IQRA NATIONAL UNIVERSITY PESHAWAR

DEPARTMENT OF CIVIL ENGINEERING

SUBJECT: IRRIGATION ENGINEERING

NAME: ABDUL BASIT
ID: 7776 SECTION: C

Q.NO (01) PART A

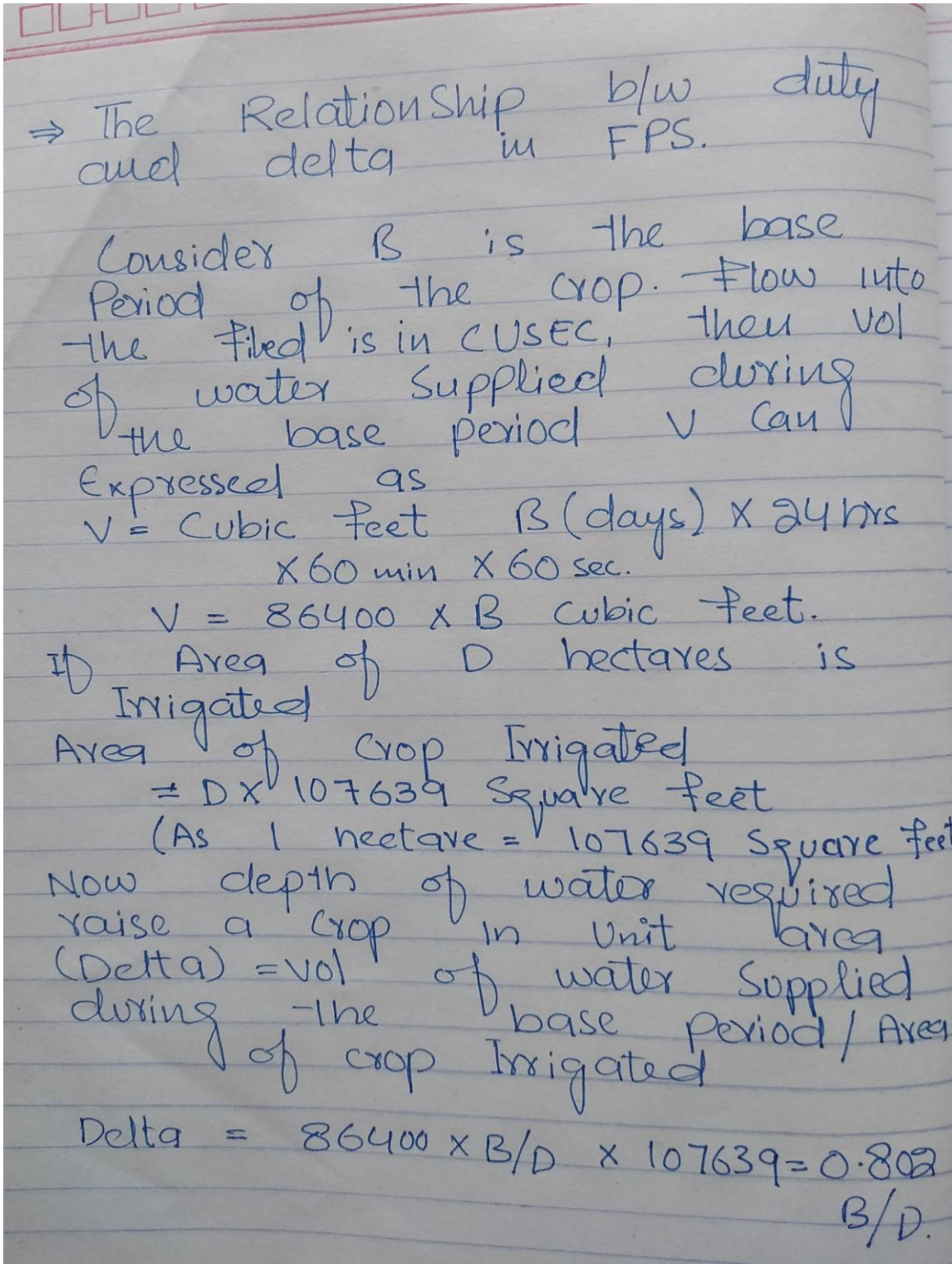
ANSWER

DUTY:

The term duty means the area of land that can be irrigated with unit volume of irrigation water. Duty represents the irrigating capacity of a unit. It is the relation the between the area of a crop irrigated and the quantity of irrigation water required during the entire period of the growth of that crop.

DELTA:

It is the total depth of the water required by a crop during the entire period the crop is in the field and is denoted by the symbol Δ.The term duty means the area of land that can be irrigated with unit volume of irrigation water. uantitatively, duty is defined as the area of land expressed in hectares that can be irrigated with unit discharge, that is, 1 cumec flowing throughout the base period, expressed in days.



The Relation Ship b/w duty and delta in MKS.

Consider B is the base period of the crop. flow into the filed is in Cumecs, then volume of water supplied during the base period V, can expressed as.

V (Cubic meters) = B(days) x 24(hrs) x(60) x(60)

V = 86400 x B cubic meter.

If Area of D hectares is irrigated Area of Crop irrigated = D x 10000 Square m(As 1 hectare = 10000 Square metter)

Now depth of water required raise a Crop in Unit area (Delta) = Volume of water Supplied during the base period/ Area of crop Irrigated

Delta = 86400 x B/D x 10000 = 8.64 B/D.

Q.NO (01) PART B

ANSWER

Q.NO (1) (B) part.

If wheat requires about 9 cm of water after every 35 days and the base period or crop period of wheat is 140 days. Find Out delta for wheat?

Solution

Assuming the base period to be representing the crop period as per usual practice. we can easily infer that water is required at an average interval of 35 dys up to a total period of 140 days.

⇒ This means that 5 (140/35) no. of watering are required 35 days

⇒ The depth of water required each time = 9 cm.

Total depth of water required in 140 days = 5 x 9 = 45 cm

hence Δ (delta) for wheat = 45 cm.

Q.NO (01) PART C

ANSWER
INDUS WATERS TREATY
The water distribution treaty between India and Pakistan that was brokered by the World Bank in 1960 to use the water available in the Indus system of rivers originating in India, has come in the limelight once again as New Delhi has decided to stop the flow of its share of water from the three eastern rivers - Beas, Ravi, and Sutlej - to Islamabad.

In the year 1960, India and Pakistan signed a water distribution agreement -- came to be known as Indus Waters Treaty -- which was orchestrated by the World Bank. This agreement took nine years of negotiations and divides the control of six rivers between the two nations once signed.

Under this treaty, India got control over:

- Beas
- Ravi
- Sutlej

While Pakistan got control over:

- Indus
- Chenab

Jhelum
Under the treaty signed between India and Pakistan in 1960, all the waters of the three eastern rivers, **averaging around 33 million acre-feet** (MAF), were allocated to India for exclusive use. The waters of the western rivers - Indus, Jhelum, and Chenab - **averaging to around 135 MAF**, were allocated to Pakistan except for 'specified domestic, non-consumptive and agricultural use permitted to India,' according to the treaty. India has also been given the right to generate hydroelectricity.
Indus, Chenab and Jhelum are the lifelines of Pakistan as the country is highly dependent on these rivers for its water supply. Since these rivers do not originate from Pakistan but flow to the country through India, Pakistan fears the threat of drought and famine.

While Chenab and Jhelum originate from India, Indus originates from China, making its way to Pakistan via India.

Q.NO (01) PART D

ANSWER
IMPORTANCE OF DUTY

- It helps us in designing an efficient canal irrigation system.
- Knowing the total available water at the head of a main canal, and the overall duty for all the crops required to be irrigated in different seasons of the year, the area which can be irrigated can be worked out.
- If we know the corps area required to be irrigated and their duties, we can work out the discharge required for designing the channel.
- It helps to grow agricultural crops, maintain landscapes, and re-vegetate disturbed soils in dry areas and during periods of less than average rainfall. Irrigation also has other uses in crop production, including frost protection, suppressing weed growth in grain fields and preventing soil consolidation.

==========Q.NO 01 END==========

Q.NO (02) PART (A) ANSWER

FACTORS AFFECTING CONSUMPTIVE USE OF WATER

Many factors operate singly or in combination to influence the amounts of water consumed by plants. Their effects are not necessarily constant, but the factors may differ with locality and water consumption may fluctuate from year to year. Some effects involve the human factor; others are related to the natural influences of the environment and to the growth characteristics of the plants.

PRECIPITATION

The amount and rate of precipitation may have some minor effect on the amount of water consumptively used during any summer. Under certain conditions, precipitation may occur as a series of frequent, light showers during the hot summer. Such showers may add little or nothing to the soil moisture for use by the plants through transpiration but do decrease the withdrawal from the stored moisture. Such precipitation may be lost largely by evaporation directly from the surface of the plant foliage and the land surface.

TEMPERATURE

The rate of consumptive use of water by crops in any particular locality is probably affected more by temperature, which for long-time periods is a good measure of solar radiation, than by any other factor.

HUMIDITY

Evaporation and transpiration are accelerated on days of low humidity and slowed during periods of high humidity. During periods of low relative humidity, greater rate of use of water by vegetation may be expected.

WIND MOVEMENT

Evaporation of water from land and plant surfaces takes place more rapidly when there is moving air than under calm air conditions. Hot, dry winds and other unusual wind conditions during the growing period will affect the amount of water consumptively used. However, there is a limit in the amount of water.

GROWING SEASON

The growing season, which is tied rather closely to temperature, has a major effect on the seasonal use of water by plants.

LATITUDE AND SUNLIGHT

Although latitude may hardly be called a climatic factor, it does have considerable influence on the rate of consumptive use of water by various plants. Because of the earth's movement and axial inclination

AVAILABLE IRRIGATION WATER SUPPLY

All the above-mentioned climatic factors influence the amount of water that potentially can be consumed in a given area. However, there are other factors that also cause important differences in the consumptive use-rates. Naturally, unless water is available from some source (precipitation, natural ground water, or irrigation)

QUALITY OF WATER

Some investigations have shown that the quality of the water supply may have an appreciable effect on consumptive use. Whether or not plants actually transpire more or less if water is highly saline may be debatable.

Q.NO (02) PART (B) ANSWER

Q NO 02 (Part B).

Given data

* Rainfall for whole season is 10 cm
* Cumulative consumptive use is 40 cm.
* water application efficiency is 80%.

Required.

$CIR = ?$

$FIR = ?$

Sol

$$C_u = \sum k \cdot f = k \sum_{i=1}^{4} P/40 (1.8t_i + 32)$$

where

$C_u = 40$ cm.

So

$C \cdot I \cdot R = C_u - R_e$

where R_e = Rainfall of whole season = 10c

$C \cdot I \cdot R = 40 - 10 = 30$ cm.

$$F \cdot I \cdot R = \frac{C \cdot I \cdot R}{E_a} \Rightarrow \frac{30}{0.8} =$$

$F \cdot I \cdot R = 37.5$ cm

Q.NO (02) PART (C) ANSWER

The Class A Evaporation Pan is a standard device for manual measurement of evaporation (Australian Bureau of Meteorology Class A type). The pan represents an open body of water: It is filled with water and exposed on a flat plateau.
The evaporation pan of this standard set is made of stainless steel and has the dimensions of a "class A" evaporation pan, namely 54 mm (10 inches) in height and 1206 mm (47.5 inches) in diameter. The evaporation pan is installed on the wooden support, which is set and leveled on the ground in a grassy location, away from bushes, trees and other obstacles which obstruct a natural air flow around the pan, thus representing open water in an open area.
The amount of evaporation is a function of temperature, humidity, wind and other ambient conditions. In order to relate the evaporation to wind current or expected conditions, the maximum and minimum temperature as well as the amount of air passed is recorded with the evaporation. For a more exact use of the evaporation pan it is recommended to use an additional wind path meter.

Q.NO (02) PART (D) ANSWER

CROP SEASON
They are hot weather crop season, rabi season and kharif season. The hot weather crop season ranges from February to May and the crops which can sustain heat and humid conditions are grown. Kharif season ranges from June to October. The crops are sown in the beginning of the monsoon and are harvested in autumn.

Kharif Crops:
Kharif crops, which are also known as monsoon crops, are the crops which are grown during the monsoon or rainy season (June to October). Their seeds are sown at the beginning of the monsoon season and the crops are harvested at the end of the monsoon season.

Kharif crops depend on the rainfall patterns. The timing and quantity of rainwater are the two important factors that decide the output of Kharif crops. The main Kharif crops grown in Pakistan include paddy, maize, jowar, bajra, cotton, sugarcane, groundnut, pulses etc.

The sowing time may vary in the different states of Pakistan as it depends on the arrival of monsoon, e.g. in southern states like Kerala, Tamil Nadu the seeds are usually sown towards the end of May and in northern states like Punjab, Haryana the seeds are sown in the month of June.

Rabi Crops:
Rabi crops, which are also known as winter crops, are the crops that are grown in the winter season (October or November). Their seeds are sown at the beginning of the winter season and crop is harvest at the end of the winter season or in the spring season.

The rabi crops are cultivated in the dry season so timely irrigation is required to grow these crops. Some of the main rabi crops of Pakistan include wheat, gram, oat, barley, potato, and seeds like mustard, linseed, sunflower, coriander, cumin, etc.
KHARIF RABI RATIO OR CROP RATIO:
The area to be irrigated for Rabi crop is generally more than that for the Kharif crop. This ratio of proposed areas, to be irrigated in Kharif season to that in the Rabi season is called, Kharif Rabi ratio. This ratio is generally 1.2 i.e. Kharif area is one-half of the Rabi area.

==========Q.NO 02 END==========

Q.NO (03) PART (A) ANSWER

FIELD CAPACITY

The term field capacity is interchangeably used with the terms the water holding capacity and water retention capacity. Field capacity is the amount of soil moisture or water content held in soil after excess water has drained away and the rate of downward movement has materially decreased, which usually takes place within 2–3 days after a rain or irrigation in pervious soils of uniform structure and texture.

When irrigation is applied to the soil, all the soil pores get filled with water. After the gravitational drainage, the large soil pores are filled with both air and water, while the smaller pores are still full of water. At this stage, the soil is said to be at field capacity. At field capacity, the water and air contents of the soil are considered to be ideal for crop growth.

Field capacity (Cc) corresponds to the superior limit of available water and represents the moisture of the soil after drainage of the water contained in the macrospores by gravity action. This moisture condition favors higher absorption of water and nutrients by the plants.

Q.NO (03) PART (B) ANSWER

PERMANENT WILTING POINT

The wilting point, also called the permanent wilting point, may be defined as the amount of water per unit weight or per unit soil bulk volume in the soil, expressed in percent, that is held so tightly by the soil matrix that roots cannot absorb this water and a plant will wilt.

The permanent wilting point is the point when there is no water available to the plant. The permanent wilting point depends on plant variety, but it is usually around 1500 kPa (15 bars). At this stage, the soil still contains some water, but it is difficult for the roots to extract from the soil. Nearly 15 bars of tension is required to extract water by the plants. At this limit, if no additional water is supplied to the soil, most of the plants die.

The permanent wilting point (Pm) corresponds to the inferior limit of available water. This moisture condition severely restricts the absorption of water by the plants, which will die if there is no replacement of the water in the soil.

Q.NO (03) PART (C) ANSWER

AVAILABLE MOISTURE (AVAILABLE WATER) (AW)

Available water capacity is the amount of water that can be stored in a soil profile and be available for growing crops. It is also known as available water content, profile available water or total available water.

The difference in moisture content of the soil between field capacity (F.C) and permanent wilting is termed the available moisture. Available moisture can be expressed as percentage moisture PW, as percentage PV or as depth d.

READILY AVAILABLE WATER (RAW)

Readily available water (RAW) is that portion of available water that the crop can use without affecting its evapo transpiration and growth. This portion is often indicated as a fraction of available water (p) and is dependent primarily on the type of crop and evaporative demand.

Soil moisture content near the wilting point is not readily available to the plant. Hence, the term readily available moisture has been used to refer to that portion of the available moisture that is most easily extracted by plants, approximately 75% of the available moisture.

Q.NO (03) PART (D) ANSWER

OPTIMUM UTILIZATION OF IRRIGATION WATER

If a crop is sown and produced under absolutely identical conditions, using different amounts of water depths, the yield is found to vary. The yield increases with water, reaches a certain maximum value and then falls down. The quantity of water at which the yield is maximum, is called the optimum water depth.

Therefore, optimum utilization of irrigation generally means, getting maximum yield with any amount of water. The supplies of water to the various crops should be adjusted in such a fashion, a to get optimum benefit ratio, not only for the efficient use.

Water resource management is the activity of planning, developing, distributing and managing the optimum use of water resources. It is a sub-set of water cycle management. The field of water resources management will have to continue to adapt to the current and future issues facing the allocation of water.

==========Q.NO 03 END==========