SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF PHYSICS

QUESTION BANK

II SEMESTER

PH3224 - PHYSICS FOR AGRICULTURAL ENGINEERING

Academic Year 2024 – 2025

Prepared by

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DEPARTMENT OF PHYSICS

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SUBJECT : PH3224 - PHYSICS FOR AGRICULTURAL ENGINEERING

SEM / YEAR: II SEM/AY-2024-2025

UNIT I - BASICS OF SOIL PHYSICS

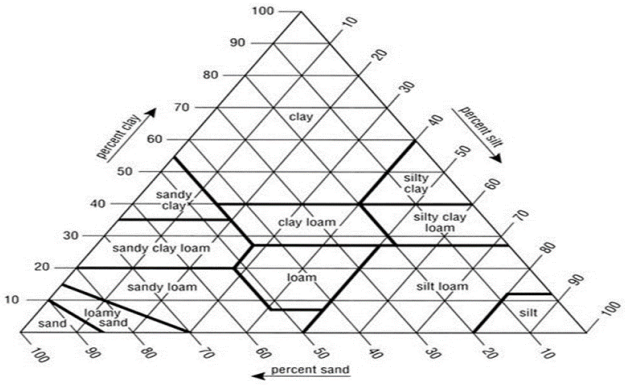
Poly-phase system of soil - components of soil - soil profile - Physical properties: Soil texture, mass - volume relationship - Soil structure: aggregation - porosity - pore size distribution - Soil water measurements - Soil water potential - Rheological properties and transport phenomena: stress - strain relations - soil moisture – movements - surface tension - contact angle - Evaporation and solution diffusion - osmosis and osmotic pressure - factors affecting soil temperature and its importance to plant growth.

PART – A

Q.No	Questions	BT Level	Competence
1.	What is soil physics?	BTL 1	Remembering
2.	What are the components of soil?	BT L 1	Remembering
3.	List out the important functions of soil.	BT L 1	Remembering
4.	Sketch the three-phase diagram of soil.	BT L 2	Understanding
5.	Write short notes on soil structure.	BT L 2	Understanding
6.	What is the soil diameter range for sand, silt and clay?	BTL 1	Remembering
7.	Name the various layers in soil Horizon.	BT L 1	Remembering
8.	Write a short note on gravimetric soil water content.	BT L 2	Understanding
9.	Give the features of soil Horizon O and A.	BT L 2	Understanding
10.	Write a short note on soil texture.	BT L 1	Remembering
11.	What are the various types of soil structure?	BTL 1	Remembering
12.	Define the term porosity.	BT L 1	Remembering
13	Write short note on gravel.	BT L 2	Understanding
14.	What are the various types of pores?	BT L 1	Remembering
15.	What are the three elementary models that explains soil responses to stress and strain?	BT L 1	Remembering
16	What is soil strength?	BT L 2	Understanding
17.	Classify the types of soil based on the contact angle between the water molecule and solid.	BT L 2	Understanding
18.	Write in brief about the term soil rheology.	BT L 2	Understanding

19	Define the term soil degradation.	BT L 2	Understanding
20.	What are osmotic pressures?	BT L 1	Remembering
21	List the factors affecting water retention in the soil.	BT L 2	Remembering
22	Write the expression for osmotic pressure of a dilute solution.	BT L 2	Understanding
23	List the types of forces acting on soil moisture.	BT L 21	Remembering
24	Name any two factors which affects the soil temperature.	BT L 2	Understanding

PART – B

Q. No	Questions		BT Level	Competence
1.	Explain the various components of soil.	16	BT L 3	Applying
2.	Write a short note on the following (i) Minerals (ii) Water (iii) Organic matter (iv) Gases	4 4 4 4	BT L2	Understanding
3.	Use a soil texture triangle to calculate the soil texture for the following combinations of sand, silt and clay: select a suitable combination for cultivation  25% sand, 30% silt, 45% clay 40% sand, 30% silt, 30% clay 60% sand, 10% silt, 30% clay 70% sand, 12% silt, 18% clay 90% sand, 5% silt, 5% clay 80% sand, 15% silt, 5% clay 10% sand, 85% silt, 5% clay 5% sand, 75% silt, 20% clay 40% sand, 40% silt, 20% clay 55% sand, 5% silt, 40% clay 10% sand, 60% silt, 40% clay 5% sand, 45% silt, 50% clay	16	BTL 5	Evaluating

4.	Describe the various components in soil Horizon	16	BT L 3	Applying
5.	Explain in detail about the features of various horizons (O, A, E, B, C, R).	16	BT L 3	Applying
6.	(i) What is soil structure? (ii) What are the various types of soil structure and how will you distinguish based on grades?	3 13	BT L1	Remembering
7.	What is pore space?	3	BT L1	Remembering
	Explain the various types of pores based on size.	13	BT L4	Analyzing
8.	Explain in detail how the soil structure can be classified based on grades and give its features.	16	BT L4	Analyzing
9.	Describe surface tension in soil. Explain how it influences the soil properties?	16	BT L4	Analyzing
10.	Define surface tension	3	BT L1	Remembering
	Explain the various effects of surface tension in soil.	13	BT L4	Analyzing
11.	Write detailed notes on particle density, bulk density and specific gravity.	16	BT L 3	Applying
12	Explain with neat diagram, mass - volume relationship in soil.	16	BT L4	Analyzing
13.	How does the contact angle between water and soil vary with changes in soil wetness, also explain hydrophilic and hydrophobic nature of soils.	16	BT L4	Analyzing
14.	(i) What is contact angle. Explain how the contact angle varies with wetness with soil.	8	BT L4	Analyzing
	(ii) Differentiate hydrophilic and hydrophobic soils.	8	BT L 2	Understanding
15.	Explain in detail about osmotic potential and osmotic pressure.	16	BT L4	Analyzing
16.	Explain the various factors affecting soil temperature.	16	BT L4	Analyzing
17	What are the various factors that influence soil temperature, and how do they contribute to the thermal dynamics of the soil environment?	16	BT L4	Analyzing

UNIT II - PHYSICS OF PRECISION FARMING AND IOT

Planting techniques: vertical farming - hydroponics-Indoor farming - plant environment interactions - Solar radiation and transpiration - greenhouse effect – light – temperature - relative humidity - Precision farming principles - IoT devices - Unmanned Aerial Vehicles (UAVs) - Drones in Agriculture - Types and Properties of Crops Monitored - Basic components of remote sensing- signals, sensors and sensing systems; active and passive remote sensing - Liquid Level Sensors.

PART A

Q.No	Questions	BT Level	Competence
1.	Define precision farming.	BTL 1	Remembering
2.	What is meant by artificial farming?	BTL 1	Remembering
3.	Write short note on vertical farming.	BTL 2	Understanding
4.	What can be grown in vertical farm?	BTL 1	Remembering

5.	List the advantages of vertical farming.	BTL 2	Understanding
6.	Explain the term Aerophonics.	BTL 2	Understanding
7.	Write in brief about the wick system.	BTL 2	Understanding
8.	What are the disadvantages of vertical farming?	BTL 1	Remembering
9.	What is meant by Ebb and flow method?	BTL 1	Remembering
10.	What are the various types of green house?	BTL 4	Analyzing
11.	How IOT can be used in agriculture?	BTL 1	Remembering
12	What are the benefits of precision farming?	BTL 1	Remembering
13	What are the infrastructures required for adopting a smart agriculture system using IOT?	BTL 1	Remembering
14.	What is UAV?	BTL 1	Remembering
15.	What type of drone is used in agriculture?	BTL 2	Understanding
16.	What is the future of drones in agriculture?	BTL 2	Understanding
17	What are the limitations of agri drones?	BTL 2	Understanding
18.	How electromagnetic sensors are used in agriculture?	BTL 2	Understanding
19.	What are the basic components of remote sensing in agriculture?	BTL 1	Remembering
21.	What are the functions of multispectral and hyper spectral sensors.	BTL 2	Understanding
22.	Differentiate active and passive remote sensing.	BTL 2	Understanding
23.	List out the advantages of active and passive remote sensing in agriculture.	BTL 1	Remembering
24.	What does the term Liquid level sensor refer to?	BTL 1	Remembering

PART – B

Q.No	Questions		BT Level	Competence
1.	What is vertical farming?	3	BTL 2	Understanding
	Explain the various types of vertical farming in detail?	13	BTL 4	Analyzing
2.	Explain in detail about the concept of Vertical Farming and various methods employed in Vertical Farming.	16	BTL 4	Analyzing
3.	Explain in detail the types of hydroponics.	16	BTL 4	Analyzing
4.	Discuss elaborately about different types of hydrophonic systems.	16	BTL 3	Applying
5.	What is greenhouse technology?	3	BTL 2	Understanding
	Explain how the greenhouse can be classified based on shapes?	13	BTL 4	Analyzing
6.	Elaborate the classification of greenhouses based on their shapes; write an explanation of the various categories.	16	BTL 4	Analyzing
7.	What are sensors?	3	BTL 1	Remembering
	Explain the various types of sensors used for soil mapping?	13	BTL 4	Analyzing

8.	Discuss the following in detail. (i) Electromagnetic sensors (ii) Electrochemical sensors (iii) Mechanical sensors (iv) Optical sensors	 4 4 4 4	BTL 4	Analyzing
9.	Discuss in detail about the solar radiation and transpiration in precision farming?	16	BTL 4	Analyzing
10.	What is UAV?	3	BTL 1	Remembering
	Explain in detail about the key features of UAV.	13	BTL 4	Analyzing
11.	Discuss the benefits and limitations of agri drones.	16	BTL 3	Applying
12.	Explain the basic components of remote sensing in agriculture.	16	BTL 3	Applying
13.	Explain the sensors and sensing systems used in precision agriculture.	16	BTL 3	Applying
14.	Demonstrate the functionalities of sensors and sensing systems employed in precision agriculture.	16	BTL 3	Applying
15.	Explain in detail about the active and passive remote sensing in precision agriculture?	16	BTL 3	Applying
16.	Give an insight into the agricultural applications of liquid level sensors and elaborate on how they are utilized in the field?	16	BTL 4	Analyzing
17.	What is Liquid level sensor?	3	BTL 1	Remembering
	Explain how liquid level sensor is used in agriculture.	13	BTL 3	Applying

UNIT- III: PHYSICS OF ENERGY HARVESTING

Energy sources - Classification - Biomass and its types - Energy from Biomass - Types of biogas plants - constructional details - Principles of combustion, pyrolysis, gasification and briquetting (qualitative). Wind energy - Types of wind mills, Constructional details and application – Solar energy applications - grain dryers - Refrigeration system - ponds- fencing - pumping systems.

PART - A

Q.No	Questions	BT Level	Competence
1.	What is meant by biomass?	BTL1	Remembering
2.	How biomass conversion takes place?	BTL2	Understanding
3.	What is the difference between biomass and bio gas?	BTL1	Remembering
4.	Name the various models of biogas plant.	BTL2	Understanding
5.	Give a list of the materials used for biogas.	BTL2	Understanding
6.	Give a brief note on the forms of biomass.	BTL2	Understanding
7.	List out the advantages biomass.	BTL1	Remembering
8.	What are the components of biogas?	BTL1	Remembering
9.	What are the factors affect the size of the biogas plants?	BTL1	Remembering
10.	What is pyrolysis?	BTL1	Remembering

11.	Define gasification processes.	BTL1	Remembering
12.	How are the gasifiers classified?	BTL1	Remembering
13.	List down the factors that influence the nature of wind.	BTL2	Understanding
14.	State the term Airfoil.	BTL2	Understanding
15.	Write short notes on the forces acting on the turbine blades.	BTL2	Understanding
16.	Name the factors that determine the output from wind energy convertor.	BTL1	Remembering
17.	Define the term power coefficient.	BTL1	Remembering
18.	What are the factors that affect the nature of the wind close to the surface of the earth?	BTL1	Remembering
19.	Write down the characteristics of good wind power site.	BTL1	Remembering
20.	What are the advantages of one bladed rotor?	BTL1	Remembering
21.	What are the advantages of vertical axis wind turbines over horizontal axis?	BTL1	Remembering
22.	Explain in brief the savonius Rotor.	BTL3	Applying
23.	What is Darrieus motor?	BTL1	Remembering
24.	Write short notes on applications of wind energy.	BTL1	Remembering

PART - B

Q.No	Questions		BT Level	Competence
1.	Describe in detail about the construction and working of any one type of biomass plant.	16	BTL3	Applying
2.	Explain in detail about the construction and working of the KVIC biogas plant.	16	BTL4	Analyzing
3.	Write a brief note on the construction and working of the Deenbandhu biogas plant.	16	BTL4	Analyzing
4.	(i) Discuss elaborately about the principles of combustion, pyrolysis and gasification.	8	BTL3	Applying
	(ii) Differentiate combustion and gasification process in biomass	8	BTL4	Analyzing
5.	What is gasifier? Explain in detail about any three types of gasifiers.	16	BTL4	Remembering
6.	Explain the following. (i) Updraught or counter current gasifier (ii) Downdraught or co-current gasifiers (iii) Cross-draught gasifier	5 5 6	BTL4	Analyzing
7.	(i) What is wind power?	3	BTL2	Understanding
	(ii) Explain in detail about the various types of wind turbine	13	BTL4	Analyzing
8.	Discuss in detail about the following (i) Horizontal Axis Wind Turbines (HAWT) (ii) Vertical Axis Wind Turbines (VAWT)	8 8	BTL4	Analyzing
9.	(i) What is solar dryer and name the types of solar dryer?	3	BTL2	Understanding
	(ii) Explain in detail about the types of solar dryer	13	BTL4	Analyzing

10.	(i) Discuss in detail about the direct and indirect solar dryers?	8	BTL5	Evaluate
	(ii) Explain elaborately on how solar grain dryers are useful in agriculture field.	8	BTL4	Analyzing
11.	(i) What is solar pond?	3	BTL1	Remembering
	(ii) Explain the construction details and key features of solar pond.	13	BTL3	Applying
12.	Explain in detail about solar power fencing system.	16	BTL3	Applying
13.	(i) What is solar fencing?	3	BTL1	Remembering
	(ii) Explain about the installation technique and working principle of solar fencing?	13	BTL3	Applying
14.	Describe the principle and working of solar-powered pump.	16	BTL3	Applying
15.	Describe the principle and working of Solar refrigeration systems.	16	BTL3	Applying
16.	Explain in detail about (i) Solar-powered pump (ii) Solar refrigeration systems	8 8	BTL3	Applying
17.	(i) What are Solar collectors?	3	BTL1	Remembering
	(ii)Explain how Solar conversion system is useful for farming.	13	BTL3	Applying

UNIT IV - PHYSICAL TECHNIQUES IN AGRICULTURE

Basics in Sensing by Electromagnetic Radiation - Emission, Absorption, Reflection and Transmission of Radiation - sensing the electrical conductivity of soil - Chlorophyll fluorescence-steady state and non-steady state - Application of X-ray computed tomography to soil science. Infrared radiometer - sensing water supply of crops - transpiration of crops. Sensing techniques in topography-Soil thermometers - soil heat flux plates, instruments for measuring soil moisture, laser land leveler.

PART - A

Q.No	Questions	BT Level	Competence
1.	What is emission spectroscopy?	BTL1	Remembering
2.	Outline the concept of absorption spectroscopy?	BTL2	Understanding
3.	Sketch the four different processes when matter interacts with electromagnetic radiation.	BTL2	Understanding
4.	Enlist the role of emission and absorption techniques in soil spectroscopy.	BTL2	Understanding
5.	What is the benefit to assess the electrical conductivity of soil?	BTL1	Remembering
6.	What is the principle to measure the electrical conductivity of soil?	BTL1	Remembering
7.	List the three methods involves in measuring the electrical conductivity of soil.	BTL2	Understanding
8.	State the principle of Chlorophyll fluorescence.	BTL2	Understanding
9.	Name the instrument which measures the Chlorophyll fluorescence.	BTL2	Understanding
10.	What are the applications of Chlorophyll fluorescence?	BTL2	Understanding
11.	What is the principle of X-ray computed tomography in soil science?	BTL1	Remembering

12.	How the absorption of X-rays varies with different soil samples?	BTL1	Remembering
13.	What are the applications of X-ray computed tomography in the field of agriculture?	BTL1	Remembering
14.	What is infrared radiometer? How it is helpful to assess plant health?	BTL1	Remembering
15.	What is the role of infrared radiometer in early disease detection of plants?	BTL1	Remembering
16.	Write in brief about bent-stem soil thermometer.	BTL 1	Remembering
17.	Write a short note on soil heat flux sensor.	BTL2	Understanding
18.	What are the advantages of the flux plate method.	BTL 1	Remembering
19.	Why it is needed to measure the soil moisture?	BTL2	Understanding
20.	Name the three different methods for soil moisture determination.	BTL 2	Understanding
21.	Write a short note on tensiometers.	BTL 1	Remembering
22.	Name the instruments which measure the soil moisture.	BTL 2	Understanding
23.	What are the available Land leveling techniques?	BTL1	Remembering
24.	List the five major components involved in Land leveling.	BTL2	Understanding

PART - B

Q.No	Questions		BT Level	Competence
1.	Explain in short about the principle of Emission, Absorption, Reflection and Transmission of Radiation.	16	BTL4	Analyzing
2.	What are the underlying principles that govern how objects interact with radiation, encompassing processes like emission, absorption, reflection, and transmission?	16	BTL 1	Remembering
3.	Explain how the Emission, Absorption spectroscopic techniques is used to sense the soil.	16	BTL4	Analyzing
4.	Explain in detail about the emission and absorption spectroscopy in soil science.	16	BTL4	Analyzing
5.	Describe in detail with the principle how to sense the electrical conductivity of soil.	16	BTL 3	Applying
6.	(i) How can the electrical conductivity of soil be effectively sensed?	8	BTL 1	Remembering
	(ii)What are the detailed principles underlying the sensing process?	8	BTL 1	Remembering
7.	Explain Chlorophyll fluorescence in detail.	16	BTL 2	Understanding
8.	Outline a comprehensive explanation of chlorophyll fluorescence and discuss its intricate details and underlying mechanisms.	16	BTL 5	Evaluating
9.	Explain the principle and working of X-ray computed tomography in soil science.	16	BTL 5	Evaluating
10.	What is the operational principle behind X-ray computed tomography in the context of soil science, and how does it function to provide insights of soil characteristics?	16	BTL 3	Applying
11.	Explain infrared radiometer in detail?	16	BTL 2	Understanding

12.	(i) What is infrared radiometer?	3	BTL 2	Understanding
	ii) Explain in detail about the working principle of infrared radiometer in detail?	13	BTL 3	Applying
13.	(i) What do you meant by soil thermometer?	3	BTL 2	Understanding
	(ii) Explain in detail about bent stem soil thermometer.	13	BTL 5	Evaluating
14.	(i) What is soil heat flux plate?	3	BTL 5	Evaluating
	(ii) Explain in detail about the procedure, advantages and disadvantages	13	BTL 3	Applying
15.	(i) What is soil moisture?	3	BTL 1	Remembering
	(ii)What are the different methods available to determine the soil moisture?	13	BTL 1	Remembering
16.	(i) Outline the principle and components of land levelling.	8	BTL2	Understanding
	(ii) Explain in detail about the various land levelling techniques.	8	BTL3	Applying
17.	Explain the principle, components and various techniques available in land levelling.	16	BTL3	Applying

UNIT – V NANO TOOLS FOR AGRICULTURE

Nano materials – properties - nanofibers-nanowires - biomass waste based nanomaterials - fluorescent C-dots - nano sensors - nano biosensors - nano smart dust and gas nanosensors - fluorescent dye biosensors - magnetic nanoparticle based sensors - nanophoto semiconductors

PART - A

Q.No	Questions	BT Level	Competence
1.	What are nanomaterials?	BTL2	Understanding
2.	List out any four properties of nanomaterial.	BTL1	Remembering
3	Write short notes about tenability of nanomaterials.	BTL2	Understanding
4.	What is the role of nanofibers in smart irrigation systems?	BTL2	Understanding
5.	What is the role of nanowire in soil science?	BTL2	Understanding
6.	How nanowires are used in trace element analysis?	BTL2	Understanding
7.	What are fluorescent carbon dots (C-dots)?	BTL1	Remembering
8.	Outline the principle of fluorescent carbon dots (C-dots).	BTL2	Understanding
9.	Write about the synthesize method to prepare C-dots.	BTL2	Understanding
10.	How C-dots is used in drug delivery system?	BTL2	Understanding
11.	Justify the role of C-dots in energy storage systems.	BTL2	Understanding
12.	What is the underlying principle behind nano-bio sensor?	BTL1	Remembering
13.	What are biomass waste nanomaterials?	BTL1	Remembering
14.	What are the sources for biomass waste?	BTL1	Remembering

15.	Enlist the common techniques to convert biomass waste into nanomaterials.	BTL1	Remembering
16.	What are the various types of nanomaterials derived from biomass waste?	BTL1	Remembering
17.	List the advantages of nanomaterials synthesized from biomass waste.	BTL2	Understanding
18.	How would you define Nano smart dust sensors	BTL2	Understanding
19.	What do you meant by Gas nanosensors?	BTL1	Remembering
20.	List any two applications of Gas nanosensors?	BTL2	Understanding
21.	How would you state the concept of Nanophotonics?	BTL2	Understanding
22.	Define Plasmonics.	BTL2	Understanding
23.	Can you provide an explanation for magnetic nanoparticle?	BTL2	Understanding
24.	Write any two applications for magnetic nanoparticle-based sensors.	BTL2	Understanding

PART - B

Q.No	Questions		BT Level	Competence
1.	Explain the various properties of nanomaterials.	16	BTL 3	Applying
2.	Give a detailed explanation of the diverse properties exhibited by nanomaterials.	16	BTL4	Analyzing
3.	Explain the role of nano fibers in soil science.	16	BTL4	Analyzing
4.	How do nano fibers contribute to advancements and applications in the field of soil science?	16	BTL4	Analyzing
5.	Explain how nanowires play a potential role in the study of soil science?	16	BTL 3	Applying
6.	(i) What are nanowires?	3	BTL1	Remembering
.	(ii) Give an elaborate discussion on how nanowires play a role in Smart Irrigation Systems.	13	BTL4	Analyzing
7	Explain about Fluorescent Carbon dots (C-dots) in detail.	16	BTL 3	Applying
8.	(i) Write about Fluorescent properties.	3	BTL1	Remembering
	(ii) Explain the structure, composition, synthesis method and applications of fluorescent Carbon dots (C-dots).	13	BTL 3	Applying
9.	Explain in detail about the principle, structure and working of nano biosensors.	16	BTL 3	Applying
10.	Elaborate on the fundamental principles, structural components, and operational mechanisms of nano biosensors.	16	BTL4	Analyzing
11.	Explain in detail about (i) Nano smart dust sensors (ii) Gas nanosensors	8 8	BTL 3	Applying
12.	Give a comprehensive explanation about the working principles and applications of Nano smart dust sensors and Gas nanosensors.	16	BTL4	Analyzing

13.	Explain in short about magnetic nanoparticle-based sensors.	16	BTL 3	Applying
14.	Discuss in detail about how magnetic nanoparticle can be applied in field of biosensing, medical diagnostics and environmental monitoring.	16	BTL4	Analyzing
15.	Explain the principles, synthesis methods and applications of Nanophotonics.	16	BTL 3	Applying
16.	Explain the various synthesis methods of Nanophotonics.	16	BTL 3	Applying
17.	Explain in detail the role of Nanophotonics in agriculture.	16	BTL 3	Applying