SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
---------AGRICULTURE ENGINEERING----------

Semester/Year	IV/II	Program		B.Tech
Subject Category: DC	Subject Code:	AE-402	Subject Name:	I.C. Engine

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Quiz	Assignment	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	-	2	4

Prerequisites:

Course Objective:

Course Outcomes:

After completion of the course, the student will be able to:
CO 1 Evaluate performance of I.C. Engines
CO 2 Understand the Combustion phenomena and design for S.I. and C.I. Engines
CO 3 Understand working of various I.C. engine systems such as Fuel, Systems, Lubrication systems
CO 4 Understand different engine exhaust emissions and their controlling methods
CO 5 Evaluate methods for improving the I.C. Engine performance

UNITs	Descriptions	Hrs.	CO's
I	**Internal Combustion Engine:** S.I. and C.I. engines of two and four stroke cycles, real cycle analysis of SI and CI engines, determination of engine dimensions, speed, fuel consumption, output, mean effective pressure, efficiency, factors effecting volumetric efficiency, heat balance, performance characteristics of SI and CI engines, cylinder arrangement, firing order, power balance for multi-cylinder engines, valve timing.	9	CO1
II	**Combustion in SI engines:** Flame development and propagation, ignition lag, effect of air density, temperature, engine speed, turbulence and ignition timings, physical and chemical aspects of detonation, effect of engine and fuel variables on knocking tendency, knock rating of volatile fuels, octane number, H.U.C.R., action of dopes, pre-ignition, its causes and remedy, salient features of various type combustion chambers.	8	CO2
III	**Combustion in C.I. Engines:** Times base indicator diagrams and their study, various stages of combustion, delay period, diesel knock, octane number, knock inhibitors, salient features of various types of combustion chambers, Simple problems on fuel injection, various types of engines, their classification and salient features. Rotary I.C. engines, their principles of working.	8	CO3
IV	**I.C. Engine System:** Fuels, ignition systems, cooling, exhaust/scavenging and lubrication system. Fuel metering in SI	8	CO4

	engine: Fuel injection in SI engine (MPFI & TDI). Theory of carburetion, simple problems on carburetion. Fuel metering in CI engines: Fuel injection in CI engine and simple problems, various types of engines, their classification and salient features.		
V	**Fuels:** Conventional fuels and alternate fuels, engine exhaust emission, carbon monoxide, un-burnt hydro carbon, oxides of nitrogen, smoke, density, measurement and control, hydrogen as alternate fuel. **Supercharging:** Effect of attitude on mixture strength and output of S.I. engines, low and high pressure super charging, exhaust, gas turbo-charging, supercharging of two stroke engines.	7	CO5
Guest Lectures (if any)			
Total Hours		40	

Suggestive list of experiments:

1. Load test on ruston oil engine.
2. Measurement of I.P.,B.P. and calculation of mechanical efficiency by conducting morse test.
3. Load test on variable compression ratio engine (VCR engine).
4. Performance and analysis of four stroke single cylinder diesel engine test rig with electric dynamometer
5. Performance and analysis of four stroke four cylinder petrol engine test rig with hydraulic dynamometer.
6. Study of carburetter.
7. Study of fuel pump and fuel injector.
8. Study of lubrication system.
9. Study of cooling system.
10. Study of battery ignition system.

Text Book-

1. A course in IC engines by M.L. Mathur & R.P. Sharma
2. Internal Combusion Engines by V. Ganeshan
3. Internal Combusion Engines Theory & Practice by G.F. Taylor

Reference Books-

1. Introduction to IC Engines by Richard Stone
2. Internal Combustion Engines by Domkundwar, Dhanpat Rai Publications

Modes of Evaluation and Rubric

Quiz, Assignment, Mid term exam, End term exam and Practical Viva.
Rubric: End term exam, Practical: 50% Quiz and 50% Viva.

List/Links of e-learning resource

Recommendation by Board of studies on	14-12-2023
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Mechanical Engineering Department

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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---------AGRICULTURE ENGINEERING----------

Semester/Year		IV/II	Program		B.Tech
Subject Category	DC	Subject Code:	AE-403	Subject Name:	Application of AC/DC Machine

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Quiz	Assignment	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	-	2	4

Prerequisites:

Course Objective:

Course Outcomes:

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

CO1: Understand the constructional features and operating principles of transformers, both single-phase and three-phase.

CO2: Evaluate the constructional details and performance characteristics of DC machines.

CO3: Review the constructional details of three-phase induction motors and understand their working principles.

CO4: Understand the constructional details and working principal of Single-phase induction motors.

CO5: Analyze the constructional features of polyphase synchronous machines and explain their operating principles

UNITs	Descriptions	Hrs.	CO's
I	**Single phase transformer** construction working principle, phasor diagram, types, transformation ratio, parallel operation of two single phase transformer. Use of an auto transformer. Three phase transformer and their applications.	9	CO1
II	**D.C. Machines** DC motors and DC generators, constructional features, voltage and torque equations. Speed torque characteristic of DC motors. Methods of speed control. Testing and applications of dc motors.	8	CO2
III	**Three phase Induction Motors** Constructional Principles, operation and application. Types of starters, torque slip characteristics application.	8	CO3
IV	**Single phase Motors** Construction working principle, starting methods and applications.	8	CO4
V	**Synchronous Machines** Construction, principle of alternator and motor, V-curves, synchronous condenser and their applications.	7	CO5

Guest Lectures (if any)		
Total Hours	40	

Suggestive list of experiments:

1. To perform load test on single phase transformer to find efficiency using resistive load and draw efficiency versus load current plot.
2. To perform parallel operation of two single phase transformer by conducting polarity test.
3. Demonstration of various configuration of three phase transformer.
4. Speed control of DC shunt motor by field weakening and armature rheostatic control method
5. Load test on DC shunt generator and to draw its performance characteristics (external/drooping)
6. To perform no load test on DC Machine (Swinburne's test) to find its efficiency at any load
7. Demonstration of starters to start a three phase induction motor .
8. Demonstration of starting method used for starting of single phase induction motor.
9. Demonstration of DC starter to start DC motor .
10. To plot the V-curves of a synchronous motor at no load.

Text Book-

1. Dr. P.S. Bimbhra, "Generalized Theory of Electrical Machines" Khanna Publishers.
2. Dr. P.S. Bimbhra, "Electrical Machines" Khanna Publishers.
3. J.B. Gupta, "Electrical Machines" S.K. Kothari & Sons.

Reference Books-

1. Electrical Machines Nagrath & Kothari
2. R K Rajput "Electrical Machine " - Laxmi Publication. MC pherson and R.D.Laramorl, "An Introduction to Electric Machine & Transformer" (2nd Ed.) John Wiley & Sons, 1990

Modes of Evaluation and Rubric

Quiz, Assignment, Mid term exam, End term exam and Practical Viva.
Rubric: End term exam. Practical: 50% Quiz and 50% Viva.

List/Links of e-learning resource

Recommendation by Board of studies on	14-12-2023
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Electrical Engineering Department

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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---------AGRICULTURE ENGINEERING----------

Semester/Year		III/II	Program		B.Tech
Subject Category	DC	Subject Code:	AE-404	Subject Name:	Fluid Mechanics

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Quiz	Assignment	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	-	2	4

Prerequisites:

Physics and Mathematics.

Course Objective:

Students are expected to learn basic concepts of fluid flow, fluid properties and relationship between them, fundamental principles of fluid mechanics (principles of continuity, momentum, and energy) as applied to fluid motions.

Course Outcomes:

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

1. Perceive the knowledge of basic properties of fluids, different types of flows and analyze the fluid behavior under static condition
2. Apply the basic concepts to examine the behaviour of fluid under kinematic and dynamic conditions
3. Perform dimensional analysis and dynamic similitude
4. Evaluate practical flow problems for pipes, open channels
5. Compare the difference between theoretical and practical values of different flow parameters and calibrate the equipment's accordingly (Lab)

UNITs	Descriptions	Hrs.	CO's
I	**Review of Fluid Properties:** Engineering units of measurement, mass, density, specific weight, specific volume, specific gravity, surface tension, capillarity, viscosity, bulk modulus of elasticity, pressure and vapour pressure. Classification of different Fluids. Rheological Classification of Fluid. Fluid Static's : Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on gravity dams and Tainter gates); buoyant force, Stability of floating and submerged bodies, Relative equilibrium.	9	CO1
II	**Kinematics of Flow:** Path lines, streak lines, streamlines and stream tubes; Types of motion of Fluid Particles, Types of flow- ideal & real , steady & unsteady, uniform & non-uniform, flow one, two and three dimensional flow, continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow nets- their utility & method of drawing flow nets.	8	CO2
III	**Dynamics of Flow:** Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for	8	CO3

	steady flow: momentum correction factor. The moment of momentum equation, forces on fixed and moving vanes and other applications. Velocity measurement (Pitot tube, Prandtl tube, current meters etc.): flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venturimeter, weirs and notches).		
IV	**Dimensional Analysis and Dynamic Similitude:** Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, similarity laws, specific model investigations (submerged bodies, partially submerged bodies, weirs, spillways, roto dynamic machines etc.)	8	CO4
V	**Laminar Flow:** Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number, relation between shear & pressure gradient, laminar flow through circular pipes, laminar flow between parallel plates, laminar flow through porous media, Stokes law, lubrication principles.	7	CO5
Guest Lectures (if any)			
Total Hours		40	

Suggestive list of experiments:

1. Verification of Energy equation
2. Calibration of Venturimeter.
3. Calibration of orifice meter.
4. Calibration of Mouth Piece.
5. Calibration of Water meter.
6. Calibration Nozzle meter.
7. Determination of Cc, Cv, Cd of Orifices.
8. Reynolds experiment for demonstration of stream lines & turbulent flow.
9. Determination of Friction Factor of a pipe.
10. Verification of impulse momentum principle.
11. Calibration Notches.(Rectangular & V notch)

Text Book-

1. Modi& Seth: Fluid Mechanics: Standard Book House, Delhi
2. Som and Biswas: Fluid Mechanics and machinery: TMH
3. Cengal: Fluid Mechanics: TMH
4. White ; Fluid Mechanics ; TMH

Reference Books-

1. Essential of Engg Hyd. By JNIK DAKE: Afrikan Network & ScInstt. (ANSTI)
2. A Text Book of fluid Mech. for Engg. Student by Franiss JRD
3. R Mohanty: Fluid Mechanics By: PHI
4. Fluid Mechanics: Gupta Pearson.
5. Dr. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering

Modes of Evaluation and Rubric

Quiz, Assignment, Mid term exam, End term exam and Practical Viva.
Rubric: End term exam. Practical: 50% Quiz and 50% Viva.

List/Links of e-learning resource

https://swayam.gov.in/nd1_noc20_ce59/preview https://nptel.ac.in/courses/112105183	
Recommendation by Board of studies on	14-12-2023
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Civil Engineering Department

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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---------AGRICULTURE ENGINEERING----------

Semester/Year		IV/II	Program		B.Tech
Subject Category	DE	Subject Code:	AE-406 (A)	Subject Name:	Departmental Elective – I (Water Resources Engineering)

Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical		Total Marks				
End Sem	Mid-Sem	Quiz &	Assignment	End Sem	Lab-Work		L	T	P	
60	20	10	10	-	-	100	3	-	-	3

Prerequisites:

Course Objective:

1. Student will understand the Role of the Water resources in Development of human civilization and sustainability.
2. Student will learn the concept, theory and principle related to Hydrological cycle and application of water for irrigation purpose .
3. Student will learn Data Collection techniques related to various parameter like precipitation, Runoff and losses.
4. Student will learn Analysis of Data, its interpretation and use for forecasting and related problems.
5. Student will learn Design of the Structures for Flood control, Canals, Wells etc.

Course Outcomes:

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

1. Understand the Role of the Water resources in human civilization and its development.
2. Demonstrate concept, theory and principle related to Hydrological cycle and application of water for irrigation purpose.
3. Understand the data Collection techniques related to various parameter like precipitation, Runoff and losses.
4. To acquire aptitude for Analysis of Data, its interpretation and use for forecasting related problems.
5. Design the Structures for Flood control, Canals, Wells etc.

UNITs	Descriptions	Hrs.	CO's
I	**Water resources planning and management:** Planning of water resources projects, data requirements, economic analysis of water resources projects appraisal of multipurpose projects, optimal operation of projects introduction to linear programming and its application to water resources projects.	9	CO1
II	**Rain water harvesting and management:** Role of water in the environment, rain water harvesting, impact assessment of water resources development and managerial measures.	8	CO2
III	**Canal irrigation:** Types of canals, alignment, design of unlined and lined canals, Kennedy's and Lacey's silt theories, typical	8	CO3

	canal sections, canal losses, linings-objectives, materials used, economics. Canal falls & cross drainage works, - description and design, head and cross regulators, escapes and outlets, canal transitions.		
IV	**Well irrigation:** Types of wells, well construction, yield tests, specific capacity level and specific yield, hydraulic design of open wells and tube wells, methods of raising well water, characteristics of pumps and their selection, interference of wells, well losses, advantages and disadvantages of well irrigation.	8	CO4
V	**Floods and Ground water**: Types of floods and their estimation by different methods, probability and frequency analysis, flood routing through reservoirs and channels, flood control measures, economics of flood control, confined and unconfined aquifers, aquifer properties, hydraulics of wells under steady flow conditions, infiltration galleries. Ground water recharge-necessity and methods of improving ground water storage. Water logging-causes, effects and its prevention. Salt efflorescence-causes and effects. Reclamation of water logged and salt affected lands.	7	CO5
Guest Lectures (if any)			
Total Hours		40	

Suggestive list of experiments:

Text Book-

1. Irrigation & Water Power Engg. - Dr. B.C. Punmia, Dr. Pande, B.B. Lal
2. Irrigation, Water Resources & Water Power by Dr. P.N. Modi
3. Irrigation Engineering by Varshney
4. Irrigation Engineering by Santosh Kumar Garg
5. Irrigation, Water Power & Water Resources Engg. by K.R. Arora

Reference Books-

1. Hydrology Engg. Hydrology - J.NEMEC - Prentice Hall
2. Hydrology for Engineers Linsley, Kohler, Paulnus - Tata Mc.Graw Hill.
3. Engg. Hydrology by K. Subhramanya - Tata McGraw Hills Publ. Co.
4. Hydrology & Flood Control by Santosh Kumar - Khanna Publishers

Modes of Evaluation and Rubric

Quiz, Assignment, Mid term exam, End term exam and Practical Viva.
Rubric: End term exam. Practical: 50% Quiz and 50% Viva.

List/Links of e-learning resource

Recommendation by Board of studies on	14-12-2023
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Civil Engineering Department

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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---------AGRICULTURE ENGINEERING----------

Semester/Year	IV/II	Program		B.Tech
Subject Category: DE	Subject Code:	AE-406 (B)	Subject Name:	Departmental Elective – I (Rain Water Harvesting)

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Quiz	Assignment	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	-	10	10	100	3	-	-	3

Prerequisites:

Course Objective:

Students create an integrated site design of their own based on design principles, analysis of water flows and quantities and assessment of overall site conditions. All assignments are components of a report template that students fill out through the process of the class, along with custom-made spreadsheets for the math involved in rain water calculation.

Course Outcomes:

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

CO-1 : Define key rainwater harvesting concepts, terms, and principles Assess a site for rainwater harvesting potential.

CO-2 : water uses Make strategic decisions about what features and systems to use for a site Design.

CO-3 : conceptual integrated rainwater harvesting plan for a site Refine a conceptual rainwater harvesting plan with relevant systems details.

UNITs	Descriptions	Hrs.	CO's
I	**Rainwater Harvesting Principles-** Define key rainwater harvesting concepts and terms, understand rainwater harvesting principles, identify regulations which may affect rainwater harvesting on your project site.	9	CO1
II	**Site Analysis for Rainwater Harvesting-** Analyze a map to identify the watershed of a site, Identify the runoff coefficient from different surfaces, Identify water entry and exit points on a site, Calculate rainwater runoff volumes from different areas and surfaces, Calculate interior water uses.	8	CO2
III	**Rainwater Harvesting Systems-** Identify rainwater harvesting resource opportunities on a design site, Determine the most effective water harvesting strategies for locations on a design site, Calculate potential rainwater resources for specific locations.	8	CO3
IV	**Rainwater Harvesting Design-** Understand the movement of the sun throughout the year and its impact on a site, Gain familiarity with standard methods and materials for system design, Define the integrated design principles.	8	CO4
V	**Integrated Design Systems-** Design rainwater harvesting	7	CO5

	collection and distribution system. Size rainwater flow features throughout the design. Comprehend the potential community impacts of rainwater harvesting design.		
Guest Lectures (if any)			
Total Hours		40	
Suggestive list of experiments:			
Text Book- 1. Qiang Zhu. John Gould. Chengxiang Ma. Yuanhong Li- Rain Water harvesting for Agricultural and water supply. 2. Michelle Avis and Rob Avis - Essential Rainwater Harvesting: A Guide to Home-Scale System Design. 3. Anthony Zagelow- Rainwater Harvesting and Use.			
Reference Books-			
Modes of Evaluation and Rubric			
Quiz. Assignment. Mid term exam. End term exam and Practical Viva. Rubric: End term exam. Practical: 50% Quiz and 50% Viva.			
List/Links of e-learning resource			

Recommendation by Board of studies on	14-12-2023
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Civil Engineering Department

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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---------AGRICULTURAL ENGINEERING----------

Semester/Year	IV/II	Program		B.Tech
Subject Category: DC	Subject Code:	AE-406 (C)	Subject Name:	Departmental Elective – I (Hydrology)

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Quiz	Assignment	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	-	2	4

Prerequisites:

Course Objective:

To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

Course Outcomes:

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

1. An understanding of the key drivers on water resources, hydrological processes and their integrated behaviour in catchments
2. Ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge
3. Ability to conduct Spatial analysis of rainfall data and design water storage reservoirs
4. Understand the concept and methods of ground water management.

UNITs	Descriptions	Hrs.	CO's
I	**Introduction** Hydrologic cycle; schematic diagram; Explaining different components of hydrologic cycles.	9	CO1
II	**Meteorological Parameters and Their Measurements.** Precipitation: Its different forms viz. snow, sleet, rain, hail etc. and their measurement technique: Evaporation, estimation and measurement techniques; Evapotranspiration, estimation and measurement techniques; Wind, measurement techniques for velocity and direction.	8	CO2
III	**Precipitation Data Analysis and Runoff Estimation** Rainfall mass curve; Hyetograph; Mean rainfall depth; frequency of point rainfall; Plotting position; Estimation of missing data; Test for consistency of rainfall records; Interception; Infiltration; Factors affecting runoff, measurement techniques, rating curves and their extension methods, estimation measurement of streams velocity and discharge.	7	CO3
IV	**Hydrograph and Flood Analysis** Hydrograph separation; Unit hydrograph theory; Unit graph of different duration and Snyder's synthetic unit hydrograph method; Flood routing; Hydrologic reservoir routing by modified Pulse method and Goodrich method; Hydrological channel routing by	8	CO3

	Muskingum routing method: Flood frequency analysis method.		
V	**Ground Water Hydrology** Occurrence distribution and movement of ground water. **Hydrological Modelling** Introduction of basic concepts.	8	CO4
Guest Lectures (if any)			
Total Hours		40	

Suggestive list of experiments:

1. Study of different types of rain gauges:
2. Rainfall chart analysis.
3. Double mass curve analysis.
4. Rainfall average depth and probability analysis.
5. Study of stage recorders and current meters.
6. Peak runoff rate and runoff volume estimation.
7. Hydrograph analysis.
8. Unit hydrograph analysis.
9. Flood routing analysis.

Text Book-

1. Subramanya, K. "Engineering Hydrology". Tata McGraw Hill. Second Edition, 1987.
2. Singh, V.P. "Elementary Hydrology". Prentice Hall of India Pvt. Ltd., Third Reprint, 1994.
3. Linsley, R.K., Kohler, M.A. and Paulhus, J.L.H. "Hydrology for Engineers". McGraw Hill International Book Company, Fourth Reprint, 1984.
4. Raghunath, H.M. "Hydrology Principles Analysis Design". New Age International (P) Ltd .. Revised Printing, 1996.
5. Chow, V.T., Maidment, D.R. and Mays, L.W. "Applied Hydrology". McGraw Hill International Editions, 1988.
6. Ghosh, R.K. and Swain, S. "Practical Agricultural Engineering", Vol. I and II, Naya Prakash, Calcutta, 1993.

1.

Modes of Evaluation and Rubric

Quiz, Assignment, Mid term exam, End term exam and Practical Viva.
Rubric: End term exam. Practical: 50% Quiz and 50% Viva.

List/Links of e-learning resource

https://swayam.gov.in/nd1_noc20_ce51/preview

Recommendation by Board of studies on	14-12-2023
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Civil Engineering Department

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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---------AGRICULTURE ENGINEERING----------

Semester/Year	IV / II	Program	B.Tech
Subject Category: OE	Subject Code: OE-405	Subject Name:	Climate Change and Its Impact

Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical		Total Marks				
End Sem	Mid-Sem	Quiz	Assignment	End Sem	Lab-Work		L	T	P	
60	20	10	10			100	3	-		3

Prerequisites:

Nil

Course Objective:

OBJECTIVES:

- To understand the basics of weather and climate
- To have an insight on Atmospheric dynamics and transport of heat
- To develop simple climate models and evaluate climate changes using models

Course Outcomes:

After completion of this course, the students will able to understand

- The concepts of weather and climate
- The principles of Atmospheric dynamics and transport of heat and air mass
- The develop simple climate models and to predict climate change

UNITs	Descriptions	Hrs.	CO's
I	BASICS OF WEATHER AND CLIMATE: Shallow film of Air– stratified & disturbed atmosphere – law – atmosphere Engine. Observation of parameters: Temperature – Humidity – Wind - Pressure – precipitation-surface – networks. Constitution of atmosphere: well stirred atmosphere – process around turbofans – in dry air – ozone – carbon Dioxide – Sulphur Dioxide– Aerosol - water. Evolution of Atmosphere. State of atmosphere: Air temperature – pressure – hydrostatic – Chemistry – Distribution – circulation	8	CO1
sII	ATMOSPHERIC DYNAMICS: Atmosphere dynamics: law – isobaric heating and cooling – adiabatic lapse rates – equation of motion - solving and forecasting. Forces – Relative and absolute acceleration – Earth's rotation coriolis on sphere – full equation of motion – Geostrophy;- Thermal winds – departures – small- scale motion. Radiation, convection and advections: sun & solar radiation – energy balance – terrestrial radiation and the atmosphere – Green house effect- Global warming - Global budget – radiative fluxes - heat transport. Atmosphere and ocean systems convecting & advecting heat. Surface and boundary layer – smaller scale weather system – larger scale weather system.	8	CO1
III	GLOBAL CLIMATE Components and phenomena in the climate system: Time and space scales – interaction and parameterization problem. Gradients of Radiative forcing and energy transports by atmosphere and ocean –	10	CO2

	atmospheric circulation – latitude structure of the circulation - latitude – longitude dependence of climate features. Ocean circulation: latitude – longitude dependence of climate features – ocean vertical structure – ocean thermohaline circulation – land surface processes – carbon cycle.		
IV	CLIMATE SYSTEM PROCESSES Conservation of motion: Force – coriolis - pressure gradient- velocity equations – Application – geotropic wind – pressure co-ordinates. Equation of State – atmosphere – ocean. Application: thermal circulation – sea level rise. Temperature equation: Ocean – air – Application – decay of sea surface temperature. Continuity equation: ocean – atmosphere. Application: coastal upwelling – equatorial upwelling – conservation of warm water mass. Moisture and salinity equation: conservation of mass – moisture. Source & sinks – latent heat. Moist processes – saturation – convection – Wave processes in atmosphere and ocean	7	CO2 & CO3
V	CLIMATE CHANGE MODELS Constructing a climate model – climate system modeling – climate simulation and drift – Evaluation of climate model simulation – regional (RCM) – global (GCM) – Global average response to warming – climate change observed to date.	7	CO3
Guest Lectures (if any)			
Total Hours		40	

1. . Fundamentals of weather and climate (2nd Edition) Robin Moilveen (2010), Oxford University Press
2. 2. Climate change and climate modeling, J. David Neelin (2011) Cambridge University press..Lee W.F., M.D. Boehlje A.G., Nelson and W.G. Murray, 1998, Agricultural Finance, Kalyani Publishers, New Delhi.

Modes of Evaluation and Rubric
Quiz. Assignment. Midterm exam. End term exam
List/Links of e-learning resource

Recommendation by Board of studies on	14-12-2023
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Civil Engineering Department