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MAHARASHTRA INSTITUTE OF TECHNOLOGY, AURANGABAD

An Autonomous Institute Affiliated to Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra (India)

Third Year B.Tech. Syllabus (Agricultural Engineering) 2023-24

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T. Y. B. Tech. Syllabus Structure w.e.f. 2023-24

Agricultural Engineering

Sr. No	Course Category	Course Code	Course Title	L	T	P	Contact Hr /Wk	Credits	MSE-I	MSE-II	CIE	TA	ESE/ Oral	Total
			Orientation Program (1Day)											
1.1	HSMC	HSM301	Engineering Economics Financial Costing	3	-	-	3	3	15	15	10	10	50	100
1.2	PCC	AED301	Watershed Hydrology and Management	3	-	-	3	3	15	15	10	10	50	100
1.3	PCC	AED302	Irrigation and Drainage Engineering	3	-	-	3	3	15	15	10	10	50	100
1.4	PCC	AED303	Food Process and Preservation Engineering	3	-	-	3	3	15	15	10	10	50	100
1.5	PCC	AED304	Fundamentals of Renewable Energy	3	-	-	3	3	15	15	10	10	50	100
1.6	PCC	AED321	Lab-I: Watershed Hydrology and Management	-	-	2	2	1	-	-	-	25	-	25
1.7	PCC	AED322	Lab-II: Irrigation and Drainage Engineering	-	-	2	2	1	-	-	-	-	25	25
1.8	PCC	AED323	Lab-III: Food Process and Preservation Engineering	-	-	2	2	1	-	-	-	-	25	25
1.9	PRO	PRO321	Lab-IV: Seminar	-	-	2	2	1	-	-	-	-	25	25
1.10	PRO	PRO322	Lab-V: Experience-based learning	-	-	2	2	1	-	-	-	25	-	25
1.11	PCC	AED324	Lab-VI: Development of Skills (Computational)	-	-	2	2	1	-	-	-	25	-	25
S5				15	0	12	27	21	75	75	50	125	325	650
Sr. No	Course Category	Course Code	Course Title	L	T	P	Contact Hr /Wk	Credits	MSE-I	MSE-II	CIE	TA	ESE/ Oral	Total
2.1	PCC	AED351	Soil and Water Conservation Engineering	3	-	-	3	3	15	15	10	10	50	100
2.2	PCC	AED352	Micro Irrigation System Design	3	-	-	3	3	15	15	10	10	50	100
2.3	PCC	AED353	Drying and Storage Engineering	3	-	-	3	3	15	15	10	10	50	100
2.4	PCC	AED354	Green House Technology	3	-	-	3	3	15	15	10	10	50	100
2.5	OEC	AED391	Open Elective-III	3	-	-	3	3	15	15	10	10	50	100
2.6	PCC	AED371	Lab-I: Soil and Water Conservation Engineering	-	-	2	2	1	-	-	-	25	-	25
2.7	PCC	AED372	Lab-II: Micro Irrigation System Design	-	-	2	2	1	-	-	-	25	-	25
2.8	PCC	AED373	Lab-III: Drying and Storage Engineering	-	-	2	2	1	-	-	-	-	25	25
2.9	PCC	AED374	Lab-IV: Green House Technology	-	-	2	2	1	-	-	-	-	25	25
2.10	PRO	PRO371	Lab-V: Major Project-I	-	-	4	4	2	-	-	-	25	25	50
S6				15	0	12	27	21	75	75	50	125	325	650

MSE- Mid Semester Exam, ESE- End Semester Examination, OR- Oral, CIE: Continuous Internal Evaluation, TA: Teacher Assessment, TW: Term work
L- Theory, T- Tutorial, P- Practical, S5-Semster V, S6-Semester-VI

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TY OPEN ELECTIVE-III (ALL)

DEPARTMENT OFFERED	COURSE CODE	COURSE TITLE
Agricultural Engineering	AED391	Fundamentals of Bioenergy
Civil Engineering	CED391	Solid Waste Management
Computer Science and Engineering	CSE391	RHCSA (RedHat Certified System Administration)
Computer Science and Engineering	CSE392	Digital Marketing
Electronics and Computer Engineering	ECE391	Data Science
Electronics and Computer Engineering	ECE392	Control Systems
Electrical Engineering	EED391	Special Purpose Electric Machines
Emerging Science and Technology	AID391	Business Intelligence
Mechanical Engineering	MED391	Industry 4.0
Mechanical Engineering	MED392	Operations Research
Plastic and Polymer Engineering	PPE391	Waste Management and Circular Economy

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Faculty of Science & Technology
Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester V)

Course Code: HSM301 Course: Engineering Economics Financial Costing **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic knowledge of concepts of economics.
Objectives	The objectives of the course are 1.Understanding the principles of economics.2. Analyzing cost-benefit analysis.3. Recognizing the role of markets and competition.4. Understand decision making in uncertainty.5. Getting introduced to Indian taxing system.
Unit-I	**Introduction to Engineering Economics:** Introduction to Economics, Importance and scope of economics in engineering, Economic analysis and its role in project management, Overview of economic principles and concepts relevant to engineering, Micro - and macro- economics, economics of growth and development, Demand and supply analysis. **(6 Hrs)**
Unit-II	**Cash Flow and Time Value of Money:** Interest rates, compounding, and discounting, Present value and future value analysis, Equivalent annual cost analysis. Cash Flow – Diagrams, Categories & Computation, Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis, Calculating Rate of Return, Incremental Analysis. **(6 Hrs)**
Unit-III	**Elements of Managerial Economics:** Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, RR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. **(6 Hrs)**
Unit-IV	**Rate analysis and Tendering:** Rate analysis - Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity. Tendering - Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, penalty and liquidated charges, Settlement of disputes. Bid conditions, alternative specifications, Alternative Bids, Bid process management. **(6 Hrs)**
Unit-V	**Decision-making under Risk and Uncertainty:** Probability and risk assessment in engineering projects, Sensitivity analysis and scenario analysis, Decision trees and expected value analysis, Real options analysis. Depreciation Basic Aspects, Deterioration & Obsolescence, Depreciation and Expenses, Types of Property, Depreciation Calculation Fundamentals, Depreciation and Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation. **(6 Hrs)**

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Unit-VI	**Personal Financial Management:** Insurance, Investment, Insurance Vs investment, Investment types, Equity and debt, Investment options, lumpsum, SIP, STP, Compounding effects of investment, Investment analysis, Introduction to Stock market, fundamental and technical analysis, Derivatives, Types of derivatives, Trading awareness Indian Taxing System, Types of tax: Direct and indirect taxation in India, Excise duty, GST, Income tax introduction, Income Tax calculations, example. **(6 Hrs)**

References

SNo.	Title	Author	Publication	Edition
1.	Economics for Engineers	James L. Riggs, David D. Bed worth, Sabah U. Randhawa	McGraw-Hill	4th
2.	Engineering Economics Analysis	Don Newnan, Ted Eschenbach, Jerome Lavelle	Oxford University Press	14th
3.	Principle of Engineering Economic Analysis	John A. White, Kenneth E. Case, David B. Pratt	Wiley	5th
4.	Engineering Economics	R. Panneerselvam	Prentice Hall India Learning Private Limited	2nd

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Faculty of Science & Technology
Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester V)

Course Code: AED301 Course: Watershed Hydrology and Management **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic knowledge about hydrological cycle and catchment
Objectives	1. To refine the understanding of the patterns and processes of water movement, storage and transformation in the environment. 2. To study the influence of weather in transformation and movement of water on the earth's surface. 3. To study measurement techniques, data sources, analytical methods and theories used to understand flows of water on the earth's surface for watershed management.
Unit-I	**Introduction**- Basic terminologies, scope of hydrology hydrologic cycle, Water balance equation, Instrumentations used for measurement of hydrological data, various hydrological data required for hydrological projects. **(6 Hrs)**
Unit-II	**Precipitation** - forms, types of precipitation, rainfall measurement, mass curve, hyetograph, mean rainfall depth estimation methods, DAD curve, frequency analysis of point rainfall, plotting position, estimation of missing data. **(6 Hrs)**
Unit-III	**Water loss Estimation**- interception, infiltration, seepage, evaporation, transpiration, Evapotranspiration - estimation and measurement. **(6 Hrs)**
Unit-IV	**Runoff** - factors affecting, measurement, stage and velocity, rating curve, extension of rating curve, estimation of peak runoff rate- rational method, Cook' s method, SCS method and volume by Curve Number method. **(6 Hrs)**
Unit-V	**Hydrograph**- Basic terminologies, components, base flow separation, unit hydrograph theory- unit hydrograph of different durations, dimensionless unit hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph. **(6 Hrs)**
Unit-VI	**Geomorphology of watersheds**: Watershed, classifications, basic terminology, Watershed characteristics: stream number, stream length, stream area, stream slope and Horton's laws, Form factor, Circularity ratio, Relief, numerical. **(6 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1	Engineering Hydrology	K. Subramanya	Tata McGraw Hill book Co.	4th
2	Hydrology-Principles, Analysis, Design	H. M. Raghunath	New Age International Pvt. Ltd.	3rd
3	Soil & Water Conservation Engineering	R. Suresh	Standard Publishers, New Delhi	5th
4	Applied Hydrology	K. N. Mutreja	Tata McGraw Hill book Co. New Delhi	4th

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Faculty of Science & Technology Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester V)	
Course Code: AED302 Course: Irrigation and Drainage Engineering **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.
Prerequisite	1 Required basic knowledge of soil mechanics 2.Understand basics of fluid mechanics
Objectives	Water is required for agriculture. Sometimes this requirement is fulfilled by rain, but there are some dry areas where water application to crop is possible only through irrigation. The present study is designed by keeping following objectives in view 1. To introduce the students about various irrigation practices & irrigation management 2. To analyze and design various irrigation systems 3. To inculcate the knowledge about irrigation structures with design 4. To study soil-water-plant relationship and irrigation scheduling
Unit-I	Irrigation Terminologies, Water resources utilization, purpose of irrigation, sources of irrigation water, present status of development and utilization of different water resources of the country. Measurement of irrigation water-Units, Methods of water measurements, weir, notches, flumes and orifices and other methods. **(6 Hrs)**
Unit-II	Water conveyance and Control- Design of irrigation field channels, underground pipe conveyance system, irrigation structures, channel lining. **(6 Hrs)**
Unit-III	Soil–Plant-water relationships - Properties influencing Irrigation, Soil water relation, soil water movement in different conditions, infiltration, soil moisture Characteristics, measurements, plant structure, Terminologies, Evaporation, Potential Evapotranspiration, Net and gross irrigation requirement, Irrigation Efficiency, Irrigation Scheduling & Water management. **(6 Hrs)**
Unit-IV	Water application Methods- Classification, Surface and Subsurface methods of irrigation with design, adaptabilities, its merits, demerits, selection and Design, cost estimation **(6 Hrs)**
Unit-V	Irrigated agriculture, soil salinity and drainage. Causes and effect of water logging, water logging prevention and control, need for land drainage. Inter-relation of irrigation and drainage, formulating drainage criteria under steady and unsteady state and on basis of dynamic equilibrium concept. Reuse of drainage water, Drainage problem of the state. **(6 Hrs)**
Unit-VI	Surface And Subsurface drainage: Surface drainage system and components, factors affecting drainage, types of land requiring drainage, design consideration for surface drainage, design of surface drainage system. Special, Drainage systems: mole drains, vertical drainage, bio drainage. Salt accumulation and its causes, influence of salt on physical properties of soil, Reclamation and management of salt affected soils, Leaching requirement. **(6 Hrs)**

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	Sr. No.	Title	Author	Publication	
References	1	Irrigation Theory & Practice	A.M. Michael	Vikas pub. House, Delhi	2nd
	2	Irrigation Hydraulics	Dr. Radhey Lal	Saroj Prakashan, Allahabad	1st
	3	Land & Water Management Engineering	V. V. N. Murthy	Kalyani Pub. New Delhi	6th
	4	Drainage Engineering	J. N. Luthin	Willey Eastern Publication, New Delhi	2nd
	5	Agricultural Drainage: principles and Practices	U. S. Kadam, R. T. Thokal	Westville Publishing House, New Delhi	1st

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Faculty of Science & Technology Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester V)	
Course Code: AED303 Course: Food Process and Preservation Engineering **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic Knowledge of Food Processing.
Objectives	To study Preservation Methods To prepare Processed food To observe preservation techniques
Unit-I	**Introduction:** Defining food, classification of food, food processing, food preservation. Food preservation and processing, principles and methods of food preservation, blanching, High Temperature Preservation, canning, principle of canning. **(6 Hrs)**
Unit-II	**Low temperature preservation:** Introduction, methods of low temperature preservation, chilling, effect of freezing on constituents of foods, factors affecting refrigerated & frozen storage of foods, refrigeration and cold storage. **(6 Hrs)**
Unit-III	Introduction, purpose, water activity and relative humidity, factors affecting rate of drying and dehydration, drying methods, changes during drying and dehydration, different driers, concentration- methods of concentration, changes, Drying, dehydration and concentration, type of irradiation, factors affecting food irradiation, effect of irradiation. **(6 Hrs)**
Unit-IV	Sugar – Introduction, factors affecting osmotic pressure of sugar solution, foods preserved using sugar, salt: introduction, antimicrobial activity of salt, estimation of salt, food products preserved using salt, Preservation using sugar, salt and acids: mechanism, common foods preserved using acids. **(6 Hrs)**
Unit-V	**Preservation by use of chemicals:** Introduction, objectives, factors affecting antimicrobial activity of preservatives, type of chemical preservatives, sulphur dioxide, benzoic acid, etc, use of other chemicals like acidulants, antioxidants, mold inhibitors, antibodies, Food fermentation: Introduction, methods, common fermented foods. **(6 Hrs)**
Unit-VI	**Effect of processing on nutritional value of food:** Introduction, consuming raw foods, changes during meat grilling, effect of processing on vitamins, effect of processing on minerals, effect of processing on carbohydrates, effect of processing on lipids. **(6 Hrs)**

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	S.No	Title	Author	Publication	Edition
References	1	Preservation of Fruits & Vegetables, Indian	Girdhari Lal, G. S. Siddappa, G. L. Tandon	ICAR Publications 1986	2nd
	2	Food Processing and Preservation	B. Sivasankar	PHI Learning Pvt. Ltd., 2002	3rd
	3	Introduction to Food Processing.	Jelen P.	Prentice Hall, 1985	2nd
	4	Food Processing Handbook	Brennan J.G.	John Wiley & Sons, 2012	4th

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Course Code: AED304 Course: Fundamentals of Renewable Energy **Teaching Scheme:** Theory: 03 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs.

Prerequisite	Basic knowledge of Renewable Energy Sources and biomass utilization
Objectives	1. Agricultural Engineering students must be introduced with various renewable energy sources. 2. Utilization of these sources can be increased in agriculture field. 3. Understand various forms of renewable energy, bio-conversion processes, production of the biomass and various energy potential with current status
Unit-I	Introduction to conventional and non-conventional energy sources, status of energy related to India & world. Solar energy: Classification of RES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of renewable energy sources with non-renewable sources. **(6 Hrs)**
Unit-II	Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages, design consideration Advantages and disadvantages of biogas spent slurry **(6 Hrs)**
Unit-III	Solar Photo voltaic: p-n junctions. Solar cells, PV systems, Stand alone, Grid connected solar power station, advantages, disadvantages, applications. **(6 Hrs)**
Unit-IV	Gasifiers: introduction, types of Gasifiers, Applications, limitations **(6 Hrs)**
Unit-V	Wind Energy: wind energy potential, measurement, various types of wind mills **(6 Hrs)**
Unit-VI	Bio-energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Solar cooker, Solar water heater, Solar Distillation Solar Dryer. **(6 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1	Fundamentals of Renewable Energy Sources	G. N. Tiwari and M. K. Ghosal	Alpha Science International ltd.	1st
2	Solar Energy Utilization	G.D. Rai	Khanna Publishers	5th
3	Renewable Energy Sources	J. W. Twidell and A. Weir	Taylor & Francis,	2nd
4	Solar Energy: Principles of thermal collection and Storage	S. P. Sukhatme, J. Nayak	McGraw-Hill Education	4th
5	Non-conventional energy Sources	G.D. Rai	Khanna Publishers	3rd

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Faculty of Science & Technology Syllabus of T. Y. B. Tech. Agricultural Engineering (Semester V)		
Course Code: AED321 Course: Lab-I: Watershed Hydrology and Management **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 TA: 25 Marks	
Objectives		1. To study the measurements techniques of Hydro-meteorological parameters. 2. To study the fundamental requirement of hydrological projects 3. The subject also intends to make the student familiar about watershed parameters, development and management
List of Practical		1. Study of different types of rain gauges. 2. Determination of Average depth of Rainfall 3. Analysis of rainfall data from rainfall records 4. Estimation of rate of evaporation in a catchment area 5. Determination of infiltration capacity of soil 6. Estimation of Peak runoff rate by Rational method 7. Estimation of peak runoff rate by CN method 8. Development of DRH from runoff data 9. Development of UH from DRH 10. Study of Stage level recorder and Current meter 11. Study of various catchment characteristics 12. Visit to meteorological observatory **Note:** Any 10 number of practical to be performed from the given list

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Faculty of Science & Technology Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester V)		
Course Code: AED322 Course: Lab-II: Irrigation & Drainage Engineering **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 ESE/Oral: 25 Marks	
Objectives		To inculcate the practical knowledge of student regarding measurement, scheduling, methods and efficiencies of irrigation.
List of Practical		1. Measurement of irrigation water 2. Design of underground pipe line system 3. Measurement of infiltration rate 4. Measurement of soil moisture by different soil moisture measuring instruments 5. Computation of evaporation and transpiration 6. Estimation of irrigation efficiencies 7. Study of border irrigation system 8. Study of furrow irrigation system design 9. Field visit for Irrigation water resources and methods of irrigation 10. Determination of chemical properties of soil and irrigation water 11. Design of surface drainage systems and subsurface drainage systems. 12.Determination of drainage coefficient **Note:** Any 10 number of practical to be performed from the given list

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Faculty of Science & Technology Syllabus of T. Y. B. Tech. Agricultural Engineering (Semester V)		
Course Code: AED323 Course: Lab-III: Food Process and Preservation Engineering **Teaching Scheme:** Practical: 2 Hrs./week		Credits: 0-0-1 ESE/Oral: 25 Marks
Objectives		1.To study Preservation Methods. 2.To prepare Processed food 3. To observe preservation techniques
List of Practical		1. Preservation by high concentration of sugar 2. Preservation by using salt 3. Preservation by using chemicals 4. Drying and dehydration of vegetables 5. Demonstration of effect of blanching on quality of foods 6. Fermentation of food 7. Preparation of Jelly 8. Preparation of Sauce 9. Preparation of Cheese 10. Preparation of fermented product 11. Processing of Ice-cream 12. Preservation by using Heat **Note:** Any 10 number of practical to be performed from the given list

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Faculty of Science & Technology Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester V)		
Course Code: PRO321 Course: Lab-IV: Seminar **Teaching Scheme:** Practical: 2 Hrs./week		Credits: 1 ESE/Oral: 25 Marks
Objectives		1. To encourage the students to study advanced engineering developments. 2. To develop skills in doing literature survey, technical presentation and report preparation. 3. To prepare and present technical reports. 4. To encourage the students to use various teaching aids such as power point presentation and demonstrative models.
Guidelines		Each student shall identify a topic of current relevance in his/her branch of engineering, get approval of faculty concerned. To encourage and motivate the students to read and collect recent and reliable information about their area of interest confined to the relevant discipline, from technical publications including peer reviewed journals, conferences, books, project reports etc., prepare a report based on a central theme and present it before a peer audience. Each student shall present the seminar for about 20 minutes duration on the selected topic. The report and the presentation shall be evaluated by a team of faculty members comprising Academic coordinator for that program, seminar coordinator and seminar guide based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
Evaluation		Distribution of marks for the seminar is as follows: i. Topic Selection and Technical Contents: 30 % ii. Presentation: 20%, iii. Ability to answer questions: 20% & iv. Report: 30%). Evaluation is based on rubrics prepared based on above guidelines.

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(Semester V)

Course Code: PRO322 Course: Lab-V: Experienced-based Learning **Teaching Scheme:** Practical: 02Hrs./week	Credits: 0-0-1 TA: 25 Marks

Objectives		On completion of the course, learner will be able to – 1. To promote professional skills and knowledge through hands on experience. 2. To inculcate independent learning by problem solving with social context.
Attributes		The following attributes are necessary in some combination, 1. The goal of experience-based learning involves something personally significant or meaningful to the students. 2. Students should be personally engaged. 3. Reflective thought and opportunities for students to write or discuss their experiences should be ongoing throughout the process. 4. The whole person is involved, meaning not just their intellect but also their senses, their feelings and their personalities. 5. Students should be recognised for prior learning they bring into the process.
Guidelines		**4 Stages of Experiential Learning Cycle** **1. Concrete Experience:** It describes the hands-on experiences that it is learn from. It's here that to try new things, face problems and step out of our comfort zone. 2. Reflective Observation Next, it is needed to reflect to learn from the experiences. The 'reflective observation' phase of the experiential learning cycle is all about reflection on the experiences which include both action and feelings. It is a stage get to reflect on what went right and what could be improved? It's also a chance to observe how it could have been done differently and to learn from each other. **3. Abstract Conceptualization** Once it has been identified and understood the defining characteristics of an experience, it can decide on what can be done differently next time. This is a time for planning and brainstorming steps for success. **4. Active Experimentation** The active experimentation phase of the learning cycle is where the experimentation with the ideas is done. It's time to put the plan of action to the test in the real world. The active experimentation phase of the learning cycle is where there is need to experiment with the ideas. It's time to put plan of action to the test in the real world. Following activities may be performed under experience-based learning. • Role Play • Case Studies

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		• Field Visits • Undergraduate Research • Question generating activity • Fishbowl • Make a Mnemonic • Peer Group Learning • Group 'Change' Projects • Creative Problem-Solving **Assessment:** Assessment will be done through following ways. • Creating a reflective journal or a portfolio • Essay, report, or presentation (could be arts-based, multimedia or oral) on what has been learnt • Short answers to questions of a 'why' or 'explain' nature • One-on-one oral assessments with the instructor • A project that develops ideas further (individually or in small groups) • Self-evaluation and/or group evaluation of a task performed Rubrics shall be prepared for the activities in which the performance is to be evaluated. During process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured. EBL is monitored and continuous assessment is done by mentor and authorities.

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Faculty of Science & Technology Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester V)		
Course Code: AED324 Course: Lab-VI: Development of skills (Computational) **Teaching Scheme:** Practical: 02Hrs./week		Credits: 0-0-1 TA: 25 Marks
Objectives		1. Develop proficiency in programming languages commonly used in agricultural engineering, such as Python MATLAB, CROPWAT, CLIMWAT, AQUACROP, AQUASTAT etc. 2. Acquire skills in data analysis and visualization techniques for extracting insights from large datasets. 3. Understand simulation modeling principles and their application to agricultural systems. 4. Explore the use of computational tools and software in solving real-world agricultural engineering problems. 5. Enhance critical thinking and problem-solving abilities by applying computational skills to agricultural engineering scenarios.
Guidelines		1.Introduction to computational thinking and its applications in agricultural engineering, use of different data set and integrate it into software and finding results for agricultural practices. 2. student expected to learn the different Softwares and use it into different agriculture domains. 3.Prepare a report based on the result including steps of software operating.

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Course Code: AED351 Course: Soil and Water Conservation Engineering **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic knowledge about watershed hydrology and watershed
Objectives	1. Study of soil erosion problems caused by natural erosive agents 2. To study various agronomical and mechanical measures for control soil & water conservation
Unit-I	**Soil erosion** – problems of soil erosion, basic terminologies, causes, types and agents of soil erosion, Factors affecting, water and wind erosion, mechanics of water erosion, classification of water erosion, splash, sheet, rill, gully & stream bank erosion. **(6 Hrs)**
Unit-II	**Soil loss estimation** - universal soil loss equation and modified soil loss equation, determination of their various parameter's rainfall erosivity and erodibility, sedimentation in reservoirs and streams, estimation and measurement, sediment delivery ratio, trap efficiency. **(6 Hrs)**
Unit-III	**Gully Erosion** - gullies and their classification, stages of gully development, principles of gully control, gully control measures, temporary and permanent gully control structures. **(6 Hrs)**
Unit-IV	Erosion control measures- Agronomical measures - contour cropping, strip cropping, mulching, wind erosion- mechanics, wind breaks and shelter belts, mechanical measures - bunds - contour bunds, graded bunds. **(6 Hrs)**
Unit-V	**Terracing** – functions, classifications, level and graded broad base terraces and their design, bench terraces, layout procedure, terrace planning. **(6 Hrs)**
Unit-VI	**Grassed water ways**- basic terminologies, uses, applicability, design aspects, various cross sections, specifications and their design, numerical. **(6 Hrs)**

References

S No.	Title	Author	Publication	Edition
1	Manual of Soil & Water Conservation Engineering	Gurmel Singh, C. Venkataramanan , G. Sastry & B. P. Joshi	Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.	6th
2	Soil & Water Conservation Engineering	R. Suresh	Standard Publishers, New Delhi	4th
3	Soil & Water Conservation Engineering	G. O. Schwab, D.D. Fangmeier, W. J. Elliot & R. K. Frevert	John Wiley & Sons, Inc. New York	3rd

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Faculty of Science & Technology
Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester VI)

Course Code: AED352 Course: Micro Irrigation System Design **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	1 Required basic knowledge of soil mechanics 2.Understand basics of fluid mechanics
Objectives	1. To stress the importance of micro-irrigation methods, design and operation of sprinkler & drip irrigation methods. 2. To emphasis the adoption of micro-irrigation in field & the economics aspects of management
Unit-I	Past, present and future need of micro-irrigation systems, Role of Govt. for the promotion of micro-irrigation in India, Merits and demerits of micro-irrigation system. **(6 Hrs)**
Unit-II	Types and components of micro-irrigation system, Micro-irrigation system- design, design synthesis, Installation and maintenance. (Descriptive & Analytical) **(6 Hrs)**
Unit-III	Sprinkler irrigation - types, planning factors, uniformity and efficiency, Layout Design-laying pipeline, hydraulic lateral, submains and main line design, pump and power unit selection. **(6 Hrs)**
Unit-IV	Drip irrigation – potential, automation, crops suitability. Fertigation – Fertilizer application criteria, suitability of fertilizer, compounds, fertilizer mixing, injection duration, rate and frequency, capacity of fertilizer tank. (Descriptive & Analytical) **(6 Hrs)**
Unit-V	Quality control in micro-irrigation components, design and maintenance of polyhouse, prospects, waste land development –hills, semi-arid, coastal areas, water scarce areas, Benefit and Cost analysis (Descriptive & Analytical). **(6 Hrs)**
Unit-VI	Design of micro-irrigation system for orchard, row crop, hilly terraced land. **(6 Hrs)**

References

S No.	Title	Author	Publication	Edition
1	Irrigation Theory & Practice	A.M. Michael	Vikas pub. House, Delhi	2nd
2	Sprinkle and Trickle Irrigation	Keller, J. and R.D. Bliesner.	Saroj Prakashan, Allahabad	1st
3	Land & Water Management Engineering	V. V. N. Murthy	Kalyani Pub. New Delhi	4th

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Faculty of Science & Technology
Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester VI)

Course Code: AED353 Course: Drying and Storage Engineering **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Student should know about basic concepts of drying and dehydration techniques, moisture contents of various agricultural produce. Students should be aware about traditional storage methods used for long term preservation of agricultural produce
Objectives	1. To learn the principles of drying of crops 2. To develop practical insights into the layout of on-farm drying and storage facilities 3. To understand different storage techniques
Unit-I	Moisture content and methods for determination, principle of drying, theory of diffusion, mechanism of drying- falling rate, constant rate, thin layer, deep bed and their analysis, critical moisture content, different methods of drying including puff drying, foam mat drying, freeze drying, etc. **(6 Hrs)**
Unit-II	Study of different types of dryers- performance, energy utilization pattern and efficiency, study of drying and dehydration of agricultural products. **(6 Hrs)**
Unit-III	Types and causes of spoilage in storage, conditions for storage of perishable products, functional requirements of storage, control of temperature and relative humidity inside storage. **(6 Hrs)**
Unit-IV	Storage of grains: destructive agents, respiration of grains, moisture and temperature changes in stored grains; conditioning of environment inside storage through natural ventilation, mechanical ventilation, artificial drying, grain storage structures such as Bukhari, Morai, Kothar, silo, CAP, warehouse. **(6 Hrs)**
Unit-V	Storage of cereal grains and their products, storage of seeds, hermetically sealed and air-cooled storages-refrigerated, controlled atmosphere, modified atmospheric and frozen storages. **(6 Hrs)**
Unit-VI	Storage condition for various fruits and vegetables under cold and CA storage system. Economic, aspects of storage. **(6 Hrs)**

References

S No.	Title	Author	Publication	Edition
1	Automatic control of food manufacturing	McFarlane Ian	Applied Science Publishers, London	2nd
2	Food Science	Norman and Potter	International Thomson Publishing	5th
3	Post-harvest technology of Cereals, Pulses and Oilseeds	Chakravarti A	Oxford Publishing	3rd

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	4	Unit Operations of Agricultural Processing	Sahay K.M. and Singh K.K.	Vikas Publishing House Pvt. Ltd.	2nd
	5	Controlled atmosphere storage of grains	Shejbal J.	Elsevier Scientific Publishing Co. London	2nd

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Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester VI)

Course Code: AED354 Course: Green House Technology **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic knowledge about soil- plant -water relationship.
Objectives	In view of day- by day increasing population and decrease in cultivated land, it is very important to enhance the agricultural production. In this sense it is important to apply advance technology like greenhouse for getting more from same piece of land. Present syllabus dealing with 1. Design & Construction of Greenhouse 2. Cost estimation for Greenhouse 3. Techno-economic feasibility of Greenhouse
Unit-I	Introduction- History and development of greenhouse, scope of greenhouse technology, its applications in various field, Classifications of green house, advantages of greenhouse. (Descriptive) **(6 Hrs)**
Unit-II	Design of Greenhouse-site selection and orientation, structural design, planning and layouts, requirements for construction, green house covering materials. **(6 Hrs)**
Unit-III	Design-construction of typical greenhouse, design criteria of construction, construction of typical glass greenhouse, construction of pipe framed greenhouse. (Descriptive & Analytical) **(6 Hrs)**
Unit-IV	Systems in greenhouse- Greenhouse irrigation, rules of watering, hand watering, perimeter watering, overhead sprinklers, boom watering, drip irrigation, advanced protected agricultural systems such as plastic mulches, row cover, liquid hydroponics and aggregate hydroponics, fertigation, humidification. (Descriptive & Analytical. **(6 Hrs)**
Unit-V	Environmental factors-plant response to greenhouse environment, light, temperature, relative humidity, carbon dioxide, greenhouse ventilation and computerized control system. Environmental requirements- Greenhouse cooling, greenhouse heating, temperature requirement of horticultural crops. (Descriptive &Analytical) **(6 Hrs)**
Unit-VI	Instrumentation and automation for greenhouses, Economics of greenhouse production for vegetable crops, different flowers, exotic crop, Cost benefit ratio. (Descriptive & Analytical) **(6 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1	Greenhouse-Technology and Management	K. Radha Manohar and C. Igathinathane	B. S. Publications, Hyderabad	2nd
2	Greenhouse technology and applications	Vilas M. Salokhe and Ajay K. Sharma	Agrotech publishing acade.)my Udaipur (Raj	1st
3	Greenhouse operation management	Paul V. Nelson	Resort pub. Co. Inc, Vergnina	7th

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Faculty of Science & Technology
Syllabus of T. Y. B.Tech. Agricultural Engineering (Semester VI)

Course Code: AED391 Course: Open Elective-III: Fundamentals of Bioenergy **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic knowledge of Bioenergy sources and biomass utilization
Objectives	1. Understand bioenergy technologies, processes, reactions and energy conversion rates for Anaerobic Digestion, gasification, pyrolysis (fast, intermediate and slow) and combustion 2. Know what constitutes a suitable feedstock for bioenergy applications
Unit-I	**Introduction to bioenergy**- Introduction, Unit of Energy and Introduction of Bioenergy, How Biomass Formed on the Earth, Basic Biomass Technology (Resources and Production) Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. **(6 Hrs)**
Unit-II	**Bioethanol**- Biofuels: Introduction, Ethanol production process, Biodiesel production process, Environmental Benefits, Bio-oil: Pyrolysis or Destructive distillation. **(6 Hrs)**
Unit-III	**Biogas**- Biogas: Introduction, process description, Constituents of biogas, main features of biogas plant, Classification & Popular designs, Applications, factors considered for selection of biogas plant, advantages, disadvantages. **(6 Hrs)**
Unit-IV	**Biodiesel-** Biodiesel production processes, Biodiesel characterization, Biodiesel feedstocks, Environmental permitting and safety considerations for biodiesel production. **(6 Hrs)**
Unit-V	**Thermo Chemical Processes:** Basic concepts in gasification and pyrolysis, chemistry of gasification, Gasification Types – Updraft Gasifier, downdraft, cross draft, applications, difference. **(6 Hrs)**
Unit-VI	**Biomass utilization:** Biomass densification technique (briquetting, pelletization, and cubing), environmental aspect of bio-energy, waste to energy conversion. **(6 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1	Introduction to Bioenergy (Energy and the Environment)	Vaughn C. Nelson, Kenneth L. Starcher	CRC Press	1st
2	Bioenergy: Biomass to Biofuels	Anju Dahiya	Elsevier Science	2nd
3	Bioenergy: Principles and Applications	Yebo Li and Samir Kumar Khanal	Wiley	2nd

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(Faculty of Science & Technology) Syllabus of T. Y. B. Tech. (AIDS) Semester VI	
Course Code: AID391 Course: Business Intelligence **Teaching Scheme:** Theory: 03 Hrs/week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15 Marks Continuous In-semester Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisites	No Prerequisites
Objectives	Student should learn fundamental concepts of Business Intelligence. To learn analytics framework to support decision making in business intelligence.
Unit-I	**Understanding Business Intelligence** The Challenge of Decision Making, What Is Business Intelligence?, The Business Intelligence Value Proposition, The Combination of Business and Technology **(6 Hrs)**
Unit-II	**Business Intelligence Technology Counterparts** Data Warehousing: What Is a Data Warehouse?, Data Marts and Analytical Data, Organization of the Data Warehouse, Enterprise Resource Planning: Distributing the Enterprise, First ERP, then Business Intelligence, The Current State of Affairs, Customer Relationship Management: CRM, ERP, and Business Intelligence, Customer Decisions, Decisions About Customers, Business Intelligence and Financial Information **(6 Hrs)**
Unit-III	**The Spectrum of Business Intelligence** Enterprise and Departmental Business Intelligence, Strategic and Tactical Business Intelligence, Power and Usability in Business Intelligence, Finding the Right Spot on the Continuum, Business Intelligence: Art or Science? **(6 Hrs)**
Unit-IV	**Business Intelligence User Interfaces** Querying and Reporting, Reporting and Querying Toolkits, Basic Approaches: Building Ad-Hoc Queries, Building On-Demand Self-Service Reports, Enhancing and Modifying, Data Access: Pull-Oriented Data Access, Push-Oriented Data Access, Dashboards: EIS Is the Engine, Metric System and KPIs, Business Intelligence Dashboards. **(6 Hrs)**
Unit-V	**On-Line Analytical Processing (OLAP)** OLAP: OLAP and OLTP, Operational Data Stores, Variations in Data and Approach, OLAP Applications and Functionality, Multi-Dimensions: Thinking in More Than Two Dimensions, What Are the Possibilities?, Drilling and Pivoting, OLAP Architecture: Cubism, Tools, ROLAP, MOLAP, HOLAP, Data Mining. **(6 Hrs)**
Unit-VI	**Visualization, Guided Analysis and** Visualization: The Basics, Unconstrained Views, Guided Analysis: The Business Intelligence Two-Step, How to Guide the Guides, Handling Unstructured Data. **(6 Hrs)**

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	Sr. No.	Title	Author	Publication	Edition
Textbooks / Reference Books	1	Decision Support and Business Intelligence Systems	Efraim Turban, Ramesh Sharda, Jay Aronson, David King	Pearson Education, 2009.	9th
	2	The Savy Manager's Guide Getting Onboard with Emerging IT,	David Loshin, Business Intelligence	Morgan Kaufmann Publishers.	2009

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Faculty of Science & Technology Syllabus of T. Y. B.Tech. Civil Engineering (Semester VI)	
Course Code: CED391 Course: Open Elective III Solid Waste Management **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisite	Environmental Science
Objectives	To get introduced to the generation, collection and management of the various types of solid waste and different waste management techniques.
Unit-I	**Introduction to Solid Waste Management (SWM):** Need and Objectives, Waste Management Hierarchy, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, types, Composition, Quantities, Physical, chemical and biological properties. **(6 Hrs)**
Unit-II	**Generation of solid waste: Factors affecting. Storage and collection:** General considerations for waste storage at source, Types of collection Systems, Transfer station: Meaning, Necessity, Transportation of solid waste: Means and Methods, Routing of vehicles. **(6 Hrs)**
Unit-III	**Segregation and Material Recovery:** Objectives, Stages of segregation, sorting operations, Guidelines for sorting for materials recovery, E waste management, Biomedical waste management**.** **(6 Hrs)**
Unit-IV	**Waste processing: processing technologies**: Composting, thermal conversion technologies incineration, treatment of biomedical wastes. Energy recovery from solid waste: Parameters affecting energy recovery, Bio-methanation, Fundamentals of thermal processing, Pyrolysis, Incineration, Advantages and disadvantages of various technological options**.** **(6 Hrs)**
Unit-V	**Disposal:** Landfills and its introduction, Definition, Essential components, Site selection, Land filling methods, Leachate analysis and landfill gas management, treatment & disposal, Determination of capacity of landfill disposal site**.** **(6 Hrs)**
Unit-VI	**Hazardous waste management (HWM):** Types of hazardous waste (such as nuclear, biomedical and industrial waste), problems and issues related to HWM, Need for HWM, Legislations on management and handling of HW, Hazardous Characteristics, reduction of wastes at source, Recycling and reuse, labelling and handling of hazardous wastes, incineration, solidification & stabilization of hazardous waste. **(6 Hrs).**

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	Sr. No.	Title	Author	Publication	Edition
References	**1**	Integrated Solid Waste Management	Hilary Theisen and Samuel A, Vigil	McGraw-Hill, New York	1993
	2	CPHEEO, Manual on Municipal Solid waste management,	Central Public Health and Environmental Engineering Organization	Government of India	2000
	3	Environmental Resources Management, Hazardous waste Management	Michael D. LaGrega, Philip L Buckingham Jeffrey C. E vans	Mc-Graw Hill International edition	2001
	4	Solid waste Engineering	Vesilind P.A., Worrell W and Reinhart	Thomson Learning Inc., Singapore	2002
	5	Hazardous Waste Management	Charles A. Wentz	McGraw Hill International Edition, New York	2nd

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Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)

Course Code: CSE392 Course: Open Elective-III: Digital Marketing **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisites	Basic Understanding of Digital Marketing
Objectives	To understand the basic concept of digital marketing To understand the concept of search engine optimization. Implement Social Media Optimization Discuss the concept of google advertising
Unit-I	**Digital Marketing Introduction** Concept of Digital Marketing, Use of Digital Marketing, Digital Marketing Platform, Digital Marketing Strategy, Types of Digital Marketing – Organic & Paid, Digital Marketing VS Traditional Marketing. How is it different from traditional marketing, ROI between Digital and traditional Marketing. **(7 Hrs)**
Unit-II	**Search Engine Optimization (SEO)** Introduction of SEO, Search Engine working, SEO Tools Web position Analysis, Competition Analysis, Google Algorithms and Updates. **(6 Hrs)**
Unit-III	**Social Media Optimization (SMO)** **Facebook** - Profile Creations, Creating groups and pages, Tips and Guides, Posts And promotions, Events Creations, Video Marketing, Promotional Techniques, Integration Techniques. **Twitter** -Set-up and usage Tips, Promoted Tweets, Video Marketing, Promotional Techniques, Integration Techniques, Analytics. **LinkedIn**-Profile Creations, Company Page Creations, Tips and Guides, LinkedIn posts LinkedIn promotions LinkedIn Groups, Video Marketing, Promotional Techniques, IntegrationTechniques, **Instagram** -Integration Techniques, Promotional Techniques. **(5 Hrs)**
Unit-IV	**Introduction to SEM** Google AdWords, Search Advertising, Display Advertising, Mobile Advertising, Video Advertising, Shopping Advertising, Report generation, Google AdWords Express, Setup, Google Mapping Ads. **(6 Hrs)**
Unit-V	**E-Commerce Management** Maintenance of an online product-listing website through product keyword research, product pricing, positive reviews, and customer retention. **(6 Hrs)**
Unit-VI	**Email Marketing** How to create and send product-based emails in bulk, and ensure that all of the emails have a good open rate and conversion rate. **(6 Hrs)**

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	Sr. No.	Title	Author	Publication	Edition
Textbooks / Reference Books	1.	Digital Marketing For Dummies	Ryan Deiss & Russ Henneberry	Tata McGraw Hill	6th
	2.	Social Media Marketing All-in-one Dummies	Jan Immerman, Deborah Ng	Prentice Hall	3rd
	3.	Digital Marketing	Seema Gupta	Tata McGraw Hill	1st

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Faculty of Science & Technology Syllabus of T. Y. B. Tech. Computer Science and Engineering (Semester VI)	
Course Code: CSE391 Course: Open Elective-III: RHCSA (RedHat Certified System Administration) **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 MarksTeacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisites	This course has prerequisites like previous system administration experience on other operating systems is beneficial. Fundamental knowledge of Operating System.
Objectives	Develop a strong understanding of the command-line interface (CLI) and become proficient in using essential command-line tools andutilities for system administration tasks. Understanding fundamental system administration tasks, such as managing file systems, users, and groups. Ability to Install, update, and remove software packages using package management tools and service management. Ability to identify and resolve common system issues, perform system analysis, and troubleshoot problems related to hardware, software. Ability to configure and troubleshoot network interfaces and handlingsystem security. Ability to manage storage devices and file systems and utilize containerization tools like Podman.
Unit-I	**Introduction to Red Hat Enterprise Linux (RHEL, Filesystem and File Permissions** Overview of RHEL and its features. Installation and deployment of RHEL, Filesystem hierarchy standard (FHS), Managing files and directories. **(6 Hrs)**
Unit-II	**User and Group Administration** Permissions and ownership User andgroup management, Password policies and authentication methods, User and group quotas user and group-level security measures, such as password policies and file permissions, to maintain system integrity. **(6 Hrs)**
Unit-III	**Package Management, System Initialization** Package installation, removal, and verification Managing softwarerepositories, Dependency resolution and package querying, Boot process and run levels Managing services and daemons, Systemd and SysVinit. **(7 Hrs)**
Unit-IV	**System Maintenance, Troubleshooting and System Recovery** System updates and patching, Kernel management, Managing log files and system monitoring, System troubleshooting methodologies, Rescue and recovery techniques, Boot loader configuration and troubleshooting. **(7 Hrs)**

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Unit-V	**Network Configuration** Network interfaces and configurations, IP addressing and routing, DNS configuration. configuring firewalls, securing SSH access, and implementing SELinux policies to protect the system from unauthorized access and potential threats. **(7 Hrs)**
Unit-VI	**Storage Administration & Run containers** Disk partitioning and formatting, Logical Volume Manager (LVM), Filesystem creation and mounting, Deploy Container, Manage Container Storage and Network Resources, Manage Containers as System Services. **(7 Hrs)**

Textbooks / Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	Linux System Programming	Robert Love	O'Reilly, SPD	10th
2.	UNIX Network Programming	W.R. Stevens	McGraw-Hill	5th
3.	Linux Command Lineand Shell Scripting Bible	Richard Blumand Christine Bresnahan	McGraw Hill	6th
4.	UNIX and Linux System AdministrationHandbook	Evi Nemeth, Garth Snyder,Trent R. Hein	Ben Whaley	3rd
5.	RHCSA/RHCE Red Hat LinuxCertification Study Guide	RedHat Student Guide	RedHat	9th

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Faculty of Science & Technology
Syllabus of T. Y. B.Tech. Electrical Engineering (Semester VI)

Course Code: EED391 Course Title: Special Purpose Electric Machines **Teaching Scheme:** Theory: 3 Hrs / week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Prerequisite	Basic electrical Engineering, magnetic circuit, conventional electrical machines
Objectives	To understand different types of motors for particular application To examine behaviour of machines for specific applications To compare different machines To develop knowledge in regards of control and use of machines
Unit-I	**Induction Generators** Construction, operating principle, types, operating characteristics, Applications. **(6 Hrs)**
Unit-II	**Doubly fed induction Machines** Construction, operating principle, types, operating characteristics, Applications to grid connected wind and mini/micro hydel systems. **(6 Hrs)**
Unit-III	**Switched Reluctance Motor**: Construction, operating performance, control and applications. **Variable reluctance stepper motor:** Construction, operating performance, control and applications. **(6 Hrs)**
Unit-IV	**Linear Machines:** Linear Induction Machines and Linear Synchronous Machines: Construction, operation, performance, control and applications. **(6 Hrs)**
Unit-V	**BLDC Machine:** Construction, magnetic materials used, types of motors, control and applications. Recent developments in BLDC motors. **(6 Hrs)**
Unit-VI	**Permanent Magnet Machines:** Construction, magnetic materials used, types of motors e.g. PMDC and PM Synchronous Machine, control and applications. Recent developments in electrical machines. **(6 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1	Switched Reluctance motor drives'	R.Krishnan,	CRC press, 2001	1st Edition
2	Permanent magnet and Brushless DC motors'	T.Kenjo and S.Nagamori	Clarendon press. London, 1988	1st Edition
3	Special Electrical Machines	Simmi P Burman	S.K. Kataria& Sons	2nd Edition
4	Permanent Magnet Synchronous and	R. Krishnan.	New Delhi, Prentice, Hall of India, 2009	2nd Edition

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		Brushless DC Motor Drives			
	5	Special Electrical Machines	Venkataratnam	Taylor and Francis, 2009	1st Edition

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Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Mechanical Engineering (Semester VI)

Course Code: MED391 Course: Open Elective III (Industry 4.0) **Teaching Scheme:** Theory: 3 Hrs/week Credits: 3-0-0	Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Course Objectives	To make students aware of the structure and role of Industry 4.0, in current evolving industrial environment. To give learners overview of Industry 4.0 technologies and their integration.
Unit I	**Introduction-** Four industrial revolutions, Digital transformation of Industry and the fourth industrial revolution, Scope of Industry 4.0, Automation pyramid and Industry 4.0, Principles of Industry 4.0. **(6 Hrs)**
Unit II	**Internet of Things (IoT)–** Concept of IoT, IoT Architecture – Sensing layer, Network layer, Data processing layer, Application layer, Applications of IoT – for automobiles, homes, etc. Internet of Service (IoS), Internet of Energy (IoE). **(6 Hrs)**
Unit III	**Technologies in Industry 4.0 (1)-** Augmented reality and Virtual Reality, 3D Printing, Collaborative robots, Smart material handling, Smart sensors, Concept of smart products. **(6 Hrs)**
Unit IV	**Technologies in Industry 4.0 (2)-** Machine learning, Introduction to Cyber Physical Systems (CPS), Components of Cyber Physical Systems, Digital twins, Machine vision, Smart factory, Artificial intelligence. **(6 Hrs)**
Unit V	**Data in Industry 4.0-** Big Data, Data Mining, Data Analytics, Cloud computing, Data – anew resource of organization, Data analysis for optimal decision making, Digitalization of the entire value chain. **(6 Hrs)**
Unit VI	**Applications of Industry 4.0-** Industry 4.0 in Manufacturing – Predictive maintenance, Real-time supply-chain optimization, Digital performance management, Smart energy consumption, Challenges in implementing Industry 4.0. **(6 Hrs)**

Textbook/ Reference Books

Sr. No.	Title	Author	Publication	Edition
1	Industry 4.0 - the Industrial Internet of Things	Industry 4.0_ the Industrial Internet of Things	Industry 4.0_ the Industrial Internet of Things	-
2	Industry 4.0- Managing The Digital Transformation	Alp Ustundag, Emre Cevikcan	Springer	1st
3	Automated Manufacturing System	Hugh Jack	Lulu.com	7th
4	Industry 4.0- Opportunities	Dr. Mirjana Stankovic, Ravi	UNIDO General Conference 2017	-

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		Behind The Challenge	Gupta and Dr. Juan E. Figueroa		
	5	Handbook of Ind. Automation	Richard L. Shell Ernest L. Hall	CRC Press	1st

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Faculty of Science & Technology
Syllabus of T. Y. B. Tech. Mechanical Engineering (Semester VI)

Course Code: MED392 Course: OE-III Operations Research **Teaching Scheme:** Theory: 03 Hrs/week Credits: 3-0-0	Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continues Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs

Objectives	To familiarize the students with formal quantitative approach to problem solving To formulate real life engineering problems To solve engineering problems using various Operations Research Techniques
Unit-I	**Introduction to Operations Research:** Basics definition, scope, objectives, phases, models, applications and limitations of Operations Research. **(2 Hrs)**
Unit-II	**Linear Programming Problem:** Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, Big-M method, two-phase method, degeneracy and unbound solutions. **(8 Hrs)**
Unit-III	**Transportation Model :** Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test – the stepping stone method or MODI method. Degeneracy in Transportation Problem. **(8 Hrs)**
Unit-IV	**Assignment Problem:** Hungarian Method to solve Assignment Problem, Travelling Salesman as an Extension of Assignment Problem. **(4 Hrs)**
Unit-V	**Queuing model and Sequencing model :** Queuing Systems And Structures, Notation Parameters, Single Server and Multi Server Models, Poisson Input, Exponential Service, Constant Rate Service, Infinite Population. Sequencing Model: Introduction, n jobs through two machines, n jobs through three machines, two jobs through m machines and n jobs through m machines. **(6 Hrs)**
Unit-VI	**Network Models:** Fulkerson's rule, concept and types of floats, float calculations, CPM and PERT, Crashing cost and crashing Network. **(8 Hrs)**

Text Book/ Reference Books

Sr. No.	Title	Author	Publication	Edition
1	Operations Research	Taha H.A.	Prentice Hall Of India.	9th Edition
2	Introduction to Operations Research	Frederick S. Hillier and Gerald J. Lieberman	Tata McGraw-Hill	7th Edition
3	Operations Research	P.K. Gupta, D.S Hira	S. Chand & Co.	4th Edition
4	Operations Research	Man Mohan, P. K. Gupta, Kanti Swarup	S. Chand & Co.	12th Edition

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	5	Operations Research Principles and Practice	Ravindran, Phillips and Solberg	Mc. WSE Willey	2nd Edition
	6	Operations Research: Applications and Algorithms	Wayne L. Winston, Jeffrey B. Goldberg	Thomson Brooks	4th edition
	7	Operations Research: Theory, Methods and Applications	S. D. Sharma, Himanshu Sharma	Kedar Nath Ram Nath	4th Edition
	8	PERT and CPM: Principles and Applications	L. S. Srinath	East-West Press Private Limited,	3rd Edition
	9	Project Planning and Control with PERT & CPM	Dr. B.C. Punmia & K.K. Khandelwal	Firewall Media	4th Edition

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Faculty of Science & Technology Syllabus of T. Y. B. Tech. Plastic and Polymer Engineering (Semester VI)	
Course Code: PPE391 Course: Open Elective III: Waste Management and Circular Economy **Teaching Scheme**: 03 hrs/week Theory: 03 Hrs/week	Credits: 03 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs
Prerequisite	Plastic materials, processing, rheology, basics of polymer technology and designing
Objectives	It aims to provide students with a comprehensive understanding of sustainable practices and the principles of the circular economy within the context of polymer engineering. Students will explore various strategies, technologies, and policies for achieving sustainability, reducing environmental impact, and promoting circularity in the polymer industry. The course will emphasize the importance of integrating sustainable principles in the design, production, and disposal of polymer materials.
Unit-I	**Topic Title: Introduction to Waste Management and Circular Economy** Definition and significance of sustainability in polymers, basics of waste management, principles and goals of the circular economy, environmental, social, and economic dimensions of waste management, life cycle thinking and assessment in plastics **(4 Hrs)**
Unit-II	**Topic Title: Waste generation, composition, and management** Sources and types of plastic and polymer waste, composition analysis and characterization of waste, quantification and assessment of waste generation, waste management and treatment methods: MSWM processing and plastics waste management comprising of waste hierarchy i.e., prevention, minimization, reuse, recycling, energy recovery, and disposal. **(8 Hrs)**
Unit-III	**Topic Title: Sustainable Polymer Processing** Energy-efficient processing techniques, clean and green manufacturing practices, waste reduction and recycling in polymer processing, sustainable additives and processing aids **(6 Hrs)**
Unit-IV	**Topic Title: Sustainable Waste Management and Disposal** Waste characterization and classification in polymers, mechanical recycling, waste-to-energy conversion technologies, biological treatment methods for polymer waste, hazardous waste management and regulations, sustainable landfilling and waste disposal practices **(6 Hrs)**
Unit-V	**Topic Title: Circular Economy Strategies** Design for recycling and upcycling principles, closed-loop supply chains and reverse logistics, extended producer responsibility and product stewardship, circular

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	economy business models and initiatives, case studies on successful implementation of circular economy strategies **(6 Hrs)**				
Unit-VI	**Topic Title: Policy and Regulatory Framework for Sustainability** International and national policies promoting sustainability in polymers, Environmental regulations and standards for the polymer industry, corporate social responsibility and sustainability reporting, challenges, and opportunities in implementing sustainable practices, future trends and emerging technologies in sustainable polymer engineering **(6 Hrs)**				
Textbooks / Reference Books	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
		Waste Management and the Circular Economy in Selected OECD Countries	OECD	OECD Publishing	1st Edition, 2019
		Plastics and Sustainability: Towards a Peaceful Coexistence between Bio-based and Fossil Fuel-based Plastics	Michael Tolinski	Wiley	1st Edition 2011
		Plastics and Sustainability: Towards a Deeper Understanding of the Environmental Role of Plastics in Today's World	Conor P Carlin	Wiley-Scrivener	1st Edition 2021
		Strategic Management for the Plastics Industry: Dealing with Globalization and Sustainability	Jones, Roger F.	CRC Press	1st Edition 2013
		Plastics in the Circular Economy	Vincent Voet, Jager, Rudy and Folkersma	De Gruyter	1st Edition 2023
		A Practical Guide to Plastics Sustainability: Concept, Solutions, and Implementation	Michel Biron	William Andrew Publishers	1st Edition, 2020
		Circular Economy and Waste Valorisation: Theory and Practice from an International Perspective	Jingzheng Ren, Long Zhang	Springer	1st Edition, 2022

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Faculty of Science & Technology Syllabus of T. Y. B. Tech. Agricultural Engineering (Semester VI)		
Course Code: AED371 Course: Lab-I: Soil and Water Conservation Engineering **Teaching Scheme:** Practical: 2 Hrs./week		Credits: 0-0-1 TA: 25 Marks
Objectives		1. Various soil loss estimation methods caused due to erosion 2. Study and design of various agronomical and mechanical erosion control measures
List of Practical		1. Study of soil loss measurement techniques. 2. Estimation of soil loss by Universal Soil Loss Equation (USLE) 3. Computation of erosion index from rainfall data 4. Determination of sediment concentration through oven dry method 5. Study of various gully erosion control structures 6. Study of agronomical erosion control measures (Shelter belts & Wind Breaks) 7. Design of contour bunding system 8. Design of graded bunding system 9. Design of various types of bench terracing systems 10. Design of vegetative waterways 11. Study of water harvesting techniques 12. Field visit to soil erosion conservation site / water harvesting structures Note: Any 10 number of practical to be performed from the given list

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Faculty of Science & Technology Syllabus of T. Y. B. Tech. Agricultural Engineering (Semester VI)	
Course Code: AED372 Course: Lab-II: Micro Irrigation System Design **Teaching Scheme:** Practical: 2Hrs./week	Credits: 0-0-1 TA: 25 Marks

Objectives		1. Familiarization with various components of micro-irrigation systems with their functions 2. To study the design of micro-irrigation system for row, orchard, terraced crops 3. To study the repair & maintenance of components of trickle & sprinkler irrigation system of micro-irrigation
List of Practical		1. Study of different types of micro-irrigation systems and components 2. Field visit of micro-irrigation system 3. Study of water filtration unit; Discharge measurement study of different micro irrigation systems. 4. Design of micro-irrigation system for an orchard. 5. Design of micro-irrigation system for row crops 6. Design of spray type micro-irrigation system. 7. Design of micro-irrigation system for hilly terraced land. 8. Study of automation in micro-irrigation system. 9. Study of micro-climate inside a Polyhouse. 10. Study of maintenance and cleaning of different components of various systems. 11. Design of sprinkler irrigation system; Design of landscape irrigation system. 12. Measurement of irrigation water Note: Any 10 number of practical to be performed from the given list

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Course Code: AED373 Course: Lab-III: Drying and Storage Engineering **Teaching Scheme:** Practical: 2 Hrs./week	Credits: 0-0-1 ESE/Oral: 25 Marks

Objectives		1. To learn about various Drying and storage characteristics of grains 2. To study the grain handling during storage 3. To study design of various storage structures
List of Practical		1. Study of mechanics of bulk solids affecting cleaning, drying and storage of grains 2. Measurement of moisture content during drying and aeration 3. Measurement of relative humidity during drying and aeration using different techniques 4. Measurement of air velocity during drying and aeration 5. Drying characteristic and determination of drying constant 6. Determination of EMC and ERH 7. Study of various types of dryers 8. To study the effect of relative humidity and temperature on grains stored in gunny bags 9. Design and layout of commercial bag storage facilities 10. Design and layout of commercial bulk storage facilities 11. Study of different domestic storage structures 12. Visit to commercial handling and storage facilities for grains. Note: Any 10 number of practical to be performed from the given list

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Faculty of Science & Technology Syllabus of T. Y. B. Tech. Agricultural Engineering (Semester VI)		
Course Code: AED374 Course: Lab-IV: Green House Technology **Teaching Scheme:** Practical: 2 Hrs./week		Credits: 0-0-1 ESE/Oral: 25 Marks
Objectives		To inculcate the practical knowledge of student regarding measurement, scheduling, methods and efficiencies of irrigation.
List of Practical		1. Study of different type of greenhouses based on shape. 2. Study of greenhouse equipments. 3. Visit to commercial greenhouse complex / structure 4. Problems on greenhouse light requirements 5. Study of fan pad system 6. Calculations of greenhouse heat 7. Study of crop economics 8. Study of Tunnels 9. Determine the rate of air exchange in an active summer winter cooling system. 10. Determination of drying rate of agricultural products inside green house. 11. To measure greenhouse environment parameters (temp., RH, Solar radiations, CO2, air velocity etc.) and prepare profiles of these parameters. 12. Problems on design of fan pad system. 13. Problems on greenhouse root media. 14. Structural design of simple rectangular gable type GI pipe greenhouse structure (i.e. To find sizes of purlins, rafters and columns for desired wind speed pressure). **Note:** Any 10 number of practical to be performed from the given list

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Course Code: PRO371 Course: Lab-V: Major Project-I **Teaching Scheme:** Practical: 4 Hrs./week	Credits: 2 TA: 25 Marks ESE/Oral:25 Marks

Objectives		Solve a real-life societal problem through research-based approaches
Course Outcome		Upon the completion of this course the students will be expected to: Formulate an analytical model for an engineering problem and obtain its solution with necessary tools. Perform and manage as an individual or as a member of a team with ethical values. Examine the concepts of environment and sustainability Write effective reports and communicate effectively on civil engineering problems. Present the conclusions in a way to benefit the society.
Instructions to Students		Solving a real life problem should be the focus of under graduate projects. Faculty members should prepare project briefs (giving scope and references) well in advance which should be made available to the students at the departmental level. The project may be classified as hardware / software / modelling / simulation. It may comprise any elements such as analysis, design, synthesis, validation etc. Interdisciplinary/Multidisciplinary projects are encouraged.
Guidelines		The department will appoint a project coordinator who will coordinate the following. 1. Grouping of students (a maximum of 3/4 in a group) 2. Allotment of projects and project guides 3. Project monitoring at regular intervals. All projects' allotments are to be completed as given in the Academic Calendar. All projects will be monitored at least twice in a semester through students' presentation and will be conducted as per Academic Calendar. Distribution of marks for TA shall be as follows: Problem Statement 10; Literature Review 10; Group formation and identification of individual responsibility 10; Objective of Project activity 10; Knowledge of domain, technology and tools being used 10 **For TA 50 Marks to be converted to 25 Marks.** Distribution of marks for ESE/Oral shall be as follows: Realization of project as per problem statement 10; Design & Testing 30; Documentation and Report Writing 20; Quality of Work 15; Performance in Question & Answers Session 15; Timely Completion of Project work 10 **For ESE/Oral – 100 Marks to be converted to 25 Marks.** Efforts be made to carry out industry based/ Societal Projects. Problems can also be invited from the industries/Society to be worked out through undergraduate projects. In case of Interdisciplinary/Multidisciplinary Projects, as per the requirements, a greater number of Guides may be appointed. A Joint committee of involved departments shall conduct the review of the students.

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		The students shall aim to promote their project work in project exhibitions/competitions, paper presentation/publication in reputed journals and conferences. The relevance of project and implementation including details of attainment of POs and PSOs addressed through the projects with justification must be clearly stated. Phases of Major Project - I: Phase I: Need Statement, Literature Review, data collection, Problem Statement, Objectives, Scope, Analysis/Framework/ Algorithm Phase II: Details of Hardware & Software, Methodology, and Implementation plan for next semester. Phase III: Submission of report of project work

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