PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

Paper 5: ATMOSPHERIC PHYSICS

Offered to : M.Sc.(PHYSICS)	Course Code : 22PH4D4
Course Type : Domain specific elective (DSE)	Course : Atmospheric physics
Year of Introduction : 2022	Year of offering : 2022
Year of Revision : 2022	Percentage of Revision : Nil
Semester : IV	Credits : 4
Hours Taught : 60 hrs. per Semester	Max.Time : 3 Hours

CourseDescription:

Atmospheric Physics course attempts to impart knowledge with the basics of atmosphere,thermodynamics and various dynamical phenomenon it leads to understanding various important aspectsof atmosphere.

CourseObjectives:

1. Todevelopknowledgeinatmosphericphysicsanditsapplicationsinmeteorology.
2. Tocreateanawarenessamongstudentsaboutourweatherandclimatesystems.
3. Todeveloptheabilitytounderstandtheatmosphericprocesses,interpretanddrawinferences fromthemeteorologicaldiagrams
4. To provide foundation of the physical aspects of atmosphere and weather.
5. To make the student understand the phenomemon behind formation of cyclones, turbulences

Course Outcomes: Attheendofthiscoursethestudentsshouldbeableto:

CO1: Applyfundamentalphysicalprinciplestounderstandatmosphericandclimate-changeprocesses
CO2: Identify and assess the fundamental numerical methods found in predictive models of weather andatmosphericclimatechange
CO3: Become familiar with thermodynamic conceptsforatmospheresandmake use of thermodynamicdiagramsforevaluationofstabilityandcloudformation
CO4: Able to understand the main components of atmosphere.
CO5: Able to identify various weather systems

CO-POMATRIX								
22PH4D4	**CO-PO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
	CO1	L					H	M
	CO2		H				L	M
	CO3						H	M
	CO4	M						M
	CO5						H	M

Syllabus		
Unit	**Learning Units**	**Lecture Hours**
I	**BasicsoftheAtmosphereandRadiationPrinciple** Thermodynamic state of the atmosphere (pressure, density, temperature), equation of state, hydrostaticequilibrium, hypsometric equations, atmospheric structure, standard atmosphere, thermal structure of theatmosphere;componentsofmeteorology,meteorologicalconventions;**Radiation**-orbitalfactors,planetary orbits, orbits of the earth, seasonal effects, daily effects, sunrise, sunset, and twilight, flux,radiation principles, propagation, emission and distribution of solar energy, absorption reflection andtransmission.Beer'slaw,surfaceradiationbudget,solarradiation,longwave radiation.	12
II	**AtmosphericThermodynamics** **Heat** - Sensibleandlatentheats,Lagrangianheatbudget,firstlawofthermodynamics; **Moisture-**measures of water vapour, saturation, humidity variables, lifting condensation level, isohumes, surfacemoistureflux,saturated adiabatic lapse rate ;**Stability-**stability of the atmosphere,parcel and slicemethods-entrainment,dryandsaturatedadiabaticandprocesses,potentialtemperature,equivalentpotential temperature, concept of lapse rate, dry adiabatic lapse rate, static energy, hydrostatic equation,convectiveinstability,thermodynamic diagrams.	12
III	**Cloud PhysicsandAerosols,OzoneandTraceGases** **Clouds-** their formation and classification, cloud condensation nuclei, warm and cold clouds, clouddroplet growth, precipitation mechanisms, artificial precipitation, radar observation,measurementofrainfall,growthofclouddropletsRain,hailandsnow,structureofthunderstormsandmesoscaleconvective systems; **Atmospheric aerosols**- ozone chemistry, atmospheric trace gases and their role inatmosphericchemistryandradiationbudget.	12

IV	**AtmosphericDynamicsandAtmosphericBoundaryLayer** Fundamentalforcesinmeteorology-pressure,gravity,centripetalandCoriolisforces,momentumequations, inertial flow, geostrophic and gradient winds, thermal wind, divergence and verticalmotion,Rossby's, Reynold's, Richardson's and Froude's number, equation of motion, scale analysis, geostrophicandhydrostaticapproximation,gradientwind,verticalvariationofwind,thermalwind,continuityequationandconvergence,circulationandvorticity,vorticityequation; **Atmosphericboundarylayer(ABL)-**boundarylayerformation,ABLstructureandevolution,ABLequation,Ekmanlayer,turbulencekineticenergy,eddytransport ofheat,watervaporsandmomentum,Richardsoncriterion.	12
V	**WeatherandClimateChange** **Weather**-surface and upper air-pressure and wind systems, synoptic observations-surface and upper air-pressure and wind systems, tropical weather systems, ITCZ, tropical cyclones, western disturbances, jetstreams,monsoonsoverIndia;**Climate-**componentsof climate system,atmospheric radiation budgetandgreenhouseeffectandthescienceofclimatechange,roleofaerosolsin climatechange.	12

TextBooks:

1. R.B.Stull,MeteorologyforScientistsandEngineers, 2ndEd.,BrooksCole, 2000
2. J.R. Holton,AnIntroductiontoDynamicMeteorology,5thEd., AcademicPress, 2012.
3. R.B.Stull,AnIntroductiontoBoundaryLayerMeteorology,Vol.13. SpringerScience&BusinessMedia,2012.
4. M.Salby,FundamentalsofAtmosphericPhysics, 1stEd., AcademicPress,1996.
5. P.A. Menon,OurWeather,NationalBookTrust,1989.
6. J.T.HoughtonandA.C.Bruce,ClimateChange,CambridgeUniversityPress,1992.

ReferenceBooks:

1. A.C.Donald,EssentialsofMeteorology,BrooksCole,2008.
2. J.T.Houghton,ThePhysicsoftheAtmospheres,CambridgeUniversityPress,2009.
3. R.K.Pachauriet al.,IntergovernmentalPanelonClimateChange,IPCC,ClimateChange,2014.