINES

Course Objectives:

- To understand the kinematics and rigid- body dynamics of kinematically driven machine components
- To understand the codes, standards and design guidelines for different elements

Course Contents:

Unit I **Mechanisms:** Elements, links, pairs, kinematic chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions.

Gear: Types of gears. Law of gearing, Involute and cycloidal profile for gear teeth. Spur gear, nomenclature. Interference and under cutting. Introduction to helical, spiral, beveland worm gear.

GearTrains: Simple, compound, reverted, and epi cyclic trains. Determining velocity ratio by tabular method.

Unit II **Power Transmission:** Beltdrives, types of drives, belt materials. Length of belt, power transmitted, velocity ratio, belt size for flat and Vbelts. Effect of centrifugal tension, creep and slipon power transmission. Chain drives. Flywheel: Turning moment diagrams, co-efficient of fluctuation of speed and energy, weight of flywheel, fly wheel applications. Friction: Types of friction, laws of dry friction. Friction of pivots and collars. Single disc, multiple disc, and cone clutches. Rolling friction, anti friction bearings.

Unit III **Introduction:** Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties. Types of loads and stresses, theories of failure, factor of safety, selection of allow able stress. Stress concentration.

Design of joints: Cotter joints, knuckle joint and pinned joints, turn buckle. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear (eccentric loading not included).

Unit IV **Design of shafts, keys and couplings:** Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff or sleeve, and rigid flange couplings. Design offlat belt drives. Design of brackets, levers. Design of helical and leaf springs.

TextBooks / References

1. Joseph E.Shigley and John J.Uicker, Jr.: Theory of Machines and Mechanisms (International Edition), Mc Graw Hill Inc.
2. R.S.Khurmiand J.K.Gupta: Theory of Machines, S.Chand & Co.Ltd. , New Delhi.
3. P.L.Ballaney: Theory of Machines, Khanna Publishers, Delhi.
4. Joseph Edward Shigely: Mechanical Engineering Design, Mc Graw Hill Book Company, Singapore.
5. P.C.Sharma and D.K.Aggarwal: Machine Design, SK Kataria & Sons, Delhi.
6. R.S.Khurmi and J.K.Gupta: A Text Book of Machine Design, S.Chand & Co. Ltd., New Delhi.

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

CO1:	Explain the terminology of kinematics and inversions of common mechanisms.
CO2:	Describe characteristics of different types of gears and compute velocity ratio of gear trains.
CO3	Perform calculations required for design of belt & chain drives, fly wheel and friction drives.
CO4:	Describe characteristics of different types of anti friction bearings.
CO5:	Demonstrate knowledge of various considerations involved in the design of machines.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	M	H	M	M	L	-	-	-	L	-	L	H	M
CO2	L3	H	M	H	H	M	-	-	-	-	L	-	L	H	M
CO3	L2	H	L	H	L	M	-	-	-	-	L	-	L	H	M
CO4	L1	H	M	H	M	M	L	-	-	-	L	-	L	M	H
CO5	L2	H	M	H	M	M	-	-	-	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

THIRD YEAR B.Tech

SEMESTER – V

S.No	Category	CourseNo.	CourseTitle	Marks			Credit		
				Ex	Int.	P	Th	P	Total
1	PCC	BTAGPCC 501	Farm Machinery andEquipment–I	50	30	20	2	1	3
2	PCC	BTAGPCC 502	Building Construction andCostEstimation	70	30	-	2	0	2
3	PCC	BTAGPCC 503	Tractor Systems andControls	50	30	20	2	1	3
4	PCC	BTAGPCC 504	Post Harvest Engineering of Cereals, Pulses, Oilseeds	50	30	20	2	1	3
5	PCC	BTAGPCC 505	Watershed Planning andManagement	50	30	20	1	1	2
6	PCC	BTAGPCC 506	Groundwater, Wells andPumps	50	30	20	2	1	3
7	PCC	BTAGPCC 507	RenewablePowerSources	50	30	20	2	1	3
8	PCC	BTAGPCC 508	EngineeringPropertiesofAgriculturalProduce	50	30	20	1	1	2
9	PSI	BTAGPSI 509	Skill Development Training- I (Student READY) Registration Only		50	50	0	5	5
10		BTAGESODECA510	Social Outreach, Discipline & Extra Curricular Activities	-		50	1	0	1
11	AEC C	BTAGAECC511	Professional Skills	50	30	20	2	0	2
12	AEC C	BTAGAECC 512	ANANDAM	50		50	2	0	2
		NC	NSS/NCC/NSO/Yoga/Scout[1]			-	-	-	0
			Total	**520**	**320**	**310**	**19**	**12**	**31**
				1150					

THIRD YEAR B.TECH. (V SEMESTER)

BTAGPCC 501: FARM MACHINERY AND EQUIPMENT–I

Course Objective:

To identify the need offarm mechanization in India. Also equip the students with technical knowledge and skills required for the operation, maintenance and evaluation of Tillage, Sowing and inter cultural operational machinery needed for agricultural farms. To abreast the students with mathematical, experimental and computational skills for solving different field problems. To develop skills in the students required to develop and modification of indigenous farm machines as per the need of the area and farmers.

Course Contents:

Unit-I Status of farm mechanization, Introduction to various farm operation, implement types. Classification of farm machines. Materials of construction. Tillage and its objectives. Field capacities, field efficiency and simple numerical problems.

Unit-II **Primary and secondary tillage equipment; Ploughs:** Disc, Mouldboard, Subsoiler, Rotary tiller, disc harrow and Puddlers. Forces acting on Disc, M.B. Plough and disc harrow. Draft measurement of tillage equipment and simple numerical problems.

Unit-III **Crop planting methods:** Sowing and planting equipment-their construction, metering mechanism, furrow openers, covering devices and metering mechanism for fertilizer applications, calibration and adjustments. Paddy transplanter and its construction. Simple numerical problems on seed drills and planters. Introduction to plot seed drills and precision planters.

Unit-IV Methods and equipments for inter culture and weed control. Introduction to plant protection equipment: Sprayers, dusters and their calibration,Constructional features of different components and adjustments of knapsack and foot sprayers and rotary duster. Simple numerical problems on calibration of sprayers. Introduction to earth moving equipment, construction & working principles of Bull dozer and numerical problems on its out put.

Practicals

1. Introduction to various farm machines and visit to implement‟s shed.
2. Construction details, adjustments and working of M.B. plough.
3. Construction details, adjustments and working of disc plough.
4. Construction details, adjustments and working of disc harrow.
5. Construction details, adjustments and working of secondary tillage tools.
6. Field capacity and field efficiency measurement of tillage and planting equipment.
7. Draft & fuel consumption measurement of different implements.
8. Working of seed-cum-fertilizer drill and its calibration.

9. Working of planters.
10. Weeding equipments and their use.
11. Study of knapsack and foot sprayers.
12. Study of rotary duster.
13. Construction and working of rotavator.
14. Study of bull dozer.

TextBooks \ References

1. Bainer, R.Barger, E.L. and R.A. Kepner. (1997). Principles of Farm Machinery. John Wiley & Sons, Inc, New York.
2. A. C. Shrivastava etal. Principle of Farm Machinery ASAE publications.
3. H.P.Smith. (1977). Farm Machinery and Equipment, Tata Mc- Graw Hill Publishing Co.Ltd. New Delhi.
4. H Singh and O.S. Bindra. (1980). Pesticides and Application Equipment, Oxford & IBM publishing Co.
5. O.P.Singhal. Elements of Agricultural Engineering, PartI and II. Saroj Prakashan, Allahbad.
6. FAO, Bulletin. (1977). Elements of Agricultural Machinery, volumeI.
7. R.L. Peurifoy. Construction, Planning, Equipment and Methods.
8. Singh, S. Principles of Farm Machinery. DIPA, ICAR, KAB-I, New Delhi
9. Singh, Surendra. Farm Machinery Principle and Application. ICAR Publication.
10. Singh, Surendra and S.R.Verma. Farm Machinery Maintenance and Management. ICAR Publication.

Course Outcomes:

At the end of the course, students will be able to

CO 1.	Understand the role of farm Mechanization in agriculture and its relation to other areas of agriculture to acquaint with recent developments in Mechanization.
CO 2.	Acquitance with primary and secondary tillage implements.
CO 3.	Acquitance with different sowing and planting implements.
CO 4.	Acquitance with different intercultural and weeding equipments.
CO5:	Knowledge about working of various implements and machinery

Course Delivery Methods (CD)

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1,L2	H	M	-	-	L	L	M	L	H	M	-	-	H	M
CO2	L4	M	M	H	L	L	-	M	L	H	M	-	-	M	H
CO3	L2,L3	H	M	M	M	M	M	M	-	H	M	-	-	M	H
CO4	L5	H	M	M	M	L	M	M	M	M	H	L	M	H	M
CO5	L5	H	H	M	H	-	L	-	M	-	H	H	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4, CO5

BTAGPCC 502: BUILDING CONSTRUCTIONS AND COST ESTIMATION

Course Objectives:

1. To how the wood, cement, admixtures is used for buildings and construction process.
2. To develop the building walls and foundations and how they are useful for buildings.
3. In these mainly we know about building arches, roofs, doors, windows and ventilators and how they are given for buildings.
4. To develop the form work and finishing work which is used for buildings and to solve the defects of building properties which are able to know with material
5. Impart the knowledge of Estimating, Costing and Valuation for Civil Engineering Structures.
6. Prepare and evaluate contract documents.

(A) BUILDING CONSTRUCTION

Unit-I Components of a building and their function. Foundation: Function, shallow and pile foundation. Causes of failure and remedial measures. Masonry Construction: English bond and Flemish bond for one bricks thick wall. Stone Masonry: Types of stone masonry, Essentials of good stone masonry.

Unit-II Concept in Concrete Technology and test on concrete.

Load Carrying Floors: Types, stone Patti, timber and R.C.C. floors.

Floor Finishing: Lime, Cement concrete, terrazzo, marble and P.V.C. tiles, details of construction.

Roofs: Simple roof trusses, king post roof truss, queen postro of truss.

Earthquake Disaster Management: Introduction, causes of earthquake, their intensities, its effect, safety measures and precautions to face earth quake problem.

(B) COST ESTIMATION

Unit-III Object, Main item of works, the unit of measurement for various item of works & materials.

Various methods of building estimate i.e. long wall-short wall methods & centre line method for one & two room building.

Unit-IV Organization of Engineering Department: General discussion of

P.W.D. accounting & procedure of works classification of work. Contract & contact document. Tender Notice- how to invite tender notice. Opening of tender & various conditions to accept it. Running & Final bill, Earnest money, Security money & measurement book.

Valuation: Purpose of valuation, Out goings, Scrap value, Salvage value, Market value, Book value, annuity capitalized value, Methods of calculating deprecation, Sinking fund deprecation, Valuation of building.

Text Books / References

1. S.P.Arora and Bindra.Building Construction.Dhanpat Rai & Sons,New Delhi
2. S.N.Awaasthy. Building Construction, Publishing House, Bhopal.
3. B.N.Datta. (1994). Estimating & Costing in Civil Engineering, Theory & Practice, Publishing Distributors Ltd., New Dehli.

Course Outcomes: After completing this course the students will be able to:

CO1.	Demonstrate the ability to know about different materials such as stones, bricks, Tiles, wood, aluminum, glass & paints and their classification , manufacture and structural requirements
CO2.	Ability to know about the materials used in making of concrete such as cement and admixtures.
CO3.	Ability to know about tests on cement such as field and lab tests and uses of cement and admixtures.
CO4:	Explain concepts related to reading drawing, measurements, preparing cost and quantity estimate for all types of building, earthwork calculations of road & canals, rate analysis, valuation, rent fixation, organization & role of government departments as construction agency, contracts and tender documents.
CO5:	Calculate/ estimate the quantities of item, perform rate analysis of items of work, prepare all contract documents.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	M	H	L	L	-	L	M	L	L	L	-	-	-	H
CO2	L1,L4	M	M	M	-	L	L	-	H	M	-	L	-	H	H
CO3	L2	L	L	L	-	M	-	L	-	H	L	M	L	L	M
CO4	L2	M	-	L	L	L	-	-	L	-	H	-	M	L	M
CO5	L2	L	-	M	L	M	L	L	M	-	M	L	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO3, CO4, CO5
CD3	Seminars / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4

BTAGPCC 503: TRACTOR SYSTEMS AND CONTROLS

Course Objective:

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

- Gaining knowledge about various tractor systems, their construction and working.
- Learning fundamentals of tractor chassis design and traction theory.

Course Contents:

Unit-I **Study of transmission system:** Functions of transmission, Clutch: single and multiple clutches and their functions, Gear box: sliding and constant mesh, differential and final drive mechanism. Simple numerical problems on calculation of speed ratios.

Unit-II **Familiarization of brake mechanism:** Mechanical and hydraulic. Steering: Ackerman and hydraulic. Hydraulic system of tractor: Automatic position and draft control.

Unit-III **Tractor power outlets:** P.T.O., belt pulley, draw bar. Introduction to traction mechanics. Tractor chassis mechanics: C.G. determination and weight transfer. Simple numerical problems on tractor chassis mechanics.

Unit-IV **Tractor stability:** Grade and non-parallel pull, turning at high speed. Simple numerical problems on tractors tability. Introduction to ergonomic considerations: Anthropometry and physiological cost measurements and tractor safety. Introduction to advances in tractor systems and controls.

Practical

1. Study of brake systems: Drum and disc brakes, Mechanical and Hydraulic brakes
2. Introduction to transmission systems and components: study of different types of gear boxes and design problems on gear box.
3. Study on differential and final drive and planetary gears.
4. Study of clutch functioning and parts.
5. Appraisal of various controls in different makes tractors in relation to anthropometric measurements.
6. Determination of location of CG of a tractor.
7. Traction performance of a traction wheel.

Suggested Readings

1. John B.Liljedahl, PaulK Turnquist, David WSmith and Makoto Hoki, Tradctor andTheir Power UnitsCBS Publisher, 2004.
2. RodichevV and GRodicheva, Tractor and Automobiles MIR Publication Moscow, 1984.
3. Kirpal Singh, Automobile Engineering Vol-I "Standard Publisher Distributor, Delhi 13th Edition, 2012.
4. Joseph Heitner, Automotive Mechanics: Principles and Practices "CBS Publishers 2006.
5. C.B.Richey, Agricultural Engineering Hand book, Mc Graw Hill Inc.USA 1961.

Course outcome

At the end of this course students will be able to

CO 1:	Knowledge about different transmission systems of tractor
CO 2:	Knowledge about brake system in tractors
CO 3:	Knowledge about different power outlet tests in tractor
CO 4:	Understanding the stability of tractor
CO5:	Knowledge about traction performance of a traction wheel

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

CO	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L4	H	M	M	L	H	M	-	-	L	H	M	H	H	H
CO2	L2	H	H	M	-	L	-	H	-	-	H	-	-	M	L
CO3	L1,L2	M	-	M	-	-	-	M	-	-	L	M	H	H	M
CO4	L4	M	M	H	M	L	H	H	M	H	M	M	M	M	M
CO5	L5	H	H	M	-	-	L	L	M	M	M	-	H	M	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3,
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO5
CD5	Industrial visit	CO1, CO4

BTAGPCC 504: POST HARVEST ENGINEERING OFCEREALS, PULSES AND OIL SEEDS

Course Objective:

To understand the various post-harvest operations of cereals, pulses and oil seeds and their products.

Course Contents:

Unit I Cleaning and grading, aspiration, scalping; size separators, screens, sieve analysis, capacity and effectiveness of screens. Air screen cleaners: specific gravity separator and indented separator.

Unit II Drying, moisture content and water activity; free, bound and equilibrium moisture content, Psychrometric chart and its use in drying, Drying principles, Thin layer, Falling rate and constant rate drying periods, different methods of drying, mechanical tray dryer and solar dryer.

Unit III Milling of rice, conditioning and par boiling, advantages and disadvantages, traditional methods and CFTRI parboiling method, modern rice milling, different unit operations in rice milling milling of wheat.

Unit IV Milling of pulses (traditional and modern milling methods, dry milling and wet milling methods, CFTRI method), Introduction to corn milling (dry and wet milling) and its products. Introduction toill seeds milling.

Practical

1. Performance evaluation of CIAE grain cleaner.
2. Determination of separation/ cleaning efficiency.
3. Study of burrmill and hammer mill.
4. Determination of fineness modulus and uniformity index.
5. Measurement of moisture content: dry basis and wet basis.
6. Study on drying characteristics of grains.
7. Study of mechanical tray dryer and solar dryer.
8. Study of CIAE dhal mill.
9. Study of indented cylinder separator.
10. Study of cylone separator.
11. Visit to grain processing industries.

Suggested Readings

1. Chakraverty, A. Post Harvest Technology of Cereals Pulses and Oil seeds, Oxford & IBH, publishing Co.Ltd. New Delhi.

2. Dash, S.K., Bebartta, J.P. n and Kar, A.Rice Processing and Allied Operations, Kalyani, Publishers, New Delhi.
3. Sahay, K.M. and Singh, K.K. 1994. Unit Operations of Agricultural Processing, Vikas, Publishing house Pvt. Ltd., New Delhi.
4. Geankoplis C.J.Transport Processes and Unit Operations, Prentice Hall of India Pvt Ltd, New Delhi
5. Earle, R.L. 2003. Unit Operations in Food Processing, Pergamon Press, Oxford. U.K.
6. Henderson, S.M. and Perry, R.L. Agricultural Process Engineering, Chapman and hall, London
7. Mc Cabe, W.L., Smith J.C. and Harriott, P. Unit Operations of Chemical Engineering, Mc Graw Hill.
8. Singh, R.Paul. And Heldman, R.Dennis. 2004. Introduction to Food Engineering, 3rd Edition, Academic Press, London.

Course Outcome:

At the end of this course students will be able to

CO1:	Knowledge about unit operations of cereals, pulses and oil seeds.
CO2:	Knowledge about drying theory and drying principle
CO3:	Knowledge about milling of rice
CO4:	Knowledge about milling of pulses
CO5:	Knowledge about cylone separator

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1,L4	H	L	H	H	M	L	L	M	L	M	-	-	M	M
CO2	L2	M	H	H	M	L	L	M	L	L	H	L	L	L	-
CO3	L2,L3	H	H	H	H	H	M	L	M	H	M	M	M	L	-
CO4	L1,L6	M	M	H	M	H	M	L	M	L	L	L	M	L	-
CO5	L5	H	H	M	M	-	-	L	L	M	M	L	H	H	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO1, CO2
CD5	Industrial visit	CO3, CO4

BTAGPCC 505: WATER SHED PLANNING AND MANAGEMENT

Course Objective:

To acquaint the students about the preparation of the detail report of the problems and causes related to the water, land, vegetation and social aspects of specific area and their remedies through watershed planning and management.

Course Contents:

Unit-I **Watershed:** Introduction and characteristics. Watershed development –problems and prospects, investigation, topo graphical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors.

Unit-II **Watershed management:** Concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for water shed planning, watershed codification, delineation and prioritization of watersheds– sediment yield index.

Unit-III Water budgeting in a watershed. Management measures – rain water conservation technologies - in-situ and ex-situ storage, water harvesting and recycling. Dry farming techniques - inter-terrace and inter-bund land management. Integrated water shed management- concept, components.

Unit-IV Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation. Participatory watershed management- role of watershed associations, user groups and self-help groups. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis.

Practical

1. Exercises on delineation of watersheds using topo sheets.
2. Exercises on PRA.
3. Surve ingand preparation of watershed map.
4. Quantitative analysis of water shed characteristics and parameters.
5. Watershed investigations for planning and development.
6. Analysis of hydrologic data for planning watershed management.
7. Water budgeting of watersheds.
8. Prioritization of water sheds based on sediment yield index.
9. Study of functional requirement of water shed development structures.
10. Study of watershed management technologies.
11. Practice on softwares for analysis of hydrologic parameters of watershed.
12. Study of role of various functionaries in watershed development programmes.
13. Techno-economic viability analysis of watershed projects.
14. Visit to watershed development project areas.

Suggested Readings

1. Ghanshyamv Das. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd Edition, Prentice-Hall of India Learning Pvt. Ltd., New Delhi.
2. Katyal, J.C., R.P. Singh, Shriniwas Sharma, S.K. Das, M.V.Padmanabhan and P.K. Mishra. 1995. Field Manual on Watershed Management. CRIDA, Hyderabad.
3. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service. New Delhi.
4. Sharda, V.N., A.K. Sikkaand G.P. Juyal. 2006. Participatory Integrated Watershed Management: A Field Manual. Central Soil and Water Conservation Research and Training Institute, Dehradun.
5. Singh, G.D. and T.C. Poonia. 2003. Fundamentals of Watershed Management Technology. Yash Publishing House, Bikaner.
6. Singh, P.K. 2000. Watershed Management: Design and Practices. E-media Publications, Udaipur.
7. Singh, R.V. 2000. Watershed Planning and Management. Yash Publishing House, Bikaner.
8. Tideman, E.M. 1999. Watershed Management: Guidelines for Indian Conditions. Omega Scientific Publishers, NewDelhi.

Course outcome:

At the end of the course, a student will be able to understand –

CO-1	Knowledge about watershed
CO-2	Able to know about management of watershed
CO-3	Knowledge about water budgeting in a watershed
CO-4	Knowledge about various watershed programmes
CO-5	Knowledge about various functionaries in watershed development programmes

Course Delivery Methods (CD)

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2,L6,L5	H	L	-	M	L	H	-	-	L	L	L	H	H	H
CO2	L3,l2	H	-	L	M	-	H	L	L	-	M	-	H	M	-
CO3	L1,l6	H	-	L	M	L	H	L	L	-	L	M	H	-	M
CO4	L3	H	M	L	M	L	H	M	M	-	L	L	M	M	M
CO5	L5	H	H	M	M	-	-	M	L	L	-	-	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO3, CO5
CD5	Industrial visit	CO4, CO5

BTAGPCC 506: GROUND WATER, WELLS AND PUMPS

Course Objective:

To enable the students to know about the ground water potential, its dynamic behavior and exploration manual and mechanically.

Course Contents:

Unit-I Occurrence and movement of groundwater; aquifer and its types; classification of wells, fully penetrating tube wells and open wells, familiarization of various types of borewells; design of open wells;

Unit-II Groundwater exploration techniques; methods of drilling of wells: percussion, rotary, reverse rotary; design of tubewell and gravel pack, installation of well screen, completion and development of well; groundwater hydraulics-determination of aquifer parameters by different method such asTheis, Jacob and Chow‟s, Theis recovery method.

Unit-III Well interference, multiple well systems, estimation of ground water potential, quality of ground water; artificial groundwater recharge techniques; pumping systems: water lifting devices; different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting.

Unit-IV Well performance curves, effect of speed on capacity, head and power, effect of change of impeller dimensions on performance characteristics; hydraulicram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.

Practical

1. Verification of Darcy's Law;
2. Study of different drilling equipments;
3. Sieve analysis for gravel and well screens design;
4. Estimation of specific yield and specificretention;
5. Testing of well screen;
6. Estimation of aquifer parameters by Theis method,
7. Estimation of aquifer parameters by Coopers-Jacob method,
8. Estimation of aquifer parameters by Chow method;
9. Estimation of aquifer parameters by Theis Recovery method;
10. Well design under confined and unconfined conditions; well losses and well efficiency;
11. Estimating ground water balance;
12. Study of artificial ground water recharge structures;
13. Study of radial flow and mixed flow centrifugal pumps, multi stage centrifugal pumps, turbine, propeller and other pumps;
14. Installation of centrifugal pump; testing of centrifugal pump and study of cavitations;
15. Study of hydraulicram; study and testing of submersible pump.

Suggested Readings

1. Michael AM, Khepar SD. And SK Sondhi. 2008. Water Well and Pumps, 2nd Edition, Tata Mc-Graw Hill.
2. Todd David Keith and Larry W.Mays. 2004. Ground water Hydrology, 3rd Edition, John Wiley & Sons, New York (International Book Distributing Company Lucknow).
3. Michael A.M. And Ojha TP. 2014. Principles of Agricultural Engineering Vol-II, 5th Edition. Jain Brothers Publication, New Delhi.

Course outcome:

CO1	Familiarization of various types of borewells; design of open wells
CO2	Knowledge about determination of aquifer parameters by different method
CO3	Knowledge about different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting
CO4	Evaluate the effect of change of impeller dimensions on performance characteristics
CO5	Knowledge about Estimating ground water balance

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1,L2	H	M	H	L	H	-	L	H	-	H	M	H	-	L
CO2	L6,L2	H	M	M	-	M	L	L	M	H	M	L	M	-	M
CO3	L6	M	H	H	-	H	-	M	L	H	M	M	-	-	-
CO4	L5	H	M	-	-	H	H	-	-	H	H	-	H	L	M
CO5	L6	H	H	M	-	-	H	H	-	M	-	H	H	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO4, CO5

BTAGPCC 507: RENEWABLE POWER SOURCES

Course Objective:

The course enables the student to outline the power generation potential from various renewable energy sources and performance evaluation of these devices.

Course Contents:

Unit-I Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization. Fundamentals of hydrogen and fuelcell technology.

Unit-II Biogas technology and mechanisms, generation of power from biogas, Power generation from urban, municipal and industrial waste. Use of different commercial sized biogas plant.

Unit-III Solar thermal and photovoltaic Systems for power generation. Central receiver (Chimney) and distributed type solar power plant, fundamentals of ocean thermal energy conversion technology, and fundamentals of magneto hydrodynamic.

Unit-IV Wind farms. Aero-generators. Wind power generation system. Power generation from biomass (gasification & Dendro thermal), Mini and micro small hydel plants.

Practical

1. Performance evaluation of solar water heater.
2. Performance evaluation of solar cooker.
3. Characteristics of solar photo voltaic panel.
4. Performance evaluation of solar air heater / dryer.
5. Performance evaluation of biomass gasifier engine system (throatless & downdraft)
6. Performance evaluation of a fixed dome type biogas plant.
7. Performance evaluationof floating drum type biogas plant.
8. Estimation of calorific value of biogas & producer gas.
9. Testing of diesel engine operation using dual fuel and gas alone.

Suggested Readings

1. Garg H.P. 1990. Advances in Solar Energy Technology; D. Publishing Company, Tokyo.
2. AlanL: Farred Bruch & R.H. Buse. 1983. Fundamentals of Solar Academic Press, London.
3. Bansal N.K., KleemannM. & Meliss Michael. 1990. Renewable Energy Sources & Conversion Technology; Tata Mec grow Publishing Company, New Delhi.
4. Rathore N.S., Kurchania A.K. & N.L. Panwar. 2007. Non Conventional Energy Sources, Himanshu Publications.
5. Mathur, A.N. & N.S. Rathore. 1992. Biogas Production Management & Utilization. HimanshuPublications, Udaipur.
6. Khandelwal, K.C. & S.S.Mahdi.1990. Biogas Technology.
7. Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
8. Mathur A.N. & N.S. Rathore. Renewable Energy Sources Bohra Ganesh Publications, Udaipur.

Course Outcome:

At the end of this course students will be able to

CO1	Knowledge about fundamentals of hydrogen and fuelcell technology
CO2	Use of different commercial sized biogas plant
CO3	Fundamentals of ocean thermal energy conversion technology, and fundamentals of magneto hydrodynamic.
CO4	Knowledge about Power generation from biomass (gasification & Dendro thermal), Mini and micro small hydel plants.
CO5	Knowledge aboit Testing of diesel engine operation using dual fuel and gas alone.

Course Delivery Method

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course outcome	Level of Taxonomy	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2,L4	H	H	M	M	H	-	M	-	-	H	-	-	L	-
CO2	L3	H	H		H	H	-	L	M	H	H	M	L	M	-
CO3	L6,L4	H	H	H	M	H	-	-	M	H	H	H	-	L	L
CO4	L3	H	H	H	M	H	M	-	L	H	H	-	M	M	M
CO5	L5	H	H	M	M	M	H	H	-	-	M	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,
CD2	Tutorials/Assignments	CO1, CO2, CO3,
CD3	Seminars	CO2, CO3,
CD4	Self- learning advice using internets	CO1, CO5
CD5	Industrial visit / Field visit	CO4, CO5

BTAGPCC 508: ENGINEERING PROPERTIES OF AGRICULTURAL PRODUCE

Course Objective:

the student will learn about different techniques of measurement of engineering properties and their importance in design of processing equipments.

Course Contents:

Unit-I Classification and importance of engineering properties of agricultural produce, physical properties such as shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surface area of grains, fruits and vegetables.

Unit-II Thermal properties such as heat capacity, specific heat, thermal conductivity, thermal diffusivity, co-efficient of thermal expansion.

Unit-III Friction in agricultural materials; staticfriction, kinetic friction, rolling resistance, angle of internal friction, angle of repose, Flow of bulk granular materials, Aerodynamics of agricultural products, drag coefficients, terminal velocity.

Unit-IV Rheological properties; force, deformation, stress, strain, elastic, plastic and viscous behavior, Newtonian and Non-Newtonian liquid, Visco-elasticity, Newtonian and Non-Newtonian fluid, Pseudo-plastic, Dilatant, Thixotropic fluids.

Practical

1. Determination of the shape and size of grains, fruits and vegetables.
2. Determination of bulk density and angle of repose of grains.
3. Determination of the particle density / true density and porosity of grains.
4. Finding the co-efficient of external and internal friction of different grains.
5. Determination of specific heat of some food grains.
6. Determination of hardness of food material.
7. Determination of viscosity of liquid foods.

Suggested Readings

1. Mohesin, N.N. 1980. Physical Properties of Plants & Animals, Gordon & Breach Science Publishers, New York.
2. Prentice, J.H. 1984. Measurement in Rheological Properties of Food Stuffs, Elsevier Applied Science Pub, Co. Inc.New York.
3. Rao, M.A. and Rizvi, S.H. 1995. Engineering Properties of Foods. Marcel Dekker Inc. New York.
4. Singhal O.P. and Samuel D.V. K. 2003. Engineering Properties of Biological Materials, Saroj Prakashan, New Delhi
5. Sahay, K.M. and Singh, K.K. 1994. Unit Operations of Agricultural Processing, Vikas, Publishing house Pvt. Ltd., New Delhi.

Course Outcome:

At the end of this course students will be able to

CO1:	Classification and importance of engineering properties of agricultural produce
CO 2:	Knowledge about differentthermal properties
CO 3:	Knowledge about friction in agricultural materials
CO 4:	Knowledge about differentRheological properties
CO5:	Knowledge about of viscosity of liquid foods

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2, L3	H	L	-	-	H	-	M	L	H	H	-	-	H	-
CO2	L1, L2	H	M	L	-	M	-	L	-	M	H	-	-	M	-
CO3	L2	M	H	-	-	H	-	H	M	H	H	-	L	M	L
CO4	L2, L3	H	H	H	M	H	H	H	-	H	H	L	H	L	H
CO5	L4	H	H	M	-	-	M	L	M	L	-	M	H	H	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO2, CO3, CO5
CD4	Self- learning advice using internets	CO1, CO3, CO4
CD5	Industrial visit / Field visit	CO1, CO3, CO4

SEMESTER - VI

S.No.	Cate-gory	CourseNo.	CourseTitle	Marks			Credit		
				Ext	Int	P	Th.	P	Total
1	PCC	BTAGPCC 601	Farm Machinery andEquipment–II	50	30	20	2	1	3
2	PCC	BTAGPCC 602	Food Packaging Technology	50	30	20	2	1	3
3	PCC	BTAGPCC 603	Water Harvesting and Soil Conservation Structures	50	30	20	2	1	3
4	PCC	BTAGPCC 604	Drainage Engineering	50	30	20	1	1	2
5	PCC	BTAGPCC 605	Tractor and Farm Machinery Operation and Maintenance	-	30	70	0	2	2
6	PCC	BTAGPCC 606	Dairy and Food Engineering	50	30	20	2	1	3
7	PCC	BTAGPCC 607	Bio-energy Systems: Design and Applications	50	30	20	2	1	3
8	PCC	BTAGPCC 608	Design of structures	50	30	20	2	0	2
9		BTAGSODECA609	Social Outreach, Discipline & Extra Curricular Activities	-		50	1	0	1
10	AECC	BTAGAECC 610	ANANDAM	50		50	2	0	2
		NC	NSS/NCC/NSO/Yoga/Scout[1]			-	-	-	-
			Total	**400**	240	310	**16**	**8**	**24**
				950					

Note:

Students have to go for Skill Development Training II in summer break June-July after VI Semester (Student READY) and will be assessed in VII sem in Skill Development Training- II (Student READY) (BTAGPSI 701)

BTAGPCC 601: FARM MACHINERY AND EQUIPMENT– II

Course Objective:

To identify the need of timely harvesting of crops in India. Also equip the students with technical knowledge and skills required for the operation, maintenance and evaluation of harvesting, threshing and land preparation (heavy) machinery needed for agricultural farms. To abreast the students with mathematical, experimental and computational skills for solving different field problems. To develop skills in the students required to develop and modification of indigenous harvesting machines/ methods as per the need of the area and farmers Also to give a brief introductory idea of importance of testing of agricultural machines and tractors.

Course Contents:

Unit-I Principles and types of cutting mechanisms. Harvesting equipment, Mowers– types of mowers (reciprocating and rotary); cutter bar, mowers parts, construction operation and adjustments. Accelerating forces on reciprocating parts and numerical problems. Attachments to the cutter bar, trouble shooting, cutting pattern of reciprocating knife. VCR and its constructional. Simple numerical problems on mowers.

Unit-II Forage Chopping and Handling: Types of field forage harvesters and choppers, part and construction, details of forage choppers, Attachments, maintenance, trouble shooting. Numerical problems on forage choppers.Introduction of Grain harvesting.

Unit-III Types and different functional units of combine.Operation, adjustment and different losses. Numerical problems on losses. Introduction to straw combine. Principles of threshing and various types of threshers. Maize harvesting and shelling equipment, Introduction to plot combines and plot threshers.

Unit-IV Root crop harvesting equipment – potato. Horticultural tools: hand tools and post hole digger. Testing procedure for thresher and combine by using BIS Test codes. Introduction to Laser land leveller.

Practicals

1. Familiarization with various farm machines related to harvesting, threshing and combine.
2. Study of cutter bar: constructional details, adjustments and working.
3. Study of verticalconveyor reaper: constructional details, adjustments and working.
4. Studyof potato harvester: constructional details, adjustments and working.
5. Study of forage harvester: constructional details, adjustments and working.
6. Study of maize sheller: constructional details, materials and working.
7. Study of various types of threshers: constructional details, adjustments and working.
8. Study of combine harvester: constructional details, working and trouble shooting.
9. Study of straw combines.
10. Study of laser land leveller.
11. Study of post hole digger.

Text Books \References

1. Bainer, R.Barger, E.L. and R.A. Kepner. (1997). Principle of Farm Machinery. John Wiley & Sons, Inc, New York.
2. A.C. Shrivastava. Et al. Principle of Farm Machinery, ASAE publications.
3. H.P.Smith. (1977). Farm Power and Equipment, Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi
4. FAO, Bulletin. (1977). Elements of Agricultural Machinery, volume II.
5. O.P. Singhal. Elements of Agricultural Engineering, PartI and II. Saroj Prakashan, Allahbad.
6. Singh, S. Principles of Farm Machinery. DIPA, ICAR, KAB-I , New Delhi.
7. Singh, S. and Verma, S.R. Farm Machinery Maintenance and Management. DIPA, ICAR, KAB-I, New Delhi.

Course Outcomes:

At the end of this course students will be able to

CO1:	Principles and types of cutting mechanisms
CO2:	Knowledge about Forage Chopping and Handling
CO3:	Knowledge about types and different functional units of combine
CO4:	Knowledge about Root crop harvesting equipment
CO5:	Knowledge about straw combines.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2, L4, L3	M	L	-	M	L	L	M	L	M	L	L	L	M	L
CO2	L1, L3, L6	M	M	L	L	L	M	L	L	M	H	L	L	M	M
CO3	L3, L6	H	L	M	M	M	L	L	L	M	L	M	M	L	L
CO4	L4, L5	H	-	L	L	H	L	-	L	L	M	M	L	-	M
CO5	L5	H	H	-	-	M	M	L	-	L	M	M	-	-	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4, CO5

BTAGPCC 602: FOOD PACKAGING TECHNOLOGY

Course Objective:

to acquaint with various food packaging materials, various aspects of packaging methods and technology.

Course Contents:

Unit-I Factors affecting shelf life of food material during storage, Packaging of foods, requirement, importance and scope, frame work of packaging strategy, environmental considerations, Packaging systems, types: flexible and rigid; retail and bulk; levels of packaging.

Unit-II Different types of packaging materials, their key properties and applications, metal cans, plastic packaging, different types of polymers used in food packaging and their barrier properties. Manufacture of plastic packaging materials; glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, modification of barrier properties and characteristics of paper / boards.

Unit-III Nutritional labeling on packages, CAP and MAP, shrink and cling packaging, vacuum and gas packaging; active packaging, factors affecting the choice of packaging materials, disposal and recycle of packaging waste, printing and labeling; lamination.

Unit-IV Package testing, testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper, glass containers, metal containers.

Practical

1. Identification of different types of packaging materials.
2. Determination of tensile / compressive strength of givenmaterial / package.
3. Vacuum packaging of agricultural produces.
4. Determination of tearing strength of paper board.
5. Measurement of thickness of packaging materials.
6. Toper form grease – resistance test in plastic pouches.
7. Determination of bursting strength of packaging material.
8. Determination of water-vapour transmission rate.
9. Shrink wrapping of various horticultural produce.
10. Testing of chemical resistance of packaging materials.
11. Determination of drop test of food package and visit to relevant industries.

Suggested Readings

1. Coles R., Mc Dowell D. and Kirwan, M.J. 2003. Food Packaging Technology, Black well publishing Co.
2. Gos by, N.T. 2001. Food Packaging Materials, Applied Science Publication
3. John, P.J. 2008. A Hand book on Food Packaging, Narendra Publishing House,
4. Mahadevia, M., Gowramma, R.V. 2007. Food Packaging Materials, Tata Mc Graw Hill
5. Robertson, G.L. 2001. Food Packaging and Shelf life: A Practical Guide, Narendra Publishing House.
6. Robertson, G.L. 2005. Food Packaging: Principles and Practice, Second Edition, Taylor and Francis Pub.

Course Outcomes

At the end of the course, a student will be able to–

CO1:	Know about factors affecting shelf life of food material during storage
CO2:	Know about different types of packaging materials
CO3:	Understand the nutritional labeling on packages
CO4:	Know about package testing and testing methods
CO5:	Know about Testing of chemical resistance of packaging materials.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	LI,L4	H	M	-	-	L	L	M	L	M	M	-	-	L	-
CO2	L3	H	M	L	-	L	-	L	M	-	M	M	M	-	M
CO3	L2,L4	M	L	L	-	-	H	M	-	L	M	M	L	-	-
CO4	L3,L2	H	L	M	L	M	M	M	M	L	M	L	M	-	-
CO5	L4	H	M	L	L	M	-	-	H	H	M	-	-	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4, CO5

BTAGPCC 603: WATER HARVESTING AND SOIL CONSERVATION STRUCTURES

Course Objectives:

To have understanding about the water scarcity and their solution to fight against the evil effects through soil and water conservation technologies.

Course Contents:

Unit-I **Water harvesting:** Principles, importance and issues. Water harvesting techniques - classification based on source, storage and use. Run off harvesting–short-term and long-term techniques. Short-term harvesting techniques-terracing and bunding.

Unit-II **Long-term harvesting techniques:** Purpose and design criteria. Structures-farm ponds-dug-out and embankment reservoir types, tanks and subsurface dykes. Farm pond - components, site selection, design criteria, capacity, embankment, mechanical and emergency spillways, cost estimation and construction. Percolation pond-site selection, design and construction details.Design considerations of nala bunds.

Unit-III **Soil erosion control structures:** Introduction, classification and functional requirements. Permanent structures for soil conservation and gully control - check dams, drop, chute and drop inlet spillways – design requirements, planning for design, design procedures-hydrologic, hydraulic and structural design and stability analysis. Hydraulic jump and its application.

Unit-IV **Drop spill way:** Applicability, types-straight drop, box-type inlet spillways - description, functional use, advantages and disadvantages, straight apron and stilling basin outlet, structural components and functions. Loads on head wall, variables affecting equivalent fluid pressure, triangular load diagram for various flow conditions, creep line theory, up lift pressure estimation, safety against sliding, overturning, crushing and tension.

Practical

1. Study of different types of farmponds.
2. Computation of storage capacity of embankment type of farm ponds.
3. Design of dug out farm ponds.
4. Design of percolation pond and nala bunds.
5. Run-off measurement using H-flume.
6. Exercise on hydraulic jump.
7. Exercise on energy dissipation in water flow.
8. Hydrologic, hydraulic and structural design of drop spill way and stability analysis.
9. Hydrologic, hydraulic and structural designof drop inlet spillway.
10. Exercise on Strength testing of structures.
11. Design of smallear then embankment structures.
12. Practice on softwares for design of soil and water conservation structures.
13. Field visit to watershed project area streated with soil and water conservation measures / structures.

Suggested Readings

1. Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
3. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
4. Schwab, G.O., D.D. Fangmeier, W.J. Elliot, R.K. Frevert. 1993. Soil and Water Conservation Engineering. 4th Edition, John Wiley and Sons Inc. New York.
5. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.
6. Samra, J.S., V.N. Sharda and A.K. Sikka. 2002. Water Harvesting and Recycling: Indian Experiences. CSWCR & TI, Dehradun, Allied Printers, Dehradun.
7. Theib Y. Oweis, Dieter Prinz and Ahmed Y.Hachum. 2012. Rain water harvesting for Agriculture in the Dry Areas. CRC Press, Taylor and Francis Group, London.
8. Studer Rima Mekdaschi and Hanspeter Liniger.2013. Water Harvesting - Guidelines to Good Practice. Centre for Development and Environment, University of Bern, Switzerland.

Course Outcomes:

At the end of this course Students will be able to

CO1:	Knowledge about water harvesting: Principles, importance and issues, Water harvesting techniques
CO2:	Procedural knowledge about Long-term harvesting techniques, Purpose and design criteria
CO3:	Know about different Soil erosion control structures
CO4:	Understand the working nature of drop spillway structure
C05:	Design of smallear then embankment structures

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

CO	Blooms level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	H	M	H	-	M	-	L	M	-	H	-	L	M	L
CO2	L1	M	H	M	-	H	-	M	H	-	M	-	M	-	M
CO3	L2	M	H	H	L	M	H	H	M	-	H	-	H	L	M
CO4	L2	M	H	M	-	M	M	M	L	-	H	-	H	-	-
CO5	L3	M	M	H	-	-	M	M	L	H	-	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial Visit / Field Visit	CO4, CO5

BTAGPCC 604: DRAINAGE ENGINEERING

Course Objective:

To train the students about the reclamation of the agricultural lands suffering from excessive water application and problematic soils

Course Contents:

Unit-I Water logging: Causes and impacts; drainage, objectives of drainage, familiarization with the drainage problems of the state; surface drainage coefficient, types of surface drainage, design of surface drains.

Unit-II Sub-surface drainage: Purpose and benefits, investigations of design parameters-hydraulic conductivity, drainable porosity, water table;

Unit-III Derivation of Hooghoudt's and Ernst's drain spacing equations: Design of sub-surface drainage system; drainage materials, drainagepipes, drainenvelope; layout, construction and installation of drains; drainage structures.

Unit-IV Vertical drainage;bio-drainage;mole drains;salt balance, reclamationof saline and alkaline soils, leaching requirements, conjunctive use of fresh and saline water.

Practical

1. In-situ measurement of hydraulic conductivity by single auger hole.
2. In-situ measurement of hydraulic conductivity by inverse auger hole method.
3. Estimation of drainage co-efficients.
4. Installation of piezo meter and observation wells.
5. Preparation of iso-bath and iso bar maps.
6. Determination of drainable porosity.
7. Design of surface drainage systems.
8. Design of gravel envelops.
9. Design of sub-surface drainage systems.
10. Determination of chemical properties of soil and water.
11. Study of drainage tiles and pipes.
12. Installation of sub-surface drainage system.
13. Cost analysis of surface drainage system.
14. Cost analysis of sub-surface drainage system.
15. Fieldvisit to water logged area.

Suggested Readings

1. Bhattacharya AK and Michael AM. 2013. Land Drainage, Principles, Methods and Applications. Vikas Publication House, Noida (UP).
2. Ritzema H.P.1994 Drainage Principles and Applications, ILRI Publication16, Second Edition (Completely Revised).
3. Michael A.M. And OjhaTP. 2014. Principles of Agricultural Engineering Vol-II 5th Edition. Jain Brothers Publication, New Delhi.
4. Kadam U.S., Thokal R.T., Gorantiwar S.D. and Powar A.G. 2007. Agricultural Drainage-Principles and Practices, West ville Publishing House.
5. FAO Irrigation and Drainage Paper No. 6, 9, 15, 16, 28 and 38. Rome, Italy

Course outcome:

At the end of course, students will be able to

CO1:	Identify Water logging: Causes and impacts
CO2:	Knowledge about sub-surface drainage, Purpose and benefits
CO3:	Concept of Hooghoudt's and Ernst's drain spacing equations
CO4:	Knowledge about Vertical drainage;bio-drainage;mole drains
CO5:	Knowledge about Determination of chemical properties of soil and water

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	H	-	-	H	H	-	H	-	H	M	M	-	M	M
CO2	L2	H	L	-	H	M	-	M	H	-	H	-	H	-	H
CO3	L1, L2	M	H	M	-	-	M	M	H	M	M	-	M	L	M
CO4	L4, L6	H	H	-	H	M	-	H	-	M	H	-	H	M	H
CO5	L5	H	H	M	-	-	M	M	-	-	H	H	L	-	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping of CO with CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4
CD2	Tutorials/Assignments	CO1, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO4, CO5

BTAGPCC 605: TRACTORS AND FARM MACHINERYOPERATIONANDMAINTENANCE

Course Objective:

First hand experience in field operation and adjustments of various agricultural implements and equipments Exposure to small scale farm machinery manufacturing unit.

Practical

1. Familiarization with different makes and models of agricultural tractors. Identification of functional systems including fuels system, cooling system, transmission system, steering and hydraulic systems.
2. Study of maintenance points to be checked before starting a tractor. Familiarization with controls on a tractor. Safety rules and precautions to be observed while driving a tractor.
3. Driving practice of tractor. Hitching & De-hitching of mounted and trailtype implement to the tractor.
4. Practice of operating a tillage tool (mould- board plough / disc-plough) and their adjustment in the field. Study offield patterns while operating a tillage implement.
5. Introduction to tractor maintenance – precautionary and break-down maintenance.
6. Introduction to trouble shooting in tractors. Familiarization with tools for general and special maintenance. Introduction to scheduled maintenance after 10, 100, 300, 600, 900 and1200 hours of operation.
7. Safety hints. Top end overhauling. Fuel saving tips. Preparing the tractor for storage.
8. Care and maintenance procedure of agricultural machinery during operation and off-season.
9. Replacement of furrow openers and change of blades of rotavators.
10. Maintenance of cutter barin area per.
11. Adjustments in a thresher for different crops. Replacement of V-belts on implements.
12. Setting of agricultural machinery work shop.

Suggested Readings

1. Ghosh RK and S Swan. Practical Agricultural EngineeringVol-I&II, Naya Prakash, 1993.
2. Jain SC and CR Rai. Farm TractorMaintenance and Repair", Standard Publishers and Dist., Delhi, 2010.
3. Operator's manuals of tractors and service manuals provided by manufacturers.

Course Outcomes:

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

CO1:	Familiarization with different makes and models of agricultural tractors
CO2:	Practice of operating a tillage tool (mould- board plough / disc-plough) and their adjustment in the field
CO3:	Driving practice of tractor. Hitching & De-hitching of mounted and trailtype implement to the tractor.
CO4:	Setting of agricultural machinery work shop
CO5:	Adjustments in a thresher for different crops

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	H	H	M	L	M	L	M	L	H	M	H	H	H	H
CO2	L1	M	M	L	-	L	L	M	L	H	M	-	L	M	H
CO3	L1,L2	H	H	M	-	L	M	M	L	H	-	-	M	M	H
CO4	L2,L3	M	M	L	H	-	-	H	-	H	M	H	-	H	M
CO5	L4	H	H	M	-	-	L	L	M	M	H	H	M	-	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lectures by use of board/LCD	CO1,CO2,CO3,CO4
CD2	Tutorial/Assignments	CO2,CO3,CO4
CD3	Seminar	CO2,CO3,CO4
CD4	Self learning	CO1,CO2,CO4, CO5
CD5	Field Visit	CO3, CO5

BTAGPCC 606: DAIRY AND FOOD ENGINEERING

Course Objective:

To acquainted with various dairy engineering operations such as homogenization, pasteurization, thermal processing, evaporations, freezing and drying of milk.

Course Contents:

Unit-I Deterioration in food products and their controls, physical, chemical andbiological methods of food preservation. Dairy development in India, engineering and chemical properties of milk and milk products.

Unit-II Principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation. Filling and packaging of milk and milk products. Preparation methods and equipment for manufacture of butter.

Unit-III Principles of operation and equipment for thermal processing, canning, aseptic processing. Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation, vapoure compression.

Unit-IV Drying of liquid and perishable foods: Principles of drying, spray drying, drum drying, freeze drying, Filtration: principle, types of filters; Membrane separation, water activity and MSI.

Practical

1. Study of pasteurizers.
2. Study of sterilizers.
3. Study of homogenizers.
4. Study of separators.
5. Study of butter churns.
6. Study of evaporators.
7. Study of milk dryers.
8. Study of freezers.
9. Study of filtration.
10. Visit to multi-product dairy plant, Estimation of steam requirements.
11. Visit to Food industry.

Suggested Readings

1. Ahmed, T. 1997. Dairy Plant Engineering and Management, 4th Ed. Kitab Mahal.
2. Mc Cabe, W.L. and Smith, J.C.1999. Unit Operations of Chemical Engineering, Mc Graw Hill.
3. Rao, D.G. Fundamentals of Food Engineering, PHI learning Pvt. Ltd., New Delhi.
4. Singh, R.P. and Heldman, D.R. 1993. Introduction to Food Engineering, Academic Press.
5. Toledo, R.T. 1997. Fundamentals of Food Process Engineering, CBS Publisher.

Course Outcome

At the end of this course students will be able to

CO1:	Idetify deterioration in food products and their controls
CO2:	Acquire the knowledge about principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation
CO3:	Principles of operation and equipment for thermal processing
CO4:	Knowledge about drying of liquid and perishable foods
CO5:	Knowledge about Membrane separation, water activity and MSI.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L1	H	H	-	-	-	-	H		M	H	-	-	H	M
CO2	L1	H	H	M	-		-	H	-	-	H	-	-	H	H
CO3	L4	H	H	M	-	-	-	H	-	L	H	M	M	M	H
CO4	L1,L2	H	H	H	-	H	H	-	L	H	H	M	L	H	-
CO5	L3	H	H	-	-	M	M	M	M	M	-	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lectures by use of board/LCD/	CO1,CO2,CO3,CO4
CD2	Tutorial/Assignments	CO1, CO2,CO3,CO4
CD3	Seminar	CO2,CO3,CO4, CO5
CD4	Self learning	CO1,CO2,CO4, CO5
CD5	Field Visit	CO4, CO5

BTAGPCC 607: BIO-ENERGY SYSTEMS: DESIGN AND APPLICATIONS

Course Objective:

The main objective of this course is to provide fundamentals of utilization of crop residues and agro industrial waste for energy production through different conversion routes and to understanding the bio fuels system, renewable feed stock and their productions that following the completion of this course, students will have the expertise to solve agro industrial, social, and environmental problems with appropriate techniques and tools.

Course Contents:

Unit-I Fermentation processes and its general requirements. An overview of aerobic and anaerobic fermentation processes and their industrial application. Heat transfer processes in anaerobic digestion systems, land fill gas technology and potential.

Unit-II Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. Harvesting of biomass and coppicing characteristics. Biomass preparation techniques for harnessing (size reduction, densification and drying).

Unit-III Thermo-chemical degradation. History of small gas producer engine system. Chemistry of gasification. Gas producer – type, operating principle. Gasifier fuels, properties, preparation, conditioning of producer gas. Application for shaft power generation, thermal application and economics.

Unit-IV Trans-esterification for bio diesel production. A range of bio-hydrogen production routes. Environmental aspect of bio-energy, assessment of green house gas mitigation potential.

Practical

1. Study of anaerobic fermentation system for industrial application.
2. Study of gasification for industrial process heat.
3. Study of bio diesel production unit.
4. Study of producer gas burner.
5. Study of biomass densification technique (briquetting, pelletization, and cubing).
6. Integral bio energy system for industrial application.

Suggested Readings

1. British Bio Gen. 1997, Anaerobic digestion of farm and food processing practices- Good practice guidelines, London, available on www. British bio gen.co. UK.
2. Butler, S. 2005. Renewable Energy Academy: Training wood energy professionals.
3. Centre for bio mass energy. 1998. Straw for energy production; Technology- Environment-Ecology. Available: www.ens.dk.

Course outcome-

At the end of course, students will be able to

CO1:	Know the Fermentation processes and its general requirements
CO2:	Knowledge about Biomass Production
CO3:	Concept of Chemistry of gasification. Gas producer – type, operating principle.
CO4:	Knowledge about trans-esterification for bio diesel production
CO5:	Knowledge about assessment of green house gas mitigation potential.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/Cos	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	H	H	M	M	M	H	H	H	M	H	-	-	M	L
CO2	L1,L5	H	H	M	M	H	H	M	L	L	L	M	M	L	M
CO3	L2,L6	M	M	H	H	L	H	M	L	L	M	L	M	M	M
CO4	L1	H	M	H	M	M	L	H	L	L	L	L	L	H	-
CO5	L4	H	H	M	M	-	-	L	L	L	M	M	-	-	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO2,CO3, CO5

BTAGPCC 608: DESIGN OF STRUCTURES

Course Objective:

CO1: Analyze Singly and doubly rein forced beams,T-beams

CO2: Understand shear behavior and analyze one way &two-way slabs

CO3: Design and analyze of RC Column

CO4: Analyze tension and compression member

Course Contents:

(A) REIN FORCED CEMENT CONCRETE STRUCTURES

Unit-I **Introduction:** Grade of Concrete and Characteristics strength, permissible stress in concrete and steel rein forcement.

Singly Reinforced Beams: Fundamental assumptions, Equivalent area of sections, Neutral axis and Moment of resistance. Balanced, Under-rein forced and Over-rein forced sections. Types of problems in singly rein forced beams.

Doubly Reinforced Beam: Neutral axis, Moment of resistance. Type of problems.

T-Beams: Dimensions, Neutral axis. Lever arm, Moment of resistance with or with out web compression.Type of problems in T-Beams.

Unit-II **Shear:** Shear stress in R.C.beams, Effect of shear, Rein forcement design for shear. Bond, anchorage, development length. Slabs spanning in one direction. Two way slabs: Supported on four edges with corners not held down and carrying U.D.L.

Unit-III **Axially loaded columns:** Long and short columns. Types of columns.

Load carrying capacity, I. S. recommendations, Deign of columns with lateral and spiral rein forcement.

(B) STEEL STRUCTURES

Unit-IV **Introduction:** Types of steels as a structural material, various grades of structural steel, properties and their permissible stresses. Various rolled steel sections and their properties.

Design of tension and compression member.

Note: The use of IS 456:2000, SP16, IS800:2007 shall be allowed in the examination.

TextBooks / References

1. B.C. Punmia. (1992). Reinforced Concrete Structure, Vol.I, Standard Publishers & Distributors, Delhi.
2. Jainand Jaikrishna. (1992). Plane and Reinforced Cement Concrete, Nemi Chand Bros., Roorkee.
3. M.M.Malhotra. (1992). Design of Steel Structure, Jain Brothers, New Delhi.
4. Ram Chandra. (1992). Design of Steel Structures, standard Publishers & Distributors, New Delhi.

SEMESTER - VII

S. No.	Category	Course No.	StudentREADY (Rural and Entrepreneurship Awareness Development Yojana)								
			Course Title	Marks			Hours/ Week			Credit		
				Ext	Int	P	L	T	P	Th.	P	Total
1	PSI	BTAGPSI 701	Skill Development Training- II (Student READY)		50	50				0	5	5
2	PCC	BTAGPCC 702	08 Weeks Experiential Learning On Campus***** (Student READY)		50	50				0	10	10
3	PSI	BTAGPSI 703	08 Weeks Industrial Attachment/Internship****** (Student READY)		50	50				0	10	10
4	PCC	BTAGPCC 704	Educational Tour (Registration only)		50	50				0	2	2
5		BTAGSODECA705	Social Outreach, Discipline & Extra Curricular Activities	-		50	0	0	0	1	0	1
6	AECC	BTAGAECC 706	Leadership and Management Skills	30		70	2	0	0	2	0	2
7	AECC	BTAGAECC 710	ANANDAM	50		50	1	0	1	2	0	2
			Total	80	200	370	3		1	**5**	**27**	**32**
			Educational Tour duringWinter/Januarybreak									

*****The experiential learning is intended to build practical skills and entrepreneurship among thegraduates with aim to deal with work situations and for better employability and self employment. Itwill involve setting-upof model plans for food processing and value addition for productdiversification, setting up of workshops for manufacturing, operation and maintenance of farmmachinery and equipment, maintenance and custom hiring of farm machinery and equipment.Exposure to Renewable Energy Technologies & Processes.Exposure to Planning, Designing &Estimations of Soil & Water Conservation Measures &Watershed Management.

**The students will be required to have hands-on-experience at progressive farms, research institutions, manufacturing or agro-processing industries and in rural areas.

VIII-SEMESTER

S. No.	Category —	Student READY							
		(Rural and Entrepreneurship Awareness Development Yojana)							
		Course No.	Course Title	Marks			Credit		
				Ext	Int	P	Th.	P	Total
1	PEC	BTAGPEC 801	Elective Course*(PEC)	50	30	20	2	1	3
2	PEC	BTAGPEC 802	Elective Course*(PEC)	50	30	20	2	1	3
3	OE	BTAOE 803	Open Elective** (OE)	50	30	20	2	1	3
4	PCC	BTAGPCC 804	Entrepreneurship Development and Business Management	50	30	20	2	1	3
5	PSI	BTAGPSI 805	Project Planning and Report Writing (StudentREADY)		50	50	0	10	10
6		BTAGSODECA806	Social Outreach, Discipline & Extra	-		50	1	0	1
7	AECC	BTAGAECC 807	ANANDAM	50		50	2	0	2
			Total	250	170	230	11	14	25

*Student will have to opt any two elective courses of 03 credits each (shall be offered by engineering and technology departments of the University.

**Student will have to opt any one course of 03 credit (shall be offered by the other engineering streams of the universityfor agricultural engineering stream students.

BTAGPCC 804:

ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS MANAGEMENT

Course Objective:

- Understand the concept of entrepreneurship in Indian and global economy; planning and execution of ventures; government report for industry & innovation, contract & joint ventures in horticulture and will be motivated for becoming entrepreneur.
- Explain various entrepreneurship models

Course Contents:

Unit-I Entrepreneurship, management – Management functions – planning-Organizing - Directing – motivation – ordering – leading – supervision-Communication and control –Capital– Financial management –importance of financial statements – balance sheet – profit and lossstatement, Analysis of financial statements – liquidity ratios – leverage ratios, Coverage ratios– turn over ratios– profitability ratios.

Unit-II Project –project cycle – Project appraisal and evaluation techniques –undiscounted measures – payback period – proceeds per rupee of out lay, Discounted measures – Net Present Value (NPV) – Benefit-Cost Ratio (BCR) – Internal Rate of Return (IRR) – Net benefit investment ratio (N / K ratio) – sensitivity analysis- Importance of agribusiness in Indian economy International trade- WTO agreements – Provisions related to agreements in agricultural and food commodities.

Unit-III Agreements on agriculture (AOA) – Domestic supply, market access, export subsidies agreements on sanitary and phyto-sanitary (SPS) measures, Trade related intellectual property rights (TRIPS). Development (ED): Concept of entrepreneur and entrepreneurship Assessing overall business environment in Indian economy– Entrepreneurial and managerial characteristics- Entrepreneurship development Programmes (EDP)-Globalization and the emerging business entrepreneurial environment-Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition.

Unit-IV Role of ED in economic development of a country- Overview of Indian social, political systems and their implications for decision making by individual entrepreneurs-Economic system and its implications for decision making by individual entrepreneurs-Social responsibility of business. Government schemes and incentives for promotion of entrepreneurship. Government policy on small and medium enterprises (SMEs) /SSIs/ MSME sectors-, contract farming (CF) and joint ventures (JV), public- private partner ships (PPP).

Practical

1. Preparation of business–Strengths Weaknesses Opportunities and Threats (SWOT) analysis,
2. Analysis of financial statements (Balance Sheet, Profit loss statement).
3. Exercise on Compounding and discounting,
4. Study of Break-even analysis with suitable example.
5. Visit to agro-based industries–I in the locality,

6. Visit to agro-based industries–II
7. Studyof Agro-industries Development Corporation,
8. Analysis of Ratio–I with suitable examples.
9. Analysis of Ratio–II with suitable examples.
10. Study of application of project appraisal technique–I (Undiscounted measures).
11. Study of application of project appraisal technique–II (Discounted Measures).
12. Formulation of project feasibility reports–Farm Machinery Project proposal sasentrepreneur–individual and group
13. Presentation of project proposals in the class.

Suggested Readings

1. Harsh, S.B., Conner, U.J. and Schwab, G.D.1981. Management of the Farm Business. Prentice Hall Inc., New Jersey.
2. Joseph, L.Massie. 1995. Essentials of Management. Prentice Hall of India Pvt. Ltd., New Delhi.
3. Omri Raw Lins, N. 1980. Introduction to Agri business. Prentice Hall Inc., New Jersey
4. Gittenger Price, J.1989. Economic Analysis of Agricultural Projects. John Hopkins University, Press, London.
5. Thomas W Zimmer and Norman M Scar borough. 1996. Entrepreneurship. Prentice-Hall, New Jersey.
6. Mark J Dollinger. 1999. Entrepreneurship Strategies and Resources. Prentice-Hall, Upper Saddal Rover, New Jersey.
7. Khanka SS. 1999. Entrepreneurial Development.S. Chandand Co. New Delhi.
8. Mohanty SK. 2007. Fundamentals of Entrepreneurship. Prentice Hall India Ltd., New Delhi.

Course Outcomes:

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

CO1.	Understand the concept of management, organization, planning, staffing
CO2.	Write project proposal
CO3.	Use various entrepreneurship models
CO4.	Understand various schemes supporting entrepreneurship
CO5.	Think creative and innovative

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	M	H	M	L	-	L	-	L	M	-	L	M	L
CO2	L2	H	M	H	M	L	-	L	-	-	M	-	L	M	M
CO3	L1	H	M	H	M	L	-	-	-	-	M	-	L	L	M
CO4	L2	H	H	H	H	L	-	L	-	-	H	-	L	M	L
CO5	L2	H	M	H	M	L	-	-	-	-	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	CO3, CO4, CO5

ELECTIVES

BTAGPEC 801: Food Quality and Control

Course Objective:

At the end of the course, the student will be able to understand concept of food quality, food safety measurements and various food standards.

Course Contents:

Unit-I Basics of food analysis, concept, objectives and need of food quality. Measurement of various properties and their relationship with food quality.

Unit-II Sensory evaluation methods, panel selection methods, interpretation of sensory results. Instrumental method for testing quality, quality control and quality control tools.

Unit-III Food adulteration and food safety. TQM and TQC, Food Safety Management Systems GAP, GHP, GMP and HACCP (Hazard analysis and critical control point), Sanitation in food industry (SSOP).

Unit-IV Dried leafy vegetables viz. spinach, fenugreek, coriander leaves, etc, quality control: Food Laws and Regulations in India, FSSAI, Food grades and standards BIS, AGMARK, ISO 9000, 22000 Series. CAC (Codex Alimantarious Commission), PFA Act, FPO Act, AGMARK, ISO-2000, CAC Codex Alimanterious, commission), BIS.

Practical

1. Examination of cereals & pulses from one of go-downs and market shops in relation to FPO and BIS specifications.
2. Detection of adulteration and examination of ghee forvarious standards of AGMARK & BIS standards.
3. Detection of adulteration and examination of spices for AGMARK and BIS standards.
4. Detection of adulteration and examination of milk and milk products for BIS standards.
5. Detection of adulteration and examination of fruit products such as jams, jellys, marmalades for FPO specification.
6. Visit to quality control laboratory.
7. Case study of statistical process control in food processing industry.
8. Study of sampling techniques from food processing establishments.
9. Visit to food processing laboratory and study of records and reports maintained by food processing laboratory.

Suggested Readings

1. Sohrab, Integrated ISO 9001 HACCP for Food Processing Industries, Allied Publishers Ltd, Mumbai
2. Krammer, A. and Twigg, B.A. Quality Control for the Food Industry, Volume2, Applications. The AVI Publishing Company, West port, Connecticut.
3. Ranganna, S., Hand book of Analysis and Quality Control for Fruits and Vegetable Products, Tata Mc Graw hill, New Delhi

Course Outcomes:-

At the end of this course students will be able to

CO1	Understand the concept of food analysis
CO2	Understand the Sensory evaluation methods, panel selection methods, interpretation of sensory results.
CO3	Knowledge about Food adulteration and food safety
CO4	Knowledge about quality control: Food Laws and Regulations in India, FSSAI, Food grades and standards
CO5	Knowledge about CAC (Codex Alimantarious Commission), PFA Act, FPO Act, AGMARK, ISO-2000, CAC Codex Alimanterious, commission), BIS.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	H	L	M	-	L	-	L	-	M	L	-	L	M	M
CO2	L2,L4	M	M	L	-	L	M	-	L	L	L	L	-	M	-
CO3	L3,L4	M	L	L	L	H	L	L	L	M	-	M	L	H	L
CO4	L2,L4	M	M	M	-	L	M	L	L	L	M	L	-	M	-
CO5	L3,L5	M	M	H	H	-	-	L	M	M	M	H	H	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	CO4, CO5

BTAGPEC 801: FOOD PLANT DESIGN AND MANAGEMENT

Course Objective:

At the end of the course, the student will learn various aspects of design and layout of food plant.

Course Contents:

Unit-I Food plant location, selection criteria, Selection of processes, plant capacity, Requirements of plant building and its components, Project design, flow diagrams, selection of equipment, process and controls.

Unit-II Objectives and principles of food plant layout. Salient features of processing plants for cereals, horticultural and vegetable crops, milk and milk products.

Unit-III Entrepreneurship development in food industry, new product development process, Government schemes and incentive for promotion of entrepreneurship.

Unit-IV Govt. policy on small and medium scale food processing enterprise, export and import policies relevant to food processing sector, procedure of obtaining license and registration under FSSAI.

Practical

1. Study of preparation of project report,
2. Study of preparation of feasibility report,
3. Study of layout of pre-processing house,
4. Study of layout of Milk and Milk product plants,
5. Development of layout of modern rice mill,
6. Development of layout of Bakery and related product plant,
7. Study of different types of records relating to production of a food plant,
8. Study of different types of records relating to finance of a food plant,
9. Study of different types of records relating to marketing of a food business.

Suggested Reading

1. Hall, H.S. and Rosen, Y.S. (1963) Milk Plant Layout. FAO Publication, Rome.
2. López Antonio. Gómez. Food Plant Design.
3. Robberts Theunis C. (2013) Food Plant Engineering Systems by CRC Press, Washington.
4. Maroulis Z B and Saravacos G D. (2007) Food Plant Economics. Taylor and Francis, LLC.
5. MahajanM. (2014) Operations Research. Dhanpat Raiand Company Private Limited, Delhi.
6. MaroulisZB. And Saravacos G.D. (2003) Food Process Design. Marcel Dekker, Inc, Cimarron Road, Monticello, New York 12701, USA.

Course Outcome:

At the end of this course students will be able to

CO1:	Knowledge about design and layout of food plant
CO2:	Objectives and principles of food plant layout
CO3:	Concept of Entrepreneurship development in food industry
CO4:	Knowledge about Govt. policy on small and medium scale food processing enterprise
CO5:	Knowledge about export and import policies relevant to food processing sector

Course Delivery Method	
CD1	Lectures by use of board/LCD/
CD2	Tutorial/Assgnments
CD3	Seminar
CD4	Self learning
CD5	Lab work

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

CO	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L4	H	M	L	-	L	-	M	-	L	H	L	L	M	L
CO2	L3	M	H	M	M	L	L	-	-	-	M	-	H		M
CO3	L1,L5	M	-	M	M	-	M	-	-	-	H	-	-	L	-
CO4	L6	H	-	M	M	L	M	-	-	L	H	L	L	L	L
CO5	L5	H	H	-	-	-	M	M	L	L	M	M	-	-	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO1, CO2, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO3, CO5

BTAGPEC 801: Agricultural Structures and Environmental Control

Course Objective:

At the end of the course, the student will learn various aspects of agricultural structures such as farm stead and dairy barn, environment control.

Course Contents:

Unit-I Planning and layout of farm stead, farm fencing, physiological responses of livestock, Environment conducive for the live stock and poultry.

Unit-II Dairy barn design, site selection and layout of dairy barn, and poultry farm design, site selection and layout of poultry farm.

Unit-III Site selection and orientation of building in regard to sanitation, community sanitation system; sewage system- its design, design of septic tank for small family.

Unit-IV Scope, importance and need for environmental control, renewable and non-renewable resources and their equitable use, concept to ecosystem, biodiversity of its conservation, environmental pollution and their control, solid waste management system.

Practical

1. Instruments for measurements of environmental parameters.
2. Cooling load of a farm building e.g. poultry house.
3. Design and layout of a dairy farm.
4. Design and layout of a poultry house.
5. Design and layout of a sheep / goat house.
6. Design of a farm fencing system.
7. Design of ventilation system for dairy and poultry house.
8. Design of a feed/fodder storage structures.
9. Familiarization with local grain storage structures.
10. Design of grain storage structures.
11. Cost estimation of a farm building.

Suggested Readings

1. Pandey, P.H. Principles and Practices of Agricultural Structures and Environmental Control, Kalyani Publishers, Ludhiana.
2. Ojha, T.P and Michael, A.M. Principles of Agricultural Engineering. Vol.I, Jain Brothers, Karol Bag, New Delhi.
3. Nathonson, J.A. Basic Environmental Technology, Prentice Hall of India, New Delhi.
4. Venu gopal Rao, P. Text Book of Environmental Engineering, Prentice Hall of India, New Delhi.
5. Garg, S.K. Water Supply Engineering, Khanna Publishers, New Delhi- 6.
6. Dutta, B.N. Estimating and Costing in Civil Engineering, Duttta & Co., Lucknow.
7. Khanna, P.N. Indian Practical Civil Engineer‟s Hand Book, Engineer‟s Publishers, New Delhi.
8. Sahay, K.M. and Singh, K.K. Unit Operations of Agricultural Processing, Vikas Publishing pvt. Ltd, Noida.
9. Banerjee, G.C. A Text Book of Animal Husbandry, Oxford IBH Publishing Co, New Delhi.

Course Outcomes:

At the end of this course students will be able to

CO 1:	Planning and layout of farm stead
CO 2:	Dairy barn design, site selection and layout of dairy barnand poultry farm
CO 3:	Identify and demonstrate orientation of building in regard to sanitation, community sanitation system
CO 4:	Learn about Scope, importance and need for environmental control
CO5:	Knowledge about concept to ecosystem

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	H	-	M	H	-	-	M	M	-	H	-	H	-	M
CO2	L3	H	H	M	H	M	H	H	H	-	H	-	H	-	H
CO3	L1, L3	H	-	L	-	H	L	H	-	H	H	-	-	H	-
CO4	L2	H	H	H	H	-	H	H	M	M	H	-	H	M	H
CO5	L4	H	H	M	M	-	-	M	H	H	L	-	L	-	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO1, CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4 , CO5
CD5	Industrial visit / Field visit	CO1, CO2,CO5

BTAGPEC 801: DEVELOPMENT OF PROCESSED PRODUCTS

Course Objective:

At the end of the course, the student will learn various methods and technologies of value addition to various food materials such as rice, oil and spices.

Course Contents:

Unit-I Process design, process flow chart with mass and energy balance, unit operations and equipments for processing.

Unit-II New product development, flow chart for value added products from cereal, pulses and oil seeds, milling, puffing, flaking, roasting, bakery products, snack food.

Unit-III Extruded products, flow chart for value added products from fruits, vegetables and spices, canned foods, frozen foods, dried and fried foods, fruit juices, sauce, sugar-based confection, candy, fermented food product, spice processing.

Unit-IV Healthfood, nutra-ceuticals and functional food, milk processing and flow chart for milk product processing.

Practical

1. Process design and process flow chart preparation.
2. Preparation of different value-added products.
3. Visit to roller wheat flour milling, rice milling.
4. Visit to spice grinding industry.
5. Visit to milk plant, dal and oil mill.
6. Visit to fruit/vegetable processing plants.
7. Process flow diagram and study of various models of the machines used in a sugar mill.

Suggested Readings

1. Gean koplis C.J. Transport Processes and Unit Operations, Prentice-Hall.
2. Rao, D.G. Fundamentals of Food Engineering, PHI Learning Pvt. Ltd, New Delhi.
3. NormanN. Potter and Joseph H.Hotchikss. Food Science. Chapman and Hall Pub.
4. Acharya, K.T. Every day Indian Processed Foods. National Book Trust.
5. Mudambi SumatiR., Shalini M.Rao and MV Rajgopal. Food Science. New Age International Publishers.
6. Negi H.P.S., Savita SharmaandK. SekhonS. Hand book of Cereal Technology, Kalyani Pub., New Delhi.

Course Outcome:

At the end of the course, a student will be able to understand –

CO1:	Process design, process flow chart with mass and energy balance
CO2:	Focus on the New product development, flow chart for value added products
CO3:	Understand Extruded products, flow chart for value added products
CO4:	Knowledge about Milk processing.
CO5:	Knowledge about flow chart for milk product processing

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L4,L6	H	M	L	-	L	-	-	H	H	M	-	H	M	M
CO2	L6,L5,L4	H	-	M	-	H	H	-	M	-	-	-	H	-	H
CO3	L6,	M	-	L	-	M	L	-	H	M	-	-	M	M	M
CO4	L3,	H	M	-	-	M	H	M	H	H	M	-	M	H	M
CO5	L5	H	M	M	L	-	-	M	M	H	H	L	-	M	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial Visit / Field Visit	CO4, CO5

BTAGPEC 801: PROCESS EQUIPMENT DESIGN

Course Objective:

At the end of the course, the student will learn various types of material available for fabrications of equipments, different types of heat exchanger and design of shell and tube heat exchanger.

Course Contents:

Unit-I Introduction on process equipment design, application of design engineering for processing equipments, design parameters and general design procedure, material specification, types of material for process equipments.

Unit-II Moisture content determination, EMC model's principle of drying, theory of diffusion, various drying rate periods falling rate and constant rate period of drying, critical moisture content.

Unit-III Design of cleaners, design of tubular heat exchanger, classification of dryers and operation, heat transfer in grain drying, dryer performance, drying methods.

Unit-IV Scope & importance of material handling devices, design consideration of different types of material handling devices such as belt, chain, screw conveyor, buck etelevator, pneumatic conveying, capacity and power requirement.

Practical

1. Study of cleaners.
2. Study of milling equipments.
3. Study of tubular heat exchanger.
4. EMC model's development
5. Design of belt conveyor, bucket elevator, screw conveyor.
6. Material of construction used in equipments.
7. Various methods of moisture content determination.
8. Determination of constantrate drying period.
9. Determination of falling rate drying period.
10. Performance evaluation of dryer.

Suggested Readings

1. Mahajani, V.V. and Umarji, S.B., Process Equipment Design, Macmillan.
2. GeankoplisC.J. (2007) Transport Processes and Unit Operations, Prentice-Hall.
3. Rao, D.G. Fundamentals of Food Engineering, PHI Learning Pvt. Ltd, New Delhi.

Course Outcome

At the end of course, students will be able to

CO1:	Application of design engineering for processing equipments
CO2:	Discus the Moisture content determination
CO3:	Design of cleaners, design of tubular heat exchanger, classification of dryers and operation
CO4:	Understand Scope & importance of material handling devices
CO5:	Knowledge about design consideration of different types of material handling devices

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	**Blooms Level**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L4, 2	H	H	M	-	H	M	-	M	M	H	-	-	M	H
CO2	L 2	H	-	M	M	H	M	-L	H	M	L	L	H	H	H
CO3	L3,	H	H	H	H	H	H	-	M	H	H	L	H	M	H
CO4	L 2, 3, 1	H	M	-	L	H	H	-	L	H	M	L	-	H	M
CO5	L5	H	H	M	M	M	-	-	H	H	L	M	M	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CD and CO

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO3, CO4, CO5

BTAGPEC 801: POSTHARVEST ENGINEERING OF HORTICULTURECROPS

Course Objective:

At the end of the course, the student will learn various aspects of post harvest engineering of horticulture crops.

Course Contents:

Unit-I Importance of processing of fruits, vegetables and spices, Peeling: different peeling methods; Slicing of fruits and vegetables: equipment for slicing, shredding, crushing, chopping, juiceextraction, etc; Blanching: importance and objectives; blanching methods.

Unit-II Application of refrigeration in different perishable food products, chilling requirements of different fruits and vegetables, freezing of food, coldStorage heat load calculations and cold storage design; dryers for fruits and vegetables.

Unit-III Common methods of storage, low temperature storage, evaporative cooled storage, controlled atmospheric storage, modified atmospheric packaging.

Unit-IV Preservation technology, general methods of preservation of fruits and vegetables, brief description, advantages and disadvantages of different physical/ chemical and other methods of preservation, flowcharts for preparation of different finished products.

Practical

1. Performance evaluation of peeler.
2. Performance evaluation of slicer.
3. Performance evaluation of juicer.
4. Performance evaluation of pulper.
5. Performance evaluation of blanching equipment.
6. Study of cold storage.
7. Study of CAP and MAP storage.
8. Preparation of value-added products.
9. Visit to fruits and vegetables processing industry.
10. Visit to spices processing plant.

Suggested Readings

1. Arthey, D. and Ashurst, P. R. 1966. Fruit Processing, Chapman and Hall, New York.
2. Pantastico, E.C.B. 1975. Post harvest Physiology, Handling and Utilization of Tropical and Sub- tropical Fruits and Vegetables AVI Pub. Co., New Delhi.
3. Pandey, R.H. 1997. Post harvest Technology of Fruits and Vegetables (Principles and practices).Saroj Prakashan, Allahabad.
4. Sudheer, K P. and Indira, V. 2007. Post Harvest Engineering of Horticultural Crops. New India.

Course Outcome:

At the end of this course students will be able to

CO1	Importance of processing of fruits, vegetables and spices
CO2	Understand basic principles, Application of refrigeration in different perishable food products
CO3	Understands Common methods of storage
CO4	Know about Preservation technology
CO5	Knowledge about flowcharts for preparation of different finished products

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	H	L	M	H	H	M	M	M	-	M	M	M	L	-
CO2	L2	M	M	H	H	L	L	-	-	L	M	-	-	M	-
CO3	L2	H	L	H	M	M	L	L	L	-	L	L	-	M	-
CO4	L1	M	M	H	M	L	M	M	M	M	L	-	L	H	L
CO5	L4	H	H	M	M	M	L	M	M	H	H	M	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	CO2,CO3

BTAGPEC 801: FLOODS AND CONTROL MEASURES

Course Objective:

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

To train the students about the understanding of extent of erosion, losses there on and stabilization of gullies and ravines and rehabilitation of the affected area and flood scontrol.

Course Contents:

Unit-I Floods - causes of occurrence, flood classification - probable maximumflood, standard project flood, design flood, flood estimation - methods of estimation; estimation of flood peak-rational method, empirical methods,unit hydrograph method.

Unit-II Statistics in hydrology, flood frequency methods - log normal, Gumbel‟s extremevalue, log-Pearson type-III distribution; depth-area-duration analysis. Flood forecasting. Flood routing - channel routing, Muskingummethod, reservoir routing, modified Pul‟s method. Flood control – history of flood control, structural and non-structural measures of flood control, storage and detention reservoirs, levees, channel improvement. Gully erosion and its control structures-design and implementation.

Unit-III Ravine control measures. River training works, planning of flood controlprojectsandtheireconomics.Earthenembankments-functions,classification - hydraulic fill and rolled fill dams - homogeneous, zone dand diaphragm type, foundation requirements, grouting, seepage through dams, flow net and its properties, seepage pressure, seepage line in composite earth embankments,drainage filters,piping and its causes.

Unit-IV Design and construction of earthen dam, stability of earth enembankments against failure by tension, over turning, sliding etc.,stability of slopes - analysis of failure by different methods. Sub-surface dams - site selection and constructional features. Check dam – Small earthen embankments - types and design criteria. Sub-surface dams-site selection and constructional features.

Practical

1. Determination of flood stage dischargerelationshipinawatershed.
2. Determinationofflood-peak-area relationships.
3. Determinationoffrequencydistributionfunctionsforextremefloodvaluesusing Gumbel’smethod.
4. Determinationofconfidencelimitsofthefloodpeakestimatesfor Gumbel’sextremevaluedistribution.
5. Determination of frequency distribution functions for extreme flood values using log-PearsonType-III distribution.
6. Determination of probable maximum flood, standard project flood and spillway design flood.
7. Design of levees for flood control. Design of jetties.

8. Study of vegetative and structural measures for gully stabilization.
9. Design of gully/ravine control structures and cost estimation. Designing, planning and cost-benefit analysis of a flood control project.
10. Study of different types, materials and design considerations of earthendams. Determination of the position of phreatic line in earth dams for various conditions,
11. Stability analysis of earthen dams against head water pressure, foundations hear, sudden draw down condition etc.
12. Stability of slopes of earth dams by friction circle and other methods. Construction of flow net for isotropic and anisotropic media.
13. Computation of seepage by different methods.
14. Determination of settlement of earth dam. Input-output-storage relationships by reservoir routing.
15. Visit to sites of earthen dam and water harvesting structures.

SuggestedReadings

1. Michael, A.M. and T.P.Ojha.2003. Principles of Agricultural Engineering.Volume II. 4th Edition, JainBrothers, NewDelhi.
2. Murthy, V.V.N.2002. Land and Water Management Engineering. 4thEdition, Kalyani Publishers, NewDelhi.
3. Suresh, R.2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, NewDelhi.
4. Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., NewYork, Delhi.
5. Subramanya, K. 2008. Engineering Hydrology3rddition, Tata McGraw-HillPublishingCo., New Delhi.
6. Bureau of Reclamation.1987.Design of Small Dams. US Department of Interior, Washington DC, USA.
7. Arora, K.R.2014. Soil Mechanics and Foundation Engineering (Geotechnical Engineering). Standard Publishers Distributors, Delhi.
8. Garg,S.K. 2014. Soil Mechanics and Foundation Engineering. Khanna Publishers Pvt.Ltd., New Delhi.
9. Stephens Tim. 2010.Manual on Small Earth Dams-A Guide to Siting, Design and Construction. Food and Agriculture Organization of theUnited Nations, Rome.

Course outcome

At the end of the course student will be able to

CO1	Understand the practical knowledge of flood estimation - methods of estimation
CO2	Gully erosion and its control structures-design and implementation.
CO3	Apply the knowledge about Ravine control measures. River training works, planning of flood controlprojectsandtheireconomics.
CO4	Sub-surface dams-site selection and constructional features.
CO5	Knowledge about Design and construction of earthen dam

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	H	L	M	H	H	M	M	M	-	M	H	M	H	L
CO2	L1	M	M	H	H	L	L	-	-	L	M	-	-	M	L
CO3	L1,L3	H	L	H	M	M	L	L	L	-	L	L	M	M	-
CO4	L4,L6	M	M	H	M	L	M	M	M	M	L	-	L	L	-
CO5	L5	H	H	M	M	M	L	L	-	-	H	H	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO2,CO3, CO5

BTAGPEC 801: WASTE LAND DEVELOPMENT

Course Objective:

To train the students about the understanding of ravine rehabilitation, Afforestation-agro-horti-forestry-silvipasture development and land reclamation and rehabilitation.

Course Contents

Unit-I Land degradation – concept, classification - arid, semiarid, humid and sub-humid regions, denudedrange land and marginal lands.Wastelands - factors causing, classification and mapping of wastelands,planning of wastelands development-constraints,agro-climatic conditions,development options,contingency plans.

Unit-II Conservation structures - gully stabilization, ravine rehabilitation, sand dune stabilization, water harvesting and recycling methods.Afforestation-Agro-horti-forestry-silvipasture methods, for age and fuel crops-socio economic constraints.

Unit-III Shifting cultivation, optimal land use options.Wasteland development –hills, semi-arid, coastal areas, water scarce areas, reclamation of water logged and salt-affected lands. Mine spoils-impact, land degradation and reclamation and rehabilitation, slope stabilization and mine environment management.

Unit-IV Micro-irrigation in waste lands development. Sustainable waste land development – drought situations, socio-economic perspectives. Government policies. Participatory approach. Preparation of proposal for waste land development and benefit-cost analysis.

Practical

1. Mapping and classification of waste lands.
2. Identification of factors causing waste lands.
3. Estimation of vegetation density and classification.
4. Planning and design of engineering measures for reclamation of wastelands.
5. Design and estimation of different soil and water conservation structures under arid conditions.
6. Design and estimation of different soil and water conservation structures under semiarid conditions.
7. Design and estimation of different soil and water conservation structures under humid conditions.
8. Planning and design of micro-irrigation in waste land development.
9. Cost estimation of the above measures/structures.
10. Visit to waste land development project sites.

Suggested Readings

1. Abrol, I.P., and V.V. Dhruvanarayana. 1998. Technologies for Waste land Development. ICAR, NewDelhi.
2. Ambast, S.K., S.K. Gupta and Gurcharan Singh (Eds.) 2007.Agricultural Land Drainage – Reclamation of Water-logged Saline Lands. Central Soil Salinity Research Institute, Karnal, Haryana.
3. Hridai RamYadav. 2013. Management of Wastelands. Concept Publishing Company. NewDelhi.
4. Karthikeyan, C., K. Thangaraja, C. CinthiaFernandez and K.Chandrakandon. 2009. Dryland Agriculture and Wasteland Management. Atlantic Publishers and Distributors Pvt. Ltd.,New Delhi.
5. Rattan Lal and B.A.Stewart (Ed.). 2015. Soil Management of Small holder Agriculture. Volume 21 of Advances in Soil Science. CRC Press, Taylor and Francis Group, Florida, USA.
6. Robert Malliva and Thomas Missimer. 2012. Arid Lands Water Evaluation and Management. Springer Heidelberg, NewYork.
7. Swaminathan, M.S.2010. Science and Integrated Rural Development. Concept Publishing Company (P) Ltd., Delhi.
8. The Energy and Resources Institute. 2003. Looking Back to Think Ahead-Green India 2047. Growth with Resource Enhancement of Environment and Nature. NewDelhi.
9. Virmani, S.M. (Ed.).2010. Degraded and Wastelands of India: Status and Spatial Distribution.ICAR, New Delhi.

Course outcome:

CO1	To know the classification and mapping of wastelands
CO2	Knowledge about Conservation structures
CO3	knowledge about Shifting cultivation, optimal land use options.
CO4	Micro-irrigation in waste lands development
CO5	Preparation of proposal for waste land development and benefit-cost analysis

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1,L2	M	M	H	L	H	-	L	H	-	H	M	M	-	L
CO2	L6,L2	H	M	M	-	M	L	M	M	H	M	L	M	-	M
CO3	L6	M	H	H	-	H	-	M	L	H	M	L	-	-	-
CO4	L5	H	M	-	-	H	H	-	-	H	H	-	H	L	M
CO5	L6	H	H	-	-	M	M	M	-	H	H	-	-	M	M

H- High, M- Moderate, L- Low, ‘-’ for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	CO2,CO3, CO5

BTAGPEC 801: REMOTE SENSING AND GIS APPLICATIONS

CourseObjective:

To train students in use of various hardware and software in use ofsatellite data, GPS technology in developing GIS based out puts for resource mapping and planningstudies.

Course Contents:

Unit-I Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth‟s surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation,soil and water;Spectral signatures; different types of sensors and platforms; contrastratio and possible causes of low contrast.

Unit-II Aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography-end lap and sidelap; stereo scopicvision, requirements of stereoscopic photographs; air-photo interpretation-interpretation elements; photogrammetry-measurements on a single vertical aerial photograph, measurements ona stereo-pair- vertical measurements by the parallax method; ground control for aerial photography.

Unit-III Satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data-image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices; microwave remote sensing. GIS and basic components, different sources of spatial data, basic spatial entities, major components of spatial data.

Unit-IV Basic classes of map projections and their properties, Methods of data input into GIS, Data editing,spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land andwaterresources.

Practical

1. Familiarization with remote sensing and GIS hardware;
2. Use of software for image interpretation;
3. Interpretation of aerial photographs
4. Interpretation of satellite imagery;
5. Basic GIS operations such as image display;
6. Study of various features of GIS software package;

7. Scanning, digitization of maps
8. Data editing
9. Database query and map algebra.
10. GIS supported case studies in water resources management.

Suggested Readings

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.
4. Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
5. Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation.7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.
6. Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation.Third Edition, Wave land PressInc., Illinois,USA.
7. Sahu, K.C. 2008. Text Book of Remote Sensing and GeographicInformationSystems.AtlanticPublishersandDistributors(P) Ltd., NewDelhi.
8. Shultz, G.A. and E.T. Engman. 2000. Remote Sensing in HydrologyandWaterManagement.Springer, NewYork.

Course Outcomes

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

CO1:	Know about remote sensing
CO2:	Knowledge about aerial photography.
CO3:	Understand the concept of satellite imagery
CO4:	Application of remote sensing and GIS for the management of land andwaterresources.
CO5:	Knowledge about **Basic** classes of map projections and their properties

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	LI,L4	H	M	-	-	L	L	M	L	M	M	-	-	L	-
CO2	L3	H	M	L	-	L	-	L	M	-	M	M	M	-	M
CO3	L2,L4	M	L	L	-	-	H	M	-	L	M	M	L	-	-
CO4	L3,L2	H	L	M	L	M	M	M	M	L	M	L	M	-	-
CO5	L5	H	L	L	L	M	M	H	H	H	-	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4, CO5

BTAGPEC 801: MANAGEMENT OF CANAL IRRIGATION SYSTEM

Course Objective:

Students are exposed with the technology to design canal irrigation network, crop water requirement and canal water distribution and management.

Course Contents:

Unit-I Purpose benefits and ill effects of irrigation; typical network of canal irrigation system and its different physical components; canal classification based on source of water, financial output, purpose, discharge and alignment; canal alignment: general considerations for alignment; performance indicators for canal irrigation system evaluation.

Unit-II Estimation of water requirements for canal command areas and determination of canal capacity; water duty and delta, relationship between duty, base period and delta, factors affecting duty and method of improving duty; silt theory: Kennedy‟s theory, design of channels by Kennedy‟s theory, Lacey‟s regime theory and basic regime equations, design of channels by Lacey‟s theory.

Unit-III Maintenance of unlined irrigation canals, measurement of discharge in canals, rostering (canal running schedule) and warabandhi, necessity of canal lining: advantages and disadvantages, types of canal lining and desirable characteristics for the suitability of lining materials; design of lined canals.

Unit-IV Functions of distributary head and cross regulators; canal falls, their necessity and factors affecting canal fall; sources of surplus water in canals and types of canal escapes; requirements of a good canal outlet and types of outlet.

Practical

1. Estimation of water requirement of canal commands;
2. Determination of canal capacity;
3. Layout of canal alignments on topographic maps,
4. Drawing of canal sections in cutting, full banking and partial cutting and partial banking;
5. Determination of longitudinal section of canals;
6. Design of irrigation canals based on silt theories;
7. Design of lined canals;
8. Formulation of warabandhi;
9. Study of canal outlets, regulators,escapes and canal falls.
10. Field visit to canal area.

SuggestedReadings

1. Arora, K.R. 2001.Irrigation, Water Powerand Water Resources Engineering. Standard PublishersDistributors, Delhi.
2. Garg S.K.2014. Irrigation Engineering and Hydraulic Structures, Khanna Publishers New Delhi.
3. Sahasra budhe SR.2011.Irrigation Engineering and Hydraulic structures. SK Kataria & Sons Reprint 2015.

Course Outcomes:

At the end of this course Students will be able to

CO1:	Describe the concept of canal irrigation system
CO2:	Knowledge about dertermination of canal capacity
CO3:	Knowledge about design of irrigation canals
CO4:	Understand the concept of canal outlets
CO5	Knowledge about Functions of distributary head and cross regulators

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

CO	Blooms level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	H	M	H	-	M	-	L	M	-	H	-	L	M	L
CO2	L1	M	H	M	-	H	-	M	H	-	M	-	M	-	M
CO3	L2	M	H	H	L	M	H	H	M	-	H	-	H	L	M
CO4	L2	M	H	M	-	M	M	M	L	-	H	-	H	-	-
CO5	L3	M	M	H	H	-	-	M	M	H	M	H	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial Visit / Field Visit	CO4, CO5

BTAGPEC 801: MINOR IRRIGATION AND COMMAND AREA DEVELOPMENT

CourseObjectives:

To train the students for design of site-specific lift irrigation system as per availability of water and command area on community basis.

Course Contents:

Unit-I Factors affecting performance of irrigation projects; types of minor irrigation systems in India; lift irrigation systems: feasibility.

Unit-II Type of pumping stations and their site selection,design of lift irrigation systems; tank Irrigation: grouping of tanks, storage capacity,supply works and sluices.

Unit-III **Command area development (CAD) programme:** Components, need, scope, and development approaches, historical perspective, command area development authorities - functions and responsibilities; on farm development works, reclamation works.

Unit-IV Use of remote sensing techniques for CAD works; water productivity: concepts and measures for enhancing waterproductivity; Farmers "participationincommand area development.

Practical

1. Preparation of commandarea development layoutplan;
2. Irrigation water requirement of crops;
3. Preparation of irrigate on schedules;
4. Planningand layout of water conveyance system;
5. Design of surplusweiroftanks;
6. Determination of storage capacityoftanks;
7. Design of intakepipe and pump house.
8. Field visittocommandarea.

SuggestedReadings

1. Arora, K.R.2001. Irrigation, Water Powerand Water Resources Engineering. Standard Publishers Distributors, Delhi.
2. Garg S.K. 2014. Irrigation Engineering and Hydraulic Structures, Khanna Publishers New Delhi.
3. Michael A.M.2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Publ. House New Delhi.
4. Sahasrabudhe SR.2011. Irrigation Engineering and Hydraulic structures. SK Kataria & Sons Reprint 2015

Course Outcomes:

At the end of the course, a student will be able to–

CO1	Know about basics of irrigation systems
CO2	Understand the cocept of lift irrigation system
CO3	Understand about CAD
CO4	Use of remote sensing techniques for CAD works
CO5	Farmers ‟participation in command area development.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	M	M	H	L	M	-	L	H	-	H	M	-	H	M
CO2	L2	H	M	M	L	-	L	L	H	-	M	M	-	M	H
CO3	L3, L1	M	M	H	-	-	-	L	H	-	M	M	H	H	L
CO4	L6	H	M	-	-	M	L		M	M	H	-	M	-	M
CO5	L5	H	H	M	-	-	H	L	M	M	M	H	H	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial Visit / Field Visit	CO2, CO5

BTAGPEC 801: LANDSCAPEIRRIGATIONDESIGNAND MANAGEMENT

CourseObjective:

To train the students about the field specific fordesign of irrigate on system, their proper operation, automation and the maintenance of the system.

Course Contents:

Unit-I Conventional method of landscape irrigation: Hose irrigation system, quick releasecoupling system and portable sprinkler with hosepipes.

Unit-II Modern methods of landscape irrigation- pop-up sprinklers spray pop-up sprinkler, shrubadopter, dripirrigation and bubblers; Merits and demerits of conventional and modern irrigation systems, types of land scapes and suitability of different irrigate on methods.

Unit-III Water requirement for different landscapes, Segments of land scape irrigate on systems,Main components of modernland scape irrigation systems and their selection criteria; Types of pipes, pressure ratings, sizing and selection criteria.

Unit-IV Automation system for land scape irrigation: Main components, types of controllersandtheir application, Design of modern land scape irrigation systems, operation and maintenance of landscapeirrigation systems.

Practical

1. Study of irrigation equipments for land scapes;
2. Designandinstallation ofirrigation system for landscape,
3. Determination of water requirement.
4. Determination of power requirement, pump selection.
5. Irrigation scheduling of land scapes,
6. Study of irrigation on trollers and otherequipments,
7. Use ofAuto CAD inirrigation design: blocks & symbols, headlayout, zonin gandvalve slayout, pipesizing, Pressurecalculationsetc.,
8. Visittoland scapeirrigation system and itsevaluation.

SuggestedReadings

1. Michael A.M.2012. Irrigation: Theory and Practice.Vikas Publishing Vikas Publ. House New Delhi.
2. Singh Neeraj Partap. 2010. Land scape Irrigati on and Floriculture Terminology, Bangalore.
3. Smith StepehenW. Land scape Irrigati on and Management. Amazon. com.

Course Outcomes

At the end of this course students will be able to

CO1	Knowledge about Conventional method of landscape irrigation.
CO2	Cocept of Modern methods of landscape irrigation
CO3	Identify the Water requirement for different landscapes
CO4	Automation system for land scape irrigation
CO5	Knowledge about operation and maintenance of landscape irrigation systems.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	M	M	L	L	M	M	-	-	-	M	-	L	-	-
CO2	L2, L3	M	M	L	-	M	L	-	-	L	M	-	L	L	L
CO3	L2, L4	H	H	H	M	H	M	M	H	H	H	M	M	H	M
CO4	L1,L3	M	M	L	-	M	-	M	L	M	M	-	M	M	M
CO5	L5	H	H	H	M	-	-	M	M	H	H	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD:

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4, CO5
CD5	Industrial visit / Field visit	CO4, CO5

BTAGPEC 802: PLASTIC APPLICATIONS IN AGRICULTURE

CourseObjective:

Students are expose with the technology to design microirrigationfertigation system green house design, environment control for efficient managementofcrop toincrease productivity.

Course Contents:

Unit-I **Introduction of plasticulture:** Types and quality of plastics used in soil and water conservation, production agriculture and post harvestman agement.Quality control measures.Present status and future prospective of plasticulture in India. Water management - use of plasticsinin- situ moistureconservation and rain water harvesting.

Unit-II Plastic film lining in canal, pond and reservoir. Plastic pipes for irrigate on water management, bore - well casing and subsurface drainage. Drip and sprinkler irrigation systems. Use of poly mers in control of percolationlosses in fields.Soil conditioning - soil solarisation, effects of different colour plastic mulching insur facecovered cultivation.

Unit-III **Nursery management:** Use of plastics in nursery raising, nursery bags,tray setc. Controlled environmental cultivation- plasticsas cladding material, green / poly / shade net houses, wind breaks, poly tunnels and crop cover.Plasticnets for crop protection- antiinsectnets, bird protectionnets. Plasticfencing. Plasticsindrying, preservation, handling and storage of agricultural produce, innovative plastic packaging solutions for processed food products. Plastic cap covers forstorage of food grains in open. Use of plastics as alternate material formanufacturing farmequipmentand machinery.

Unit-IV **Plastics for aquacultural engineering and animal husbandry:** Animal shelters, vermi-beds and inland fisheries. Silage film technique for fodderpreservation. Agencies involved in the promotionofplasticulture in agriculture at national and state level. Human resource development in plasticulture applications.

Practical

1. Design, estimation and layingofplasticfilmsinliningofcanal, reservoir and water harvesting ponds.
2. Study of plastic components of drip and sprinkler irrigation systems laying and flushingoflaterals.
3. Study of components of sub-surfacedrainagesystem.
4. Study of different colour plasticmulchlaying.
5. Design, estimation and installation of green, poly and shade net houses,low tunnels etc.

6. Study on cap covers for food grain storage, innovative packaging solutions -leno bags, crates, bins, boxes, vacuum packing, unit packaging, CAS andMAP and estimation.
7. Study on use of plastics in nursery, plant protection, inland fisheries ,animal shelters, preparation of vermi-bed and silage film for fodderpreservation.
8. Study of plastic partsinmaking farmmachinery.
9. Visits to nearby manufacturing units / dealers of PVC pipes, drip and sprinklerirrigation systems, green house / Polyhouse / shade house / net houseetc.
10. Visittofarmers ‟fields with theseinstallations.

Suggested Readings

1. Brahma Singh, Balraj Singh, Naved Sabir and Murtaza Hasan. 2014. Advances in Protected Cultivation. New India Publishing Agency, New Delhi.
2. Brown, R.P. 2004. Polymers in Agriculture and Horticulture .RAPRAReview Reports : Vol. 15, No.2, RAPRA Technology Limited, U.K.
3. Central Pollution Control Board. 2012. Material on Plastic Waste Management. Parivesh Bhawan, East Arjun Nagar, Delhi - 110032.
4. Charles A. Harper. 2006. Handbook of Plastics Technologies. The Complete Guide to Properties and Performance. Mc Graw - Hill, New Delhi.
5. Dubois. 1978. Plastics in Agriculture. Applied Science Publishers Limited, Essex, England.
6. Manas Chanda, SalilK. Roy. 2008. Plastics Fundamentals, Properties, and Testing. CRC Press.
7. Ojha,T.P. and Michael, A.M., 2012, Principles of Agricultural Engineering - I.Jain Brothers, Karol Bagh, New Delhi.
8. Pandey, P.H. 2014. Principles and Practices of Agricultural Structures and Environmental Control. Kalyani Publishers, Ludhiana, India.
9. Shankar, A.N. 2014. Integrated Horti culture Development in Eastern Himalayas, Plasticulturein Agri- Horti culture Systems, 241 - 247.
10. Srivastava ,R.K.,R.C. Maheswari, T .P. Ojha, and A. Alam. 1988. Plasticsin
11. Agriculture. Jain Brothers, Karol Bagh, New Delhi.

Course outcome:

At the end of course, students will be able to

CO1:	Knowledge about Plasticulture
CO2:	Plastic pipes for irrigate on water management
CO3:	Use of plastics as alternate material formanufacturing farmequipmentand machinery.
CO4:	Human resource development in plasticulture applications.
CO5:	Knowledge about Agencies involved in the promotion of plasticulture in agriculture at national and state level

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/Cos	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	M	M	H	L	H	H	M	H	H	H	M	H	M	M
CO2	L2	H	M	M	H	M	L	M	M	H	M	M	H	H	H
CO3	L3	M	H	H	H	H	H	M	L	H	M	L	H	M	M
CO4	L6	H	M	M	M	H	H	H	H	H	H	H	H	H	H
CO5	L5	H	H	M	M	M	-	-	-	L	M	-	M	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping of CO with CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO4, CO5

BTAGPEC 802: MECHANICS OF TILLAGE AND TRACTION

Course Objective:

Know Mechanics of soil cutting, Traction force, torque-slip relationship and tractionaidfor tractor and other traction machineries.

Course Contents:

Unit-I Introduction to mechanics of tillage tools, engineering properties of soil, design oftillage tool sprinciples of soil cutting, designequation.

Unit-II Introduction totraction mechanics, Measurement and characterizationofterrainbehaviour: stress-strainrelationship, pressure sinkage relationshipandconepenetrometer.

Unit-III Motion resistance of a rigid and pneumatic wheel, Mechanics of towed,selfpropelled and drivingwheel; Wheel slip,its measurement; Criteria of performance of traction devices.

Unit-IV Traction prediction approach: Mobility number & effect of mobility number on tractive effort, traction improvement, tyre construction: biasandradial, tyretesting, soilcompaction.

Practicals

1. Measurementof static and dynamic soil parameters relatedto tillage.
2. Measurementof slip and sinkageunderdry and wetsoil conditions.
3. Measurement of load and fuel consumption for different

Farm operations.

4. Studies on tyres under different conditions.
5. Studies on compaction and number of operations.

Text Books / References

1. W.R.Gilland V and en Berg.(1968). SoilD yna micsin Tillage, Hand book No. 316, US Department of Agriculture, USA.
2. M.G. Bekker. (1956). Theory of land Locomotion, University of Michigan Press, USA.
3. M.G. Bekker. (1969). Off-Road Locomotion, University of Michigan Press USA.
4. M.G.Bekker. (1969). Introduction of Terrain Vehicle System, Michigan, USA.
5. J.Y.Wong. (1978). Theory of Ground Vehicle, John Willey & Sons, New York.

Course outcome:

At the end of course, students will be able to

CO1:	Knowledge about mechanics of tillage tools
CO2:	Concept of traction mechanics, Measurement and characterizationofterrainbehaviour
CO3:	Concept of Motion resistance of a rigid and pneumatic wheel
CO4:	Traction prediction approach
CO5:	Knowldege about Mechanics of towed, self propelled and driving wheel

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1, L2	H	-	-	M	H	-	H	-	H	H	M	-	M	-
CO2	L2	H	L	-	H	M	-	M	H	-	H	-	H	L	-
CO3	L2	M	H	M	-	-	M	H	H	M	M	-	M	L	-
CO4	L5, L6	H	H	-	H	M	-	H	-	M	H	-	H	M	L
CO5	L4	M	H	H	M	M	-	-	M	H	H	M	-	-	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping of CO with CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4
CD2	Tutorials/Assignments	CO1, CO4 , CO5
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO2, CO4

BTAGPEC 802: FARM MACHINERY DESIGN AND PRODUCTION

Course Objective:

Thestudent will be abletodesign standard power transmission components used in agricultural machines. The student will also havethe knowledge of various heat treatment methods and industrial layout planning along with quality production management.

Course Contents:

Unit-I Introductionto designparametersofagricultural machines & design procedure. Characteristicsoffarmmachinerydesign. Research and development aspects offarmmachinery. Design of standard powerTransmission components used in agricultural machines: mechanical & hydraulicunits.

Unit-II Introduction to safety in power transmission. Application of design principles to the systems of selected farm machines. Critical appraisal in production of Agricultural Machinery; Advance sinmaterial used for agricultural machinery.

Unit-III Advanced manufacturing techniques including powder metallurgy, EDM (Electro-Discharge Machining), Heat Treatment of steels including pack car burizing, shot pining process,etc.

Unit-IV Limits, Fits & Tolerances, Jigs & Fixtures. Industrial lay-out planning, Quality production management. Reliability. Economics of process selection. Familiarization with Project Report.

Practical

1. Familiarization with different design aspects of farm machinery and selected components.
2. Solving design problems on farm machines & equipment
3. Visit to Agricultural machinery manufacturing industry
4. Tractor manufacturing industry
5. Jigs and Fixtures– study in relation to agricultural machinery.Fits, tolerances and limits
6. Layou planning of a small-scale industry
7. Problems on Economics of process selection; Preparation of a project report;
8. Case study for manufacturing of simple agricultural machinery.

Suggested Readings

1. Richey, C.B. Agricultural Engineering Hand book", Mc Graw Hill Inc. US A, 1961.
2. Adithan M.and A.B. Gupta, Manufacturing Technology" IstEdition (Reprint 2012), New Age International (P) Ltd.)
3. Sharma P.C. and D.K. Agrawal Machine Design, S.K.Kataria & Sons, 1997.
4. Narula V.Manufacturing Processes, S.K.K ataria & Sons, 2010.
5. Singh S. Mechanical Engineer’s Hand book, S.Chand Publisher, 2011.
6. Chakrabarti N.R. Data bookfor Machine Design, KhannaPublisher, 1984.

Course outcome:

At the end of this course students will be able to

CO1:	Acquire the basic knowledge about the designparametersofagricultural machines & design procedure
CO2:	Application of design principles to the systems of selected farm machines
CO3:	Evaluate the Advanced manufacturing techniques
CO4:	Industrial lay-out planning, Quality production management. Reliability
CO5:	Economics of process selection

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

POs/COs	**Blooms Level**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L6,	M	M	-	H	H	H	H	-	-	M	M	H	-	H
CO2	L6,	H	M	H	H	H	L	M	H	M	L	M	H	M	M
CO3	L5	M	M	L	H	H	H	M	H	L	M	H	H	L	H
CO4	L3	M	H	H	H	M	M	M	M	H	H	H	H	H	M
CO5	L4	M	M	H	-	-	M	M	H	-	-	M	M	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping of CO with CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4
CD2	Tutorials/Assignments	CO1, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial Visit / Field Visit	CO3, CO5

BTAGPEC 802: TRACTOR DESIGN AND TESTING

Course Objective:

Design parameters of tractor engine components and power transmission system. Stability during operation and different tests conducted on tractor.

Course Contents:

Unit-I Introduction to development of agricultural tractor. Study of parameters for balanced design of tractor for stability, weight distribution and hitch system.

Unit-II Design of various engine components: Piston, cylinder and cylinder liner, connectingrod, crankshaft and valve.

Unit-III Design of mechanical power transmission in agricultural tractors. Design of Ackerman Steering. Introduction of computer application to design of engine components,differential, final driveand axle power take off shaft.

Unit-IV Design of seat and controls of an agricultural tractor. Tractor Testing as per BIS codes.

Practicals

1. Design problem of tractor clutch.
2. Design problem on spurgears.
3. Design problem of bevelgears.
4. Design problem of helicalgears.
5. Design of gear box (synchromesh / constantmesh).
6. Selecti on of tractor tires – Problem solving.
7. Problem on design of governer.
8. Engine testing as per BIS code–various tests; Drawbar performance in the lab; PTO test and measure the tractor power in the lab/field.
9. Visit to tractor testing centre / industry.

Text Books / References

1. A. Kolchinand V.Dominov. (1984) .Design of Automotive Engines. Mir Publications, Moscow.
2. B.J.Liljedahl, P.K. Turnquist, W.D. Singhand Hoki, Makato. (1989). Tractorandthere Power Units, Fourth Edition, Avi Publication, New York.
3. C.V. Litchy. (1951). Internal Combustion Engines, McGraw Hill Pub., NewYork.
4. V.L. Maleev. (1951). Internal Combusti on Engines, Mc Graw Hill Pub., New York.

Course Outcomes:

At the end of the course, students will be able to

CO 1	Knowledge aboutparameters for balanced design of tractor
CO 2.	Knowledge about various engine components
CO 3.	Knowledge about mechanical power transmission in agricultural tractors
CO 4.	Knowledge about tractor testing
CO 5:	Knowledge about Design of seat and controls of an agricultural tractor

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2,L4	H	L	L	-	M	-	L	-	H	M	-	-	M	-
CO2	L1	M	M	H	L	L	M	L	L	M	L	-	L	M	L
CO3	L3	M	-	M	M	M	M	L	L	H	M	L	M	H	-
CO4	L6	H	L	M	L	-	M	L	M	M	H	L	M	-	M
CO5	L5	H	M	M	L	H	-	-	H	L	L	-	-	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO4, CO5

BTAGPEC 802: HYDRAULIC DRIVES AND CONTROLS

Course Objective:

Basic knowledge of hydraulic system of tractor its operation and maintenance Detailed information of different components of hydraulic system and construction of hydraulic circuits. Selection criteria of different hydraulic components. Common calculations for load and capacity of the system components.

Course Contents:

Unit-I **Principles of Hydraulics:** Hydraulic Basics: Pascal'sLaw, Flow, Energy, Work, and Power. Working of Hydraulic Systems, Open centreand close centre hydraulic systems, Reservoirs, Strainers and Filters, Filtering Material. Types of hydraulic Fluid and their properties.

Unit-II **Pumps:** Pump Classifications, selection, Performance, Displacement, Gear Pumps, Vane Pumps, Piston Pumps, Pump Operation. Hydraulic Actuators: Cylinders-displacement, Construction and Applications, Semirotary actuators.Simple numerical problems on pumps.

Unit-III **Hydraulic Motors. Accumulators:** Types and working.Fittings and Connectors. Hydraulic valves: Pressure-Control Valves, Directional-Control Valves, Flow-Control Valves, Valve Failures and Remedies, Valve Assembly.

Unit-IV **Hydraulic Trouble shooting:** Tractor hydraulics, nudging system, ADDC. Use of Hydraulics and Pneumatics drives in agricultural systems. Maintenance of hydraulic system.

Practical

1. Introduction to Hydraulic Systems.
2. Study of Hydraulic Pumps.
3. Study of Hydraulic Actuators.
4. Study of Hydraulic Motors.
5. Study of Hydraulic Valves.
6. Maintenance of hydraulic system.
7. Hydraulics in Tractors.
8. Pneumatics in Agriculture.

TextBooks/References

1. Lilijedahl, B.J., Turanquist, P.K.SmithW.D. and Hok:Makoto,1989. Tractors and their power unity.AG publication, fourth edition, NewYork.
2. Michael, J.P. and John., G.A. 1989. Power Hydraulics, Prenlice Hall, NewYork.
3. Fundamentals of service,, FOS‟, Hydraulics, Johndeere and company, Moline.
4. Singh Kirpal, Automobile Engineering Part I, Standard Publishing Distributors, Delhi.

BTAGPEC 802: PRECISION AGRICULTURE AND SYSTEM MANAGEMENT

Course Objective:

The Student will get familiarize with different equipment for precision agriculture. The student will be able to know use of GIS for precision agriculture along with application to PERT and CPM for machinery system management.

Course Contents:

Unit-I Precision Agriculture: Need and functional requirements. Familiarization with issues relating to natural resources. Familiarization with equipment for precision agriculture including sowing and planting machines, power sprayers and land clearing machines.

Unit-II Familiarization with equipment for precision agriculture including laser guided land levellers, straw-chopper, straw-balers, grain combines, etc.

Unit-III Introduction to GIS based precision agriculture and its applications. Introduction to sensors and application of sensors for data generation. Data base management.

Unit-IV System concept. System approach in farm machinery management, problems on machinery selection, maintenance and scheduling of operations. Application to PERT and CPM for machinery system management.

Practical

1. Familiarization with precision agriculture problems and issues.
2. Familiarization with various machines for resource conservation.
3. Solving problems related to various capacities, pattern efficiency, system limitation, etc.
4. Problems related to cost analysis and inflation and problems related to selection of equipment, replacement, break-evenanalysis, time value of money etc.

SuggestedReadings

1. Kuhar John.E.1977. The Precision Farming Guide for Agriculturist.LoriJ. Dhabalt, USA.
2. Dutta S.K. 1987. Soil Conservation and land management, International distributors, Dehradun.
3. Sigma and Jagmohan.1976Earth Moving Machinery,Oxford & IBH.
4. DeMess M.N.Fundamentals of Geographic Information System,John Willy and Sons, NewYork.
5. HuntD.1977. Farm Power and Machinery Management,Iowa State University Press.
6. Sharma D.N. and S.Mukesh, 2013.Farm Power and Machinery Management, VolIst, Jain Brothers.
7. Stuart Wood,1977. Heavy Construction Equipment and Method,Prentice Hal

Course Outcome:

At the end of this course students will be able to

CO1	Familiarization with equipment for precision agriculture including sowing and planting machines, power sprayers and land clearing machines
CO2	Familiarization with equipment for precision agriculture
CO3	Knowledge about application of sensors for data generation
CO4	Apply the knowledge to PERT and CPM for machinery system management.
CO5	Knowledge about systematic approach in farm machinery management

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	H	L	M	H	H	M	M	M	-	M	M	M	L	-
CO2	L2	M	M	H	H	L	L	-	-	L	M	-	-	M	-
CO3	L2	H	L	H	M	M	L	L	L	-	L	L	-	M	-
CO4	L1	M	M	H	M	L	M	M	M	M	L	-	L	H	L
CO5	L4	H	H	M	-	-	M	H	-	H	M	-	M	L	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	CO2,CO3

BTAGPEC 802: HUMAN ENGINEERING AND SAFETY

Course Objective:

The student will have knowledge of various human factors in systemdevelopment, importance of anthropometry in utilization of work space, heat exchange process and performance and safety gadgets for different farm operations.

Course Contents:

Unit-I Human factors in system development: Concept of systems; basic processes in system development, performance reliability, human performance. Information input process, visual displays, major types and use of displays, auditory and factual displays.

Unit-II Speech communications, Biomechanics of motion, types of movements, Range of movements, strength and endurance, speed and accuracy, human control of systems.

Unit-III Human motor activities, controls, tools and related devices. Anthropometry: Arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution

Unit-IV Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.

Practical

1. Calibration of the subject in the laboratory using bi-cycle ergo-meter.
2. Study and calibration of the subject in the laboratory using mechanical treadmill.
3. Use of respiration gasmeter from human energy point of view.
4. Use of Heart Rate Monitor.
5. Familiarization with anthropometric measurements of as elected subjects.
6. Optimum workspace layout and locations of controls for different tractors.
7. Familiarization with the noise and vibration equipment.
8. Familiarization with safety gadgets for various farm machines.

Suggested Readings

1. Chapanis A.1996.Human Factors in System Engineering. JohnWiley & Sons, NewYork.
2. DulJ.and Weerdmeester B.1993.Ergonomics for Beginners.A Quick Reference Guide.Taylor and Francis, London.
3. Mathews J.and Knight A.A.1971. Ergonomics in Agricultural Equipment Design. National Institute of Agricultural Engineering.
4. Astr and P.And and RodahlK. 1977. Textbook of Work Physiology. McHill Corporation, New York.
5. Mark S.S Anders and Ernest James Mc Cormick.1993.Human Factors in Engineering and Design. McHill Corporation, NewYork.
6. KeeganJJ, RadkeAO.1964. Designing vehicle seats for greater comfort. SAE Journal; 72:50~5.
7. Yadav R, Tewari V.K.1998. Tractor operator workplace design-are view. Journal of Terra mechanics 35:41-53

BTAGPEC 802: PRECISION FARMING TECHNIQUES FOR PROTECTED CULTIVATION

Course Objective:

The student will gain knowledge of need, design and construction of Greenhouse. The student will be able to demonstrate the abilities to operate greenhouse by having the knowledge of rootmedia, instrumentation, fertilization, and other operating parameters.

Course Conetnts:

Unit-I **Protected cultivation:** Introduction, History, origin, development, National and International Scenario, components of greenhouse, perspective, Types of greenhouses, polyhouses/shednets, Plant environment interactions – principles of limiting factors, solar radiation and transpiration, greenhouse effect, light, temperature, relative humidity, carbondioxide enrichment.

UnitII Design and construction of green houses: Site selection, orientation,design, construction, design for ventilation requirement using exhaustfan system, selection of equipment, Greenhouse cooling system –necessity, methods– ventilation with roof and sideventilators ,evaporative cooling, different shading material fogging, combined fogging and fan-pad cooling system, maintenance of cooling andventilation systems, pad care etc. Greenhouse heating – necessity, components, methods.

Unit-III Rootmedia – types–soil and soilless media, composition, estimation, preparation and disinfection, bed preparation. Planting techniques in green house cultivation. Irrigation in greenhouse and net house – Waterquality, types of irrigation system, components, installation and material requirement. Fogging system for green houses and net houses–introduction, benefits, design, installation and material requirement. Maintenance of irrigation and fogging systems.

Unit-IV **Fertilization:** Nutrient deficiency symptoms and functions of essential nutrient elements, principles of selection of proper application of fertilizers, fertilizer scheduling, rate of application of fertilizers, methods, automated fertilizer application. Greenhouse climate measurement, control and management. Insect and disease management in greenhouse and net houses Selection of crops for greenhouse cultivation, major crops in greenhouse – irrigation requirement, fertilizer management, cultivation, harvesting and postharvest techniques; Economic analysis.

Practical

1. Estimation of material requirement for construction of greenhouse.
2. Estimation of material equirement for preparation of root media; Root media preparation, bed preparation and disinfections.
3. Studyof different planting techniques.
4. Design and installation of irrigation system.
5. Study of different greenhouse environment control instruments.
6. Study of operation maintenance and fault detection in irrigation system.
7. Economic analysis of greenhouses and net houses.
8. Visit to green houses.

Suggested Readings

1. Salokhe V.M. and Ajay Kumar Sharma 2006.Greenhouse: Technology and applications. Agrotech Publishing Academy, Udaipur (Raj) ISBN No. 81-8321-057-0
2. Singh Brahma and Balraj Singh.2014.Advances in protected cultivation, New India Publishing Company.
3. Sharma P.2007.Precision Farming. Day a Publishing House New Delhi.

Course Outcome:

At the end of the course, a student will be able to –

CO1	Develop concept of greenhouse technology, types of green houses and construction of green houses.
CO2	Create knowledge of Green house equipment's and its Irrigation System.
CO3	Rootmedia – types–soil and soilless media, composition, estimation, preparation and disinfection, bed preparation
CO4	Greenhouse climate measurement, control and management. Insect and disease management in greenhouse and net houses
CO5:	Knowledge about Economic Analysis

Course Delivery Methods (CD)	
CD1	Lecture by use of boards / LCD projectors / OHP projectors
CD2	Tutorials / Assignments
CD3	Seminars
CD4	Self – Learning advice using internet
CD5	Industrial Visit / Field Visit

Mapping between Programme Outcomes (POs) and Course Outcomes (Cos)

Course Outcome	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L6	M	-	L	H	L	M	-	L	H	M	L	H	H	M
CO2	L6	H	L	M	L	-	M	L	-	L	H	L	M	M	H
CO3	L2	L	M	-	H	L	L	-	H	M	L	M	L	M	-
CO4	L5	H	M	L	-	L	M	H	M	-	M	L	H	H	M
CO5	L4	H	M	-	M	L	-	-	M	M	H	H	M	-	H

H- High, M- Moderate, L- Low "-" for no correlation

Mapping between Cos and CD

CD	**Course delivery Method**	**Course Outcome**
CD1	Lecture by use of boards / LCD projectors/ OHP projectors	CO1, CO2, CO3
CD2	Tutorials / Assignments	CO4, CO5
CD3	Seminars	CO4, CO5
CD4	Self – Learning advice using internet	CO1, CO2, CO4
CD5	Industrial Visit / Field Visit	CO2, CO5

BTAGPEC 802: PESTICIDES APPLICATION AND EQUIPMENT

CourseObjective: At theendofthecourse, the studentwillbeable to:

Knowledge of pesticide application machineries. Operation, repair and maintenance of pesticide application equipments. Assessment of performance and safety during use of pesticide application equipments.

Course Contents:

Unit-I Fundamentals of pesticide application, sprayers-manually and power operated-types-construction operations, calibration, Introduction to electrostatic and ULV sprayers.

Unit-II Air assisted sprayers, High clearing sprayers, Dusters: manually and power operated-types-construction, operation, calibration.

Unit-III Atomizing devices, nozzles, types, flow rates, spray angles, droplet size, agitations of spray material, Arial spray application-limitation and advances, air crafts spraying and dusting equipment. Measurement of efficiency of pesticide application-collection and measurement of droplets- determination of vmd.

Unit-IV Factors for selection of sprayer/duster and planning pesticide application. Safety in pesticide application-selection of pesticide –storage and handling of protective devices.

Practicals

1. Studyof various types of nozzles
2. Studyof manually operated sprayers.
3. Studyof power operated sprayers
4. Studyof manually operated dusters.
5. Study of power operated dusters.
6. Calibration of sprayers.
7. Calibration of dusters.
8. Testing of different types of nozzles.

TextBooks/References

1. R. Bainer, E.L.Barger and R.A. Kepner, (1979), principals of Farm Machinery.John Wiely & Sons, Inc, NewYork.
2. H. Singh and O. S. Bindra, (1980), Pesticides and Application Equipment, Oxford & IBM Publication co.
3. P.R. Mathew, Pesticides Application and Equipment.

Course Outcomes:

At the end of this course students will be able to

CO 1:	Knowledge about electrostatic and ULV type sprayers
CO 2:	Knowledge about commercial manual sprayers and power operated sprayers
CO 3:	Learning of calibration procedures of sprayers and dusters
CO 4:	Testing of different types of nozzles
CO5:	Knowlwdge about selection of pesticide –storage and handling of protective devices.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L5	H	-	M	H	-	-	M	M	-	H	M	H	-	H
CO2	L3	H	H	M	H	M	H	H	H	-	H	-	H	M	M
CO3	L2, L3	H	-	L	-	H	L	H	-	H	H	-	-	H	-
CO4	L2, L3	H	H	H	H	-	H	H	M	M	H	-	H	M	H
CO5	L4,L5	H	M	M	-	-	H	H	M	L	-	-	M	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between Cos and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO1, CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO1, CO2, CO5

BTAGPEC 802: PHOTO VOLTAIC TECHNOLOGY AND SYSTEMS

Course Objective:

The course is designed to generate awareness on fundamentals of solar p-v systems and basic know how about p-v technology and power generation.

Course Conetns:

Unit-I Solar PV Technology: Advantages, Limitations, Current Status of PV technology, SWOT analysis of PV technology. Types of Solar Cell, Wafer based Silicon Cell, Thin film amorphous silicon cell Thin Cadmium Telluride (CdTe) Cell, Copper Indium Gallium Selenide (CiGS) Cell, Thin film crystalline silicon solar cell.

Unit-II Solar Photo Voltaic Module: Solar cell, solar module, solar array, series & parallel connections of cell, mismatch in cell, fill factor, effect of solar radiation and temperature on power output of module, I-V and power curve of module.

Unit-III Balance of Solar PV ystem: Introduction to batteries, battery classification, lead acid battery, Nicked Cadmium battery, comparison of batteries, battery parameters, Charge controller: types of charge controller, function of charge controller, PWM type, MPPT type charge controller.

Unit-IV Converters: DC to DC converter and DC to AC type converter. Application of Solar PV system. Solar home lighting system, solar lantern, solar fencing, solar street light, solar water pumping system, Roof top solar photovoltaic power plant and smart grid.

Practical

1. To study of V-I characteristics of solar PV system
2. To demonstrate the I-V and p-V characteristics of PV module with varying tradition and temperature level
3. To demonstrate the I-V and p- Vcharacteristics of series and parallel combinations of PV Module
4. To show the effect of variation in tilt angle on PV module power
5. To study smart grid technology and application.
6. To study manufacturing technique of solar array, different DC to DC and DC to AC converter.
7. To study domestic solar lighting system.
8. To study various solar module technologies.

SuggestedReadings

1. Rai GD.1998. Non-conventional Sources of Energy. Khanna Pub.
2. Rathore N.S., Kurchania A.K., Panwar N.L.2006. Renewable Energy: Theory & Practice, Himanshu Publications,.
3. SolankiC.S.2011.Solar Photovoltaic: Fundamentals, Technologies and Applications, PHI Learning Private Ltd.
4. Meinel & Meinel. Applied Solar Energy.
5. Derrick, Francis and Bokalders, Solar Photo-voltaic Products.

BTAGPEC 802: WASTE AND BY-PRODUCTS UTILIZATION

Course Objective:

The course is designed to generate awareness on recycling and energy recovery from different wastes and by-products from households, municipal or industrial sectors. It is useful in creating confidence on reduced dependence of fossil fuel-based economy.

Course Contents:

Unit-I Types and formation of by-products and waste: Magnitude of waste generation in different food processing industries; Environmental performance of food industry to comply with ISO-14001 standards.Waste utilization in various industries, furnaces and boilers run on agricultural wastes and by-products. Biological and chemical oxygen demand from different food plant waste, other chemical impurities in industrial wastes like metallicion, additives, and microbial load, etc.

Unit-II Waste water management and effluent treatment, Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste water, other ingredients like insecticide, pesticides andfungicides residues in waste water.

Pre-treatment of Waste Water: Single dwelling unit, aseptic tank, Primary treatment: sedimentation, coagulation, flocculation and floatation, Secondary treatments:– trickling filters, oxidation ditches, activated sludge process,rotating biological contractors, lagoons, Advanced treatment process. Final Treatment Solid processing

Unit-III Concept, scope and maintenance of Solid Waste treatment and disposal, Assessment, treatment and MSW management Land filling. Effluent treatment plants in Industries.

Unit-IV Uses of different agricultural by-products from rice mill,sugar cane industry, oilmill, etc.

Bioconversion Technology: Organic manure, Vermi-composting, Biogas generation: design, construction, operation and management of institutional community and family size biogas plants, Biogas utilization briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization.

Practical

1. Determination of temperature, pH, total Solid in waste water.
2. BOD and COD analysis of waste water.
3. Determination of ash content of a gricultural wastes and determination of un-burnt carbon in ash.
4. Study about briquetting of agricultural residues.
5. Estimation of excess air for better combustion of briquettes.
6. Study of extraction of oil from rice bran.
7. Study on bioconversion of agricultural wastes.
8. Visit to various industries using waste and food by-products.

SuggestedReadings

1. Markel, I.A.1981. Managing Livestock Waste, AVI Publishing Co.
2. Pantastico, ECB.1975. PostHarvest Physiology, Handling and utilization of Tropical and Sub-tropical fruits and vegetables, AVIPub.Co.
3. Shewfelt, R.L. and Prussi, S.E. 1992. Post-Harvest Handling – A Systems approach, Academic Press Inc.
4. USDA.1992.Agricultural Waste Management Field Handbook. USDA, Washington DC.
5. Weichmann J. 1987. Post Harvest Physiology of vegetables, Marcel and Dekker Verlag.
6. V.K. Joshi & S.K. Sharma. Food Processing Waste Management: Treatment & Utilization.New India Publishing Agency.
7. Vasso Oreo poulou and Winfried Russ (Edited).2007.Utilization of By-products and Treatment ofwaste in the Food Industry. Springer Science & Business media, LLC233 NewYork.
8. Prashar, Anupama and Bansal, Pratibha. 2007-08. Industrial Safety and Environment. S.K.Kataria and sons, New Delhi
9. Garg, S K. 1998. Environmental Engineering (Vol. II) – Sewage Disposal and Air Pollution Engineering. Khanna Publishers, New Delhi
10. Bhatia, S.C. 2001. Environmental Pollution and Control in Chemical Process Industries. Khanna Publishers, New Delhi.

Course outcome-

At the end of course, students will be able to

CO1:	Know different types and formation of by-products and waste
CO2:	Knowledge about waste water management and effluent treatment
CO3:	Knowledge about maintenance of Solid Waste treatment and disposal
CO4:	Uses of different agricultural by-products from rice mill,sugar cane industry, oilmill
CO5:	Knowledge about Generation of electricity using surplus biomass

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/Cos	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	H	H	M	M	M	H	H	H	M	H	-	-	M	L
CO2	L1,L5	H	H	M	M	H	H	M	L	L	L	M	M	L	M
CO3	L2,L6	M	M	H	H	L	H	M	L	L	M	L	M	M	M
CO4	L1	H	M	H	M	M	L	H	L	L	L	L	L	H	-
CO5	L3,L5	H	M	L	-	M	L	-	M	H	H	-	-	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO2,CO3, CO5

OpenElectivesto beofferedin8th Semesterwithcode BTAGOE….

(for AgriculturalEngineeringonly)

BTAGOE803: WASTE MANAGEMENT IN URBAN AREA

Course Objectives:

To impart the knowledge and Problems of National & global scenario of solid waste management, knowledge of solid waste seperation, collections, transfer and transport and Analysis of solid waste & chemical characteristic of refuse.

Course Contents:

Unit –I **Generation of Solid Waste:** Objectives of solid waste management, Classification of solid waste. Activities associated with generation of solid waste, quantity of waste generation, factors affecting solid waste generation.Problems associated with Urban Waste Disposal. National & global scenario of urban waste management.

Unit-II **Types of Urban Waste:** Sources of solid waste. Food & biodegradable waste, recyclable waste. Hazardous waste. Solid Waste Management Approach: Waste Collections, Transfer and Transport. Storage of waste at source & source separation of waste. Primary collection of waste, secondary storage of waste. Waste storage depot.Transportation of waste.

Unit-III **AnalysisofUrbanWaste:** Need for physio-chemical analysis of municipal solid waste. Physical characteristic of refuse: specific weight & category analysis.

Chemical Characteristic of Refuse: Determination of moisture content, volatile solid, pH, carbon, nitrogen, phosphorus, potassium & calorific value.Estimationofsolidwastegeneration. Composting & incineration, their advantages & disadvantages.

Unit-IV **Sanitary Land Filling:** Introduction, approach to design of sanitary land filling.Typical component of land-fill cover.Various guidelines for design of land-fill. Trench of municipal solid waste disposal. Environmental quality monitoring at land-fill site.Recommendation for problems of municipal solid waste.

Practical: As per theory syllabus.

Suggested Books & References

1. G.Techobanogious, H.Theisen & R. Blassen,'Solid Waste Engineering, Principles and Management Issues‟, McGraw Hills, Book Co.NewYork.
2. C.L.Mentell,'SolidWasteManagement,'JohnWhely, New York.
3. Bhide&Sundrashen,'SolidWasteManagementinDevelopingCountries'.

Course Outcome:

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

CO1:	Demonstrate knowledge of Problems & National & global scenario of solid waste management.
CO2:	Demonstrate knowledge of solid waste seperation, collections, transfer and transport.
CO3:	Analysis of solid waste & chemical characteristic of refuse.
CO4:	Understand composting and incineration.
CO5:	Understand sanitary land filling.
CO6:	Monitor effects of solid waste on environment.

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

Course outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	L	M	L	M	M	L	M	L	L	M	H	H	L	M
CO2	L3	H	L	M	M	L	L	M	H	M	H	M	H	-	H
CO3	L4	M	L	M	M	M	M	L	L	M	L	H	H	M	M
CO4	L2	M	M	M	L	M	L	M	L	M	M	M	H	-	H
CO5	L2,L3	L	L	M	-	L	L	M	L	M	L	M	M	M	M
CO6	L2	M	M	M	L	M	L	M	L	M	M	M	H	-	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO6
CD3	Seminars	CO3, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit / Field visit	CO5, CO6

BTAGOE803: MANAGEMENT INFORMATION SYSTEM

Course Contents:

Unit-I Introduction: MIS concept, Definition, role & Impact of MIS, Process ofmanagement,organizationstructure&behaviour.BasicofManagementInformationSystem:DecisionMaking,Informationconcepts.

Unit-II Systemconcepts & control, Typesofsystem,handlingsystemcomplexity, System development model.DevelopmentofManagementInformationSystem: Requirement andimplementationofMIS,ChoiceofinformationTechnologyforManagementInformationSystem.

Unit-III ApplicationofManagementInformationsystem:Applicationinmanufacturingsectorusing forpersonalmanagement,financialmanagement,ProductionManagement,MaterialManagement,Marketing ManagementApplicationinServiceSector.

Unit-IV EnterpriseResourcePlanning(ERP):EMS,ERP,Benefitsimplementation, EMS & MIS. E-Business Security and control: Threat ofaccidentsand Malfunctions, Threat of Computer Crime, Factors thatincreasetheRisks,MethodsofMinimizing Risk.

TextBooks/References

1. "ManagementInformationSystem", W.S.Jawadekar,TataMcGrawHill.
2. "ManagementInformation",Loudon&Loudon,PearsonEducationAsia.
3. "InformationSystems",StevenAlter,PearsonEducationAsia.

Prerequisite:GoodknowledgeofthesubjectDatabaseManagementsystemsisdesirable

Course Outcome:

At theendofthecourse,the studentwillbeable to:

CO1:	IdentifyandunderstandthenatureofMISinanorganization.
CO2:	Understandandaddresstheissueofinformationrequirement,information collection and decidability.
CO3:	IdentifytypesofMISsystemsandabilitytoreducecomplexityofsystems.
CO4:	IdentifythemasterdatainPersonnel,Finance,Production,MaterialandMarketing.
CO5:	UnderstandthestepsforimplementationofEnterpriseResourcePlanning(ERP).

BTAGOE803: ADVANCE SURVEYING

Course Objective:

Upon completion of this course the students will be familiar with:

- To study about various Advance surveying instruments and techniques
- To study about EDM,Total Station, GPS, DGPS, Aerial Photogrammetry,GIS,3D Laser scanner etc.

Course Contents:

Unit –I **Geodetic Surveying:** Introduction & object of Geodetic Surveying, Principal & classification of triangulation system, Selection of base lineand stations, Orders of triangulation-triangulation figures, Station marks and signals-marking signals, Examples on Phase error, Extension ofbase, reduction ofcentre,selection and marking of stations

Traversing: Theory and principles associated with traversing, Balancingoftraverse,Numerical examples related to traversing and joins.

Unit-II Modern Surveying Instruments and Techniques: Principles of EDM-electronic distance measurement technique, Electronic theodolite and total station; Concept and definition of Digital Terrain Models (DTM); LIDAR (Light detection and ranging)-introduction, concept, overview, structure, classification, application and data processing. 3D laser scanner, its working principal and uses in surveying.

Introduction to mapping, estimation of area and volume, tonnage/ volume calculation.

Unit-III Global Positioning Systems (GPS):Principle of GPS measurements,various applications of GPS; adjustment/calibration and care of Differential GPS; Various modes of observations; transformation from one system to another system of coordinates,GPS data processing. Signal structure of GPS, pseudorange and phase observables, recent advances- such as GLONASS, Galileo and GNSS. Differential Global Positioning System (DGPS).

Aerial Photogrammetry: Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problems),Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of aerial survey, overlaps and mosaics, Stereoscopes, Derivation Parallax.

Unit-IV **Geographical Information System (GIS):** Concepts, essential components, data acquisition, raster and vector data, Geo-referencing, topology and spatial relations, data storage verification and editing, database construction, database structure, hierarchical data, network systems, relational database; data manipulation and analysis; Spatial and mathematical operations in GIS, overlay, query based buffers,spatial analysis,Triangulated Irregular Network (TIN),various GIS packages and their salient features.

Practical: As per theory syllabus.

Suggested Readings

1. S.K.Duggal; SurveyingVolume-II; Tata McGraw Hill Publishers, NewDelhi.
2. W.Schofield; Engineering Surveying; Replica Publications Delhi.
3. T.P.Kanetkar/Kulkarni;Survey and Leveling Vol.1, 2 and 3; Vidya Griha Prakashan, Pune.
4. B.C.Punmia /AKJain; SurveyingV ol.1, 2 and 3; Laxmi Publications, NewDelhi

Course outcome:

At the end of course, students will be able to

CO1:	Theory and principles associated with traversing and Geodetic Surveying.
CO2:	Identify the Modern Surveying Instruments and knowing their Techniques
CO3:	Principle of GPS measurements,various applications of GPS
CO4:	Plan and execute various GIS packages and their salient features.
CO5:	Knowledge about Triangular Irregular Network (TIN)

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit / Field visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs):

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	H	-	-	M	H	-	H	-	H	H	M	-	M	M
CO2	L2	H	L	-	H	M	-	M	H	-	H	-	H	-	H
CO3	L1, L2	M	H	M	-	-	M	H	H	M	M	-	M	M	M
CO4	L5, L6	H	H	-	H	M	-	H	-	M	H	-	H	M	H
CO5	L6	M	H	M	H	-	-	H	-	M	L	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping of CO with CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO4
CD2	Tutorials/Assignments	CO1, CO3, CO4
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit / Field visit	CO4, CO5

BTAGOE803: ENTREPRENEURSHIP AND MANAGEMENT

Course Contents:

Unit –I **Entrepreneurship:** Definition and Meaning; Characteristics of Entrepreneurship/Traits of an Entrepreneur; Functions of Entrepreneurship-Job Creation, Innovation, Inspiration, Economic Development; Types of Entrepreneurship, Entrepreneurship and Intrapreneurship, Entrepreneurship Strategy,The Business Plan: Creating and Starting the Venture: The Marketing Plan, The Financial Plan, Sources of Capital; Legal Issues for the Entrepreneur: Patents, Trademarks, Copyrights, TradeSecrets, Licensing, Product Safety and Liability, Insurance; Contracts, Advertising, Supply Chain Management, Retail & FDIProposals & risks: Project Report Preparation (Feasibility, Cost Estimation, CVP Analysis, Detailed Project Report, Concept of Risk and decision making, Risk Management – SWOT etc

Unit-II **Entrepreneurship and Innovation:** The Innovation Concept, Importance of Innovation for Entrepreneurship, Source of Innovation forOpportunities, The Innovation Process, Product life cycle, new product development process, mortality curve, Creativity and innovation in product modification/developmentEntrepreneurship and Economic Development: Role of Entrepreneurship in Modern Economy, Managers Vs Entrepreneurship: Characteristic of Managers, Characteristic of Entrepreneurs, Similarities and differences between Managers and Entrepreneurs

Unit-III Industry, Commerce and Business: Types of ownership in the organization-Definition, characteristics, Merits & Demerits; Single ownership, Partnership, Cooperative Organizations, Joint Stock Companies,Government owned, Differences between Management and Administration, Leadership Models.Industry Size & Current schemes: Micro, Small, Medium- Industry; Registration Process, Current Promotional Schemes for new Enterprise

Unit-IV Function of Management: Planning- Types of Planning-Strategic Plan, Tactical Plan and Operation Plan; Organizing-Definition and Meaning, Types of Organizing; Staffing- Definition and Meaning, Types of Staffing – Internal & External, the Basic Steps in the Staffing Process; Directing (Leading) - Definition and Meaning; Controlling-Definition and Meaning, Relationship between Planning and Controlling.

Social Responsibility:

Social Obligation, Social Responsiveness and Social Responsibility, Managerial Ethics.

Practical: As per theory syllabus.

TextBooks/References

1. Entrepreneurship Development and Management, A.K.Singh, Jain Book Agency (JBA) publishes, New Delhi
2. Small Scale Industries and Entrepreneurship,Vasant Desai, Himalaya 2008
3. Industrial Engineering and Management, O.P.Khanna, Dhanpat Rai and Sons, Delhi
4. Industrial Management and Entrepreneurship, V. K. Sharma, Scientific Publishers, NewDelhi.

Course Outcome:

Upon completion of this course the students will be familiar with:

CO1:	Selection and development of a small or medium business idea
CO2:	Make and Implement project proposals and reports to hunt for venture capital etc.
CO3:	Market competition and innovation in products and processes.
CO4:	Develop managerial skills to achieve goals, & Plan and implement projects applying management techniques.
CO5:	Understand social responsibility as a modern management concept.

BTAGOE803: FUNDAMENTALS OF ELECTRONICS IN AGRICULTURE

Course Objectives: Students will be able to

- To study about designing of simple digital circuits like adder, substractor, etc.
- To study about the working principle of various agro-sensors
- To understand simple programs for 8085
- To understand simple programs for 8051

Course Contents:

Unit –I Introduction to Digital Electronics: Introduction to Logic Gates, Introduction to Logic Families, K-Map, Combinational circuits: Half adder, Full adder, Full-Subtractor, Sequential circuits: S-R flipflop, D flip-flop, JK flip flop, Master slave JK flipflop and T flipflop, Introduction to data-loggers.

Unit-II Introduction to Sensor Basic requirements of sensors: Classification of sensors. Principles of Displacement Sensors, Opticalsensors, Photo electric sensor, Hall Effect Sensor, Ultra sonic sensor,Resistive sensor, Thermo-sensors, Humidity, Moisture, pH, Dielectric and NPK sensors.

Unit-III Introduction to 8085 Microprocessor: The 8085 Microprocessor-pins & their description, de-multiplexing of buses, control signals & flags Instruction & Timings: Instruction classification, instruction formats, addressing modes, Instruction timings and status.Interrupts.

Unit-IV Introduction to 8051 Microcontroller: The 8051 Microcontroller: Introduction, The 8051 microcontroller hardware. I/O pins, Port, Externalmemory. Countersand Timers, Serial data.Interrupts. 8051AssemblyLanguage Programming: Addressing modes, External data moves, pushand pop opcodes, Logical operations, and Byte level and bit level logicaloperations.Arithmetic operations, Jump and call instructions, Interrupts & returns.

List of Experiments

1. Develop an assembly language code in 8085 to perform the addition and subtraction of two 8-bit numbers.
2. Develop an assembly language code in 8085 to perform the addition of 10 consecutive 8-bit numbers stored in memory starting from address 2000H.
3. Develop an assembly language code in 8085 to find out the largest and the smallest number from an array of data using the concept of subroutine.
4. Develop an assembly language code in 8085 to arrange an array often 8-bit numbers in ascending and descending order.
5. To Study and analyze the interfacing of ultrasonic sensor
6. To Study and analyze the interfacing of potentiometer.
7. To Study and analyze the interfacing of humidity sensor
8. To Study and analyze the interfacing of pH sensor.
9. To Study and analyze the interfacing of NPK sensor.

10. To Study and analyze the interfacing of dielectric sensor.

Reference/TextBooks

1. R.S.Gaonkar, Microprocessor Architecture, Programming and applications with the 8085/8080A, Wiley Eastern Ltd., 2nd ed /Updated edition.
2. Aditya P. Mathur., Introduction to Microprocessor, 3rd ed., Tata Mc Graw, Hill Publishing Company Limited, New Delhi.
3. John Vetelino, Aravind Reghu, Introduction to Sensors, 1st Edition, CRC Press.
4. MorrisMano, Digital logic& ComputerDesign 2006 PHI.
5. Mohammed Ali mazidi, Janice Gillespie, 8051 micro controller and embedded system, Pearson Publication

Course Outcome:

At the end of the course, a student will be able to–

CO1:	Design simple digital circuits like adder, substractor, etc.
CO2:	State the working principle of various agro-sensors
CO3:	Write simple programs for 8085
CO4:	Write simple programs for 8051
CO5:	Learn about Byte level and bit level logical operations

Course Delivery Methods (CD)	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping between Programme Outcomes (POs) and Course Outcomes (COs)

POs/COs	Blooms Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	LI,L4	H	M	-	-	L	L	M	L	M	M	-	-	L	-
CO2	L3	H	M	L	-	L	-	L	M	-	M	M	M	-	M
CO3	L2,L4	M	L	L	-	-	H	M	-	L	M	M	L	-	-
CO4	L3,L2	H	L	M	L	M	M	M	M	L	M	L	M	-	-
CO5	L5	H	L	-	H	-	M	H	-	H	H	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Experiments, Seminars	CO2, CO3, CO4
CD4	Self- learning advice using internets	CO3, CO5
CD5	Industrial visit	CO4, CO5

BTAGOE803: POWER CONVERTERS

Course Contents:

Unit –I **Converters:** Performance measures of single and three-phase converters, discontinuous conduction in two quadrant converters, powerfactorimprovements: Extinction angle control, symmetrical angle control, pulse width modulation control, and sinusoidal pulse width modulation control.

Unit-II **Cycloconverter:** Basic principle of operation, single phase to single phase, three phase to three phase and three phase to single phase cyclo converters, Output equation.

Unit-III **Choppers:** Principle of chopper operation, control strategies, step-upchopper, reversible chopper, Steady state time domain analysis of chopper, Chopper configuration, and choppercommutation.

Unit-IV **Inverters:**Inverter classification, Voltages our cethyristorinverters, single phase half and full bridge inverters with auxiliary communicationand with complementary communication, Three phase bridge inverters with 180 mode & 120 mode, Pulse width modulation inverters.

TextBooks/References

1. P.S.Bimbhra.Power Electronics, Khanna Publisher.
2. Berde.PowerElectronics, PHI Publication.
3. P.C.Sen.PowerElectronics, PHI Publication

Course Outcomes:

At the end of the course, a student will be able to–

CO1:	Proficiency in converter system technicalities.
CO2:	Capability in Cyclo-convertersdesign&operation.
CO3:	Competency in choppers design, control & operationalissues.
CO4:	Ability to design different Inverter system.

11. TEACHING-LEARNING PROCESS/ METHODOLOGY (TLM):

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of technical program in a canonical manner. In this context, applications of technical program and linkage with the theory constitute a vital aspect of the teaching-learning process. The course offers many modes of learning and assessment methods. Students have great freedom of choice of course which they can study. The various components of teaching learning process are summarized in the following heads.

1. **Class room Lectures:** The most common method of imparting knowledge is through lectures. There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.
2. **Tutorials:** To reinforce learning, to monitor progress, and to provide a regular pattern of study, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with. Tutorials are also aimed at solving problems associated with the concepts discussed during the lectures.
3. **Practical:** To provide scientific visualization and obtaining results of Technical program in practical sessions. These sessions provide vital insights into scientific concepts and draw learner's attention towards limitations of scientific computations. During practical, scientific models arising in real life problems can also be simulated.
4. **Choice based learning/Open elective:** LOCF in this undergraduate program provides great flexibility both in terms of variety of courses and range of references in each course.
5. **Field based learning:** Students may enhance their knowledge through field based learning while understanding the practical importance.
6. **Textbooks learning:** A large number of books are included in the list of references of each course for enrichment and enhancement of knowledge.
7. **E-learning:** Learner may also access electronic resources and educational websites for better understanding and updating the concepts.
8. **Self-study materials:** Self-study material provided by the teachers is an integral part of learning. It helps in bridging the gaps in the classroom teaching. It also provides scope for teachers to give additional information beyond classroom learning.
9. **Assignment/Problem solving:** Assignments at regular intervals involving applications of theory are necessary to assimilate basic concepts of courses. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.
10. **Internships:** The teaching-learning process needs to be further supported by other activities devoted to subject-specific and interdisciplinary skills, summer and winter internships. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.

11. **Institute visits:** Institute visit by a learner is also a part of learning process. During such visits a learner has access to knowledge by attending academic activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.
12. **Industrial visits:** Industrial visits offer an opportunity to observe applications of scientific concepts. These visits also give an opportunity to realize the power of mathematical ideas and their translation in problem solving.
13. **Training programs:** Training programs organized by various agencies/institutes provide an opportunity to learn various dimensions of courses.

12. ASSESSMENT AND OUTCOME MESUAREMENT METHODS (AOMM):

A range of assessment methods which are appropriate to test the understanding of various concepts of courses will be used. Various learning outcomes will be assessed using time-bound examinations, problem solving, assignments and viva-voce examination. For various courses in this program, the following assessment methods shall be adopted:

i Scheduled/unscheduled tests

ii. Problem solving sessions aligned with classroom lectures

iii. Practical assignments

iv. Regular chamber consultation with faculty members

v. Class Tests and semester end comprehensive examination

Examination and Evaluation:

I. The medium of instructions and examination shall be Bilingual.

II. Candidates shall be examined according to the scheme of examination and syllabus as approved by the BOS and Academic Council from time to time.

III. To pass each semester examination, a candidate must obtain at least 40% marks in each written paper, practical work semester examination.

IV. Each theory paper for the respective semester examination shall be set and evaluation of the answer books shall be done as per the University rules.

V. The assessment of External Evaluation i.e. End Term Semester Examination will be made out of 70 (Seventy) marks in theory Papers and Internal Evaluation of 30 (Thirty) marks.

Criterion for awarding Grading System:

Criterion for Awarding SGPA and CGPA: The criterion for awarding the Semester GradePoint Average (SGPA) and Cumulative Grade Point Average (CGPA) for B.Tech. Program shall be as follows:

a) The criterion for passing in a subject is that a student should secure minimum 40% marks in individual paper.

b) A student obtaining less than pass marks as specified above, in each subject (sum of internal and End-Term examinations) he will be declared fail in that subject and will have to re-appear in a End-Term examination of the course in subsequent odd / even

semester end term examination, subject to maximum permissible period of n+4 semesters to complete the course.

c) The University has adopted Absolute Grading System for converting marks into grades. The formula of 10- point grading system for conversion of marks obtained into Letter Grades and converting Letter Grades to Grade Point is given below:

Table: Marks, Letter Grades and Grade Points

Marks	Letter Grade	Grade Points
91-100	O (Outstanding)	10
81-90	A+(Excellent)	9
71-80	A(Very Good)	8
61-70	B+(Good)	7
51-60	B(Above Average)	6
46-50	C(Average)	5
40-45	P (Pass)*	4
0-39	F(Fail)	0
-	AB (Absent)	0

***Pass Mark: 40% in individual paper**

d) While converting the marks into Letter Grade, the rounding off marks must be considered.

e) A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

f) For noncredit courses "Satisfactory" or Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

Computation of SGPA and CGPA:

The university has adopted UGC recommended procedure for computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

a) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the papers/ courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$\textbf{SGPA}\ (Si) = \Sigma\ (Ci \times Gi) / \Sigma Ci$$

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course. The university shall issue Semester Grade Card to the student.

b) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$\textbf{GPA} = \Sigma\ (Ci \times Si) / \Sigma\ Ci$$

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

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

Illustration of Computation of SGPA and CGPA and Format for Transcripts:

a) Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course/Paper 1	3	A	8	3x8=24
Course/Paper 2	4	B+	7	4x7=28
Course/Paper 3	3	B	6	3x6=18
Course/Paper 4	3	O	10	3x10=30
Course/Paper 5	3	C	5	3x5=15
Course/Paper 6	4	B	6	4x6=24
	20			**139**

Thus, SGPA= 139/20= 6.95

b) Illustration for CGPA

Semester-1	**Semester-2**	**Semester-3**	**Semester-4**	**Semester-5**	**Semester-6**	**Semester-7**	**Semester-8**
Credit: 20 SGPA:6.9	Credit: 22 SGPA:7.8	Credit: 25 SGPA:5.6	Credit: 26 SGPA:6.0	Credit: 26 SGPA:6.3	Credit: 25 SGPA:8.0	Credit: 24 SGPA:8.0	Credit: 26 SGPA:8.0

Thus, CGPA= $\frac{20x6.9+22x7.8+25x5.6+26x6.0+26x6.3+25x8.0+24x8.0+26x8.0}{194}$ = **7.06**

13. TEACHERS TRAINING (TT):

Learning Outcomes Based Curriculum Framework (LOCF) Quality initiative of UGC based on Outcome Based Education (OBE) is being implemented by the University Grants Commission to enhance the Quality of Higher Education and that of Higher Education Learners and Teachers. Therefore, university arrange following activities for teachers training:

1. Workshops for LOCF implementation.
2. Seminar for LOCF implementation.

3. FDP on LOCF.
4. Outcome based higher education and understanding the learning objectives, learning outcomes, new approaches in the area of outcome measurement, preparing future ready teachers and students.
5. Developing a battery of quality speakers/educators to become resource persons to play role for Training of Trainers (TO

14. KEY WORDS:

LOCF, CBCS, Course Learning Outcomes, Employability, Graduate Attributes Communication Skills, Critical Thinking, and Descriptors.

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