

INSTRUCTION TO STUDENTS: ATTEMPT ALL THE QUESTIONS (100%)

TIME FOR THE EXAM: THREE HOURS

1. What do you understand by the following terms?

- i. Aquaculture** – This is fish farming. It is the art and science of controlled rearing of fish in ponds, farms and in some instances natural water bodies from hatchlings to matured size. It involves the farming of fish, crustaceans, mollusks, aquatic plants, algae, and other organisms. Aquaculture involves cultivating freshwater and saltwater populations under controlled conditions, and can be contrasted with commercial fishing, which is the harvesting of wild fish. Unlike fish that grow in the wild water bodies, without human interference, in aquaculture, activities such as feeding, fertilization, stocking, reproduction and harvesting are controlled.
- ii. Semi-closed Aquaculture Systems** - Semi-closed aquaculture refers to the land-based production of aquatic animals, in which water is exchanged between the farm and a natural waterway. Waste water is released from the ponds into the local waterway, whilst the farm is replenished with fresh water pumped back into the system.
- iii. Closed Aquaculture Systems** - Closed system aquaculture refers to the land-based rearing of aquatic species in raceways, tanks and ponds. Recirculation technology is implemented which cycles water through filtration processes and returns it back into the aquaculture system
- iv. Extensive production of fish** - usually refers to fish farming conducted in medium- to large-sized ponds or water bodies; the fish production relies merely on the natural productivity of the water which is only slightly or moderately enhanced. Externally supplied inputs are limited; costs are kept low; capital investment is restricted; the quantity of fish produced per unit area is low. In brief, the control over the production factors is kept low. The return on labour is high.
- v. Intensive production of fish** – This implies that the quantity of fish produced per unit of rearing area is great. To intensify the culture, production factors, such as feed, quality of water and quality of stocked fingerlings, are controlled to improve the production conditions. There is steady monitoring during the

production cycle. Intensive fish farming carries with it high costs or threats to the environment.

- vi. **Dams** - A dam is a barrier that stops or restricts the flow of water or underground streams. Reservoirs created by dams not only suppress floods but also provide water for activities such as irrigation, human consumption, industrial use, aquaculture, and navigability. Hydropower is often used in conjunction with dams to generate electricity. A dam can also be used to collect water or for storage of water which can be evenly distributed between locations. Dams generally serve the primary purpose of retaining water, while other structures such as floodgates or levees (also known as dikes) are used to manage or prevent water flow into specific land regions.
- vii. **Overfishing** - Overfishing is the removal of a species of fish from a body of water at a rate that the species cannot replenish, resulting in those species becoming underpopulated in that area.

2. Discuss in brief Five aims of aquaculture

- i. Production of protein rich, nutritive, palatable and easily digestible human food benefiting the whole society through plentiful food supplies at low or reasonable cost.
- ii. Providing new species and strengthening stocks of existing fish in natural and man-made water-bodies through artificial recruitment and transplantation.
- iii. Production of sportfish and support to recreational fishing.
- iv. Production of bait-fish for commercial and sport fishery.
- v. Production of ornamental fish for aesthetic appeal.
- vi. Recycling of organic waste of human and livestock origin.
- vii. Land and aquatic resource utilization - this constitutes the macroeconomic point of view benefiting the whole society. This involves maximum resource allocation

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to aquaculture and its optimal utilization, increasing standard of living by maximizing profitability; and creation of production surplus for export (earning foreign exchange especially important to most developing countries).

3. Name FIVE types of aquacultures for fish farming.
 - i. Static freshwater ponds culture.
 - ii. Running water culture.
 - iii. Culture in recirculatory systems (reconditioned water and in closed systems.)
 - iv. Culture in rice fields.
 - v. Aquaculture in raceways (cages, pens and enclosures)
 - vi. Finfish-culture cum livestock rearing.
 - vii. Monoculture
 - viii. Polyculture

4. Dams can be sources of water supply to an aquaculture project or the medium through which marine life flourishes. Briefly discuss any FIVE types of dams

- i. Arch dams

In the arch dam, stability is obtained by a combination of arch and gravity action. If the upstream face is vertical the entire weight of the dam must be carried to the foundation by gravity, while the distribution of the normal hydrostatic pressure between vertical cantilever and arch action will depend upon the stiffness of the dam in a vertical and horizontal direction. When the upstream face is sloped the distribution is more complicated. The normal component of the weight of the arch ring may be taken by the arch action, while the normal hydrostatic pressure will be distributed as described above.

- ii. Gravity dams

In a gravity dam, the force that holds the dam in place against the push from the water is Earth's gravity pulling down on the mass of the dam. The water presses laterally (downstream) on the dam, tending to overturn the dam by rotating about its toe (a point at

the bottom downstream side of the dam). The dam's weight counteracts that force, tending to rotate the dam the other way about its toe.

iii. Arch-gravity dams

A gravity dam can be combined with an arch dam into an arch-gravity dam for areas with massive amounts of water flow but less material available for a pure gravity dam. The inward compression of the dam by the water reduces the lateral (horizontal) force acting on the dam. Thus, the gravitational force required by the dam is lessened.

iv. Barrages

A barrage dam is a special kind of dam that consists of a line of large gates that can be opened or closed to control the amount of water passing the dam. The gates are set between flanking piers which are responsible for supporting the water load, and are often used to control and stabilize water flow for irrigation systems. Barrages that are built at the mouths of rivers or lagoons to prevent tidal incursions.

v. Embankment dams

Embankment dams are made of compacted earth, and are of two main types: "rock-fill" and "earth-fill". Like concrete gravity dams, embankment dams rely on their weight to hold back the force of water.

vi. Concrete-face rock-fill dams

A concrete-face rock-fill dam (CFRD) is a rock-fill dam with concrete slabs on its upstream face. This design provides the concrete slab as an impervious wall to prevent leakage and also a structure without concern for uplift pressure. In addition, the CFRD design is flexible for topography, faster to construct and less costly than earth-fill dams.

vii. Earth-fill dams

Earth-fill dams, also called earthen dams, rolled-earth dams or simply earth dams, are constructed as a simple embankment of well-compacted earth. A homogeneous rolled-earth dam is entirely constructed of one type of material but may contain a drain layer to collect seep water. A zoned-earth dam has distinct parts or zones of dissimilar material, typically a shell of locally plentiful material with a watertight clay core. Modern zoned-earth embankments employ filter and drain zones to collect and remove seep water and preserve the integrity of the downstream shell zone.

viii. Fixed-crest dams

A fixed-crest dam is a concrete barrier across a river. Fixed-crest dams are designed to maintain depth in the channel for navigation. They pose risks to boaters who may travel over them, as they are hard to spot from the water and create induced currents that are difficult to escape.

5. When considering to feed your fish, the quality and type of food selected should matter. In the selection of food, there are two divisions of food types, Natural fish food and supplementary artificial fish food. Discuss each giving examples.

Natural Fish Food – These are food that are produced naturally in ponds or reservoirs. They are very small and their movements depend on the direction of the water current that helps goes towards them. They are known as plankton. Plankton are the diverse collection of organisms found in water (or air) that are unable to propel themselves against a current (or wind). The individual organisms constituting plankton are called plankters. Plankton can be seen in all types of reservoirs, except for high flowing rivers. Plankton is one of the small flora and fauna whose movement capacity is so limited that they cannot cross the stream. Therefore, in most aquatic environments, movements of a large number of plankton species are controlled by wave and water currents. Plankton are of two the following types; Phytoplankton and Zooplankton. Another example is the Green Algae. They are a portion of very popular fish food. Their main feature is the presence of chlorophyll or green particles in the body. Among the various green algae, Chlorella, Chlamydomonas, Volvox, Scenedesmus, and Ulothrix are notable. These kinds of algae do not live for a long time. Overall, they are regulated when fertilizer and supplementary foods are stopped. Another example is the Blue-Green Algae which are

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are also plant-like microscopic organisms that grow in water bodies such as ponds, rivers, lakes, and streams. They are blue-green but can also be olive-green or red in colour. They also play important fish food while alive and dead.

Supplementary or Artificial Fish Foods - When we cultivate fish in large quantities and raise them, then it will not depend only on natural food. They have to provide supplementary or artificial foods made from outside. Examples include low cost of plant-based foods such as grains like rice grain, rice bran, groundnut pieces etc are usually used to make supplementary food etc.

6. In a free market system, the prices of fish are not fixed and are determined by a complex of factors. State any FIVE

- (a) transport cost,
- (b) production cost,
- (c) supply and demand,
- (d) competition,
- (e) processing technique,
- (f) variety of fish