Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. | Question                                                                                                                                                                                                 | M.M.
---|---
1(a) | What are the various zones of the atmosphere? Discuss the significance of stratosphere and thermosphere in detail.                                                                                       | 6
(b)  | Write short notes on the followings:
     | (i) National ambient air quality standards (NAAQS)                                                                                                                                                    | 3x3
     | (ii) Primary and Secondary pollutants                                                                                                                                                               |
     | (iii) Composition of the atmosphere                                                                                                                                                                     |
2(a) | What are the criteria pollutant existing under NAAQS. Discuss in detail the Particulate Matter and its significance.                                                                                      | 6
(b)  | Write short notes on of the followings:
     | (i) Venturi Scrubber                                                                                                                                                                                   | 3x3
     | (ii) Fabric filters                                                                                                                                                                                     |
     | (iii) Spray Tower                                                                                                                                                                                       |
3(a) | Discuss in detail the method of adsorption and absorption for monitoring gaseous pollutants.                                                                                                          | 5
(b)  | Write brief notes on any two of the followings:
     | (i) Quantitative estimation of $SO_2$ and $NH_3$                                                                                                                                                      | 2x5
     | (ii) Volumetric and Gravimetric Analysis                                                                                                                                                              |
     | (iii) Principle of UV-visible spectrophotometer                                                                                                                                                       |
4 (a) Describe the significance of Carbon cycle with labelled diagram. [5]
(b) Write brief notes on \textbf{any two} of the followings: [2x5]
   (i) Sources and effects of indoor air quality
   (ii) Regional impact of temperature change
   (iii) Impact of increased exposure to UV radiation

OR

4' (a) Define alternative fuels and discuss the gasoline type biofuels in detail. [6]
(b) Write an informative notes on of the followings: [3x3]
   (i) Formation of photochemical Smog
   (ii) Nitrogen cycle
   (iii) Green House Effect
B.TECH. WINTER (SEMESTER) EXAMINATION
OPEN ELECTIVE (ALL BRANCH)
ADVANCED NUMERICAL METHODS
(AM443)

Maximum Marks: 60
Credits: 04
Duration: Two Hours

Note: Answer all the questions. Use of programmable calculators is not allowed.
Write answers up to four decimals.

1(a) Perform one iteration of Bairstow’s method to extract a quadratic factor
\[ x^2 + px + q \] from the polynomial
\[ x^4 - x^3 + 6x^2 + 5x + 10 = 0. \]
Take \( p_0 = 1.14 \) and \( q_0 = 1.42 \). Write all necessary steps.

OR

(a') Use two iterations of Newton Raphson’s method (matrix form) to determine a root of nonlinear equations
\[ \log_e(x^2 + y) - 1 + y = 0, \quad \sqrt{x} + xy = 0. \]
Take \( x_0 = 2.4 \) and \( y_0 = -0.6 \).

(b) Obtain the Chebyshev linear polynomial approximation of second degree to the function \( f(x) = \sqrt{x} \) on the set of points \( \{0, \frac{1}{2}, \frac{4}{9}, 1\} \).

2(a) Evaluate \( \int_0^{1/2} \frac{x}{\sin x} \, dx \) correct to 6-decimals, using Trapezoidal rule with
\( h = \frac{1}{2}, \frac{1}{4}, \frac{1}{8} \) and \( \frac{1}{16} \). Hence improve the result by using Romberg integration.

(b) Use RK-4 method to solve the following system of equations
\[
\begin{align*}
y' &= u, \\
u' &= -4y - 2u,
\end{align*}
\] for \( x = 0.2 \) with \( h = 0.1 \).

OR

(b') Solve by finite difference method the following BVP:
\[ y'' + 8(\sin^2 \pi x)y = 0, \quad 0 < x < 1, \quad y(0) = 1 = y(1) \]
with \( h = 1/3 \).

3(a) Write down the finite difference analogue of the Poisson’s equation
\[
\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -10(x^2 + y^2 + 10) \]
over the region bounded by the square.
0 ≤ x ≤ 3 and 0 ≤ y ≤ 3 with the mesh size h = 1 = k. The boundary conditions being \( u = 0 \) at \( x = 0 = y \) and at \( x = 3 = y \). Hence use \textit{two} iteration of Gauss-Seidel’s method to improve the values of \( u \) at the internal mesh points.

(b) Use Crank-Nicolson method to solve the heat conduction equation

\[
\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}
\]

with the boundary conditions: \( u(x, 0) = 0, \ u(0, t) = 0 \ \text{and} \ u(1, t) = t \),

by take \( h = 0.25 \ \text{and} \ k = 0.125 \). Write answers correct to six decimals.

4(a) Obtain a \textit{two} parameter solution of the boundary value problem:

\[
u'' + u = -1, \quad u(0) = 0 = u(1)
\]

by Galerkin’s method.

(b) Solve the boundary value problem:

\[
u'' - u = x, \quad u(0) = 0 = u(1)
\]

by finite element method for \( h = \frac{1}{5} \).
Maximum Marks: 60
Credits: 04
Duration: Two Hours

Answer all the questions.

1(a) Describe the primary and secondary bonds. Explain the formation of vander Waals and hydrogen bonds with two examples of each. [7.0]

1(b) What is STM? With the help of suitable illustrations, explain the principle, various modes of operation and applications of STM. [8.0]

OR

1(b') Explain the production of continuous and characteristics x-rays. Derive the Bragg’s law for x-ray diffraction. [8.0]

In a Bragg’s spectrometer using set of atomic planes of a crystal of interplanar spacing 2.5 Å, the glancing angle for the first order maximum was 10°. Find the wavelength of X-rays employed. At what angle would the second order maximum occur?

2(a) Explain the chemical (primary) structure of DNA in detail. Why G-C base pairing is stronger than A-T base pairing? [5.0]

OR

2(a') Differentiate between resting potential and action potential. How does a nerve signal pass through a nerve cell? [5.0]

2(b) What are chaperon molecules? Explain their role in protein folding. [3.0]

2(c) What is vertebrate heart? How many chambers does it have? Is heart really a pump? Show the pathway of blood circulation through it. [7.0]

3(a) Explain Raman effect and give its significance. The exciting line in an experiment is at 5460 Å and the Stokes line is at 5520 Å. Find the wavelength of the anti-Stokes line. [5.0]

3(b) Describe photoacoustic spectroscopy (PAS) and discuss its biological applications. [5.0]

3(c) Explain the term LASER, spontaneous emission, stimulated emission, population inversion and optical pumping. [5.0]

4(a) What are radiations? Write about chronic and acute exposure effects of radiation on biological system? [7.5]

4(b) What is radioactive labelling? Write a detailed note on radiation detector and its measurement. [7.5]
2018-2019
B.Tech (VIII SEMESTER) EXAMINATION
Electrical/Mechanical/Civil/Electronics/Computer/Architecture/Chemical/Petro Chemical Engineering
(Open Elective)
Fundamentals of Environmental Engineering
(CE-481)

Duration 2 hours

Maximum Marks : 60

Instructions:

Attempt all the questions.
Assume suitable data/value, if not given or missing.
Notations used have their usual meanings.

Q.No.1a Raw water analysis from any source indicates its quality for possible usage and accordingly the treatment scheme is chosen. List all the parameters (physical, chemical and biological) that you may analyze for a given water sample from a river source and describe the significance of each parameter. [06]

Q.No.1b Prepare a suitable scheme (neat sketch) to treat the water from a river source and describe the function and working principle of each unit of your scheme. [06]

Q.No.1'b Discuss the factors in detail that you may take into account while planning, siting, and designing the water treatment facility that receives raw water from a far distant source? [06]

OR

Q.No.2a A 200ml sample of water with an initial pH of 11.8 is titrated with 0.01N H₂SO₄. The sample reaches pH 8.3 after an addition of 8.2ml of the acid and additional 5.8ml is required to bring the sample to an end point pH 4.5. Determine the species of alkalinity present and the concentration of each in mg/l as CaCO₃. [06]

Q.No.2b The BOD of a wastewater is determined to be 225 mg/l at 20°C. The k value is known to be 0.23 /day. What would be the BOD₀ if the test were run at 15°C? [03]

Q.No.2c How do you characterize bio-degradable and non-biodegradable organic substances present in the wastewater? Discuss their laboratory measurement methods. [03]

Contd...
Q.No.3a Discuss aerobic and anaerobic processes for wastewater treatment. Classify and list few technologies that are based on the suspended and attached growth culture system.

Q.No.3b Prepare neat sketches (flow diagrams) each for technologies based on aerobic and anaerobic processes of your choice.

Q.No.3c Explain in brief with the help of neat diagram the working principles of UASB and Constructed Wetlands for wastewater treatment.

Q.No.4a Design a wastewater treatment plant based on an activated sludge process to treat 6 MLD of wastewater with the following input data:

- Incoming BOD = 180mg/l
- Outlet BOD < 20 mg/l
- MLSS = 3500mg/l
- Y = 0.5 kg/kg
- Kd = 0.05d⁻¹
- Underflow Biomass = 10000mg/l

Your design should include:
1. Volume of the tank
2. Geometry of the Tank
3. HRT
4. Quantity of the Wasted Sludge
5. Recirculation Ratio

Also prepare the flow diagram of your treatment scheme showing other units typically required.

OR

Q.No. 4'a i. Using the above data, design the UASB reactor (s) to treat the same quality of wastewater. Also prepare plan and a section of the UASB reactor showing your design values and other components.

ii. Why do post-treatment is required after UASB treatment system? What are the possible post-treatment units that you may provide?

Q.5 i. Discuss primary and secondary sources of air pollution. Give two examples of each.

ii. What do you mean by lapse rate? Show different forms of plume behavior in the atmosphere.

iii. List different types of control devices for air pollution. Write a brief note on the working principle of Electro-Static Precipitator

OR

iii. What are the different methods for disposal of solid waste? Write a short note any one of them.

[06] [03] [03] [12] [08] [04] [04] [04] [04] [04]
2017-18
B.TECH. (WINTER SEMESTER) EXAMINATION
(Civil/ Mechanical/ Electrical/ Electronics/ Computer/ Chemical/Petrochemical/ Architecture Engineering)

WATER RESOURCES AND WATERSHED MANAGEMENT
Open Elective

(CE-483)

Maximum Marks: 60 Credits: 04 Duration: Two Hours

Answer All Questions. Assume suitable data if missing. Notations used have their usual meaning.

Q.No. Question M.M.
1 (a) What do you understand by the term management of watershed? Discuss the essential activities adopted for sustainable management of any watershed. [7]
1 (b) Derive Horton’s expression for calculating total length of streams of all orders. For a given drainage basin of 5th order, the average length of channels are given below:

<table>
<thead>
<tr>
<th>Order ‘w’</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. channel length ‘Lw’ (Km)</td>
<td>0.382</td>
<td>0.621</td>
<td>1.025</td>
<td>13.95</td>
<td>21.14</td>
</tr>
</tbody>
</table>

Also given are the bifurcation ratio ‘Rb’ as 3.7, stream area ratio ‘Ra’ as 4.5 and the average area of the first order channel as 0.072 Km². Compute stream length ratio ‘Rl’, and the drainage area of the 5th order channel. Also, find the drainage density of the basin ‘Da’ and total number of streams of all orders ‘Nw’.

OR

1’ (a) Explain the following: [8]
   (i) Basin order and Circularity ratio
   (ii) Drainage density ‘Da’ and its significance
   (iii) Drainage patterns
   (iv) Slope of drainage basin

contd...2.
1' (b) Discuss the importance of delineating drainage basins. Appropriately assign the stream ordering to a drainage network shown in Fig. 1, and calculate the regression coefficients $a$ and $b$ of the best fit line for this network. Also state whether the correlation is weak or strong by determining the coefficient of determination.

Fig. 1

2 (a) Explain the term rainfall excess (RE). How is rainfall excess hyetograph (REH) obtained? Rainfall of magnitude 4.8 cm and 2.6 cm occurring on two consecutive 5-hour duration over a drainage basin of area 75 km$^2$ produced the following hydrograph at the outlet. Estimate the $\phi$ index and lag time ($T_\ell$) by plotting the hydrograph at a suitable scale.

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>-4</th>
<th>0</th>
<th>4</th>
<th>16</th>
<th>20</th>
<th>24</th>
<th>28</th>
<th>32</th>
<th>36</th>
<th>40</th>
<th>44</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runoff discharge (Q) m/s</td>
<td>7</td>
<td>7</td>
<td>14</td>
<td>25</td>
<td>32</td>
<td>40</td>
<td>35</td>
<td>27</td>
<td>16</td>
<td>12</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

2 (b) Explain the Rational method of computing the peak discharge of the catchment. Also discuss briefly the major demerits of this method. A sub-catchment of river Yamuna has an area of 42 km$^2$. The slope of sub-catchment is 0.005 and the maximum length of travel of water is 5 km. The maximum depth of rainfall recorded for 25 years period is as below:

<table>
<thead>
<tr>
<th>Duration (min)</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>175</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth of rainfall (mm)</td>
<td>22</td>
<td>34</td>
<td>48</td>
<td>62</td>
<td>79</td>
<td>94</td>
</tr>
</tbody>
</table>

Estimate the peak flow rate using Rational formula by assuming runoff coefficient $C$ as 0.46. Compare the peak discharge obtained from Rational method with that obtained from Dicken’s empirical formula.

OR

2' (b) Explain the following:

(i) Cloud seeding
(ii) Interlinking of rivers (Indian perspective)
3 Discuss the various steps involved in the planning of water-resources engineering projects.

4 (a) How does the economic viability of water resources project is determined?

OR

4 (a') Discuss the following:

(i) Hydrologic cycle with neat sketch
(ii) Soil Erosion

4 (b) A 250 kW hydropower project has the following two alternatives for conveyance of water from the reservoir to the power house. Which of the alternative is more economical? The annual interest rate may be taken as 6%.

I Alternative:

| i) Initial cost of the lined tunnel | = Rs 2,00,000.00 |
| ii) Useful life                     | = 100 years    |
| iii) Annual maintenance cost       | = Rs 15000.00  |

II Alternative:

(a)

| i) cost of power channel           | = Rs 500,000.00 |
| ii) useful life                    | = 100 years    |
| iii) annual maintenance cost       | = Rs 10,000.00 |

(b)

| i) cost of lining                   | = Rs 150,000.00 |
| ii) useful life                     | = 50 years     |
| iii) annual maintenance cost        | = Rs 7000.00   |

(c)

| i) cost of penstocks                | = Rs 225,000.00 |
| ii) useful life                     | = 50 years     |
| iii) annual maintenance cost        | = Rs 8000.00   |
2017-18
B.TECH. (WINTER SEMESTER) EXAMINATION
(MECH. / ARCH. / CIVIL. / CHEMICAL / PETROCHEMICAL / ELECTRICAL
/ ELECTRONICS / COMPUTER ENGINEERING)
(OPENS ELECTIVE)
SOLID WASTE MANAGEMENT
(CH-427)

Maximum Marks: 60 Credits: 04 Duration: Two Hours

Answer the questions in the order stated in the question paper.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question M.M.
1(a) What are the various types of properties of MSW? Explain the significance of [07] [CO 1]
properties in selecting appropriate disposal technology.

OR

1(a') Discuss the factors which lead to the development of the stream of, ‘Solid Waste [07] [CO 1]
Management’. Explain the role played by ‘H.B. Parsons in developing this stream.

1(b) The effectiveness of residential waste separation programs depends on the type of [08]
system used for the collection of separated wastes. A number of communities use a
system in which three containers are used for recycled materials in addition to one or more containers for non-recyclable materials. In the three-container system
(system 1), newspaper is placed in one container. Aluminum cans, glass, and plastics
are placed in the second container. The remaining wastes are placed in the 3rd
container. The separated materials, placed in special containers, are collected at the
curb. In another system (system 2), 4 containers are used. All paper and cardboard
materials are placed in one container. All plastic, glass, tin cans, aluminum, and any
other metals are placed in 2nd container. Garden wastes are placed in the 3rd container,
and all remaining waste materials are placed in the 4th container. Compare these 2
systems. Assume newspaper represents 25% of the total amount of paper. [CO 1]

2(a) Derive Pick up time equation for Stationary Container System (Mechanically [05]
Loaded) [CO 2]

(OR)

contd...
2(a') What is a Hauled Collection System (HCS)? Discuss

2(b) Explain the following terms with reference to waste collection operation.
   (i) Pickup
   (ii) Haul
   (iii) At Site
   (iv) Off Route

3(a) Explain and illustrate various gas generation phases in an active landfill.

3(a') What is a leachate? Explain how would you differentiate between old and fresh
leachate? Explain the Water Balance Method for estimating the quantity of leachate

3(b) With the help of a neat illustration give a brief account of final landfill cover
explaining various components involved into it?

4(a) List down and discuss various types of Gasifiers used for the gasification of organic
waste.

(OR)

4(a') Explain the process of pyrolysis and also discuss the effect of temperature on its
product distribution.

4(b) Determine the amount of oxygen required to oxidize 600 kg of an organic solid waste
aerobically. Assume that the initial composition of the organic material to be
decomposed in given by \([C_6H_{12}O_2(OH)]_3\), that the final composition of the residual
organic matter is estimated to be \([C_6H_2O_2(OH)]_3\), and that 300 kg of material
remains after the oxidation process.
END SEMESTER EXAMINATION 2017-18
COMPUTER ENGINEERING
SELECTED TOPICS IN COMPUTER ENGINEERING – II (CO-447N)
B.TECH. (VI/VIII SEMESTER)
OPEN ELECTIVE
Credits: 04
Duration: Two Hours

Maximum Marks: 60

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>Explain CSMA/CD. How is it different from ALOHA protocol? What will be the minimum frame size, if the network using CSMA/CD has bandwidth of 10Mbps and propagation delay is 25.6μs?</td>
<td>[3+3+1.5]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Explain Selective Repeat ARQ Protocol. In the explanation, justify the maximum size for sender’s and receiver’s window that could be chosen, assuming that the sequence number of frames is represented by m bit.</td>
<td>[7.5]</td>
</tr>
<tr>
<td>2(a)</td>
<td>How is Flow Control and Error Control achieved in Transmission Control Protocol?</td>
<td>[07]</td>
</tr>
</tbody>
</table>

OR

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2'1(a)</td>
<td>Explain, how are the tables in Distance Vector Routing updated? Discuss the solution to Two-Node Instability.</td>
<td>[4+3]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Write short note on the following:</td>
<td>[4+4]</td>
</tr>
<tr>
<td></td>
<td>1. File Transfer Protocol (FTP).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Role of SMI (Structure of Management Information) and MIB (Management Information Base) in SNMP.</td>
<td></td>
</tr>
<tr>
<td>3(a)</td>
<td>Explain the extended Relational-Algebra Operations. What are the five main functions of a Database Administrator?</td>
<td>[3+5]</td>
</tr>
</tbody>
</table>

OR

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'1(a)</td>
<td>What is the role of Storage Manager in DBMS? Explain about the various keys with an example for each.</td>
<td>[4+4]</td>
</tr>
</tbody>
</table>
3(b) Consider the following relations:

branch (branch_name, branch_city, assets)
customer (customer_name, customer_street, customer_city)
account (account_number, branch_name, balance)
loan (loan_number, branch_name, amount)
depositor (customer_name, account_number)
borrower (customer_name, loan_number)

Write SQL for the following queries:
1. To find the name, loan number and loan amount of all customers; rename the column name loan_number to loan_id.
2. Find all customers who have an account but no loan.
3. Find the number of depositors for each branch.
4. Find the names of all branches where the average account balance is more than ₹1,200.
5. Find all branches that have greater assets than some branch located in Brooklyn.
6. Provide as a gift for all loan customers of the Perryridge branch, a $200 savings account. Let the loan number serve as the account number for the new savings account

4(a) List and explain the ACID properties of the transaction. How can we ensure that the schedules are Recoverable Schedules and Cascadeless Schedules?

4(b) Explain the Log-Based Recovery? How is it different for Deferred Database Modification and Immediate Database Modification? What is Write-Ahead Logging?

OR

4'(a) What is Normalization of Database? Discuss 1NF, 2NF and 3NF.

4'(b) What are the modes in which a data item can be locked? Explain the Two-Phase locking protocol. How can we avoid Cascading Rollbacks in the Two-Phase locking protocol?
2017-18
B. TECH. / B. ARCH. (WINTER SEMESTER) EXAMINATION
INTELEECUTAL PROPERTY RIGHTs (IPR)
(OPEN ELECTIVE)
(HU-301)

Maximum Marks: 60
Duration: 2: 00 Hours

Note  Answer all the questions.

1. (a) Define Intellectual Property Rights (IPRs)? Discuss the nature & scope of IPR. (CO-1) (7.5)
(b) Define Patent. Discuss the major International conventions, treaties and agreements relating to Patents and Trademark. (CO-1,2) OR (7.5)
(b') Define Traditional Knowledge. How can we protect traditional knowledge? Discuss in the light of Neem & Turmeric case. (CO-1,2) (7.5)

2. (a) Who can file an application for grant of patent? Discuss the procedure for acceptance of application and grant of patent. (CO-2) (6)
(a') Define the term invention and patent. Explain the criteria for an invention to qualify for the grant of patent. (CO-3) (6)
(b) “Protection of Confidential Information/Trade Secret is least known and also least talked about, although it is perhaps the most important form of protection for Industries, R&D institutions and other agencies dealing with IPRs”. Comment in short. (CO-04) (5)

(c) What are obligations and limitations on the rights of Patentee? (CO-4) (4)

3. (a) Discuss the procedure for registration of Semi Conductor Integrated Layout Design. (CO-1,3) (7.5)
(b) Define copyright infringement and plagiarism. Bring out the similarities and differences between copyright infringement and plagiarism. (CO-3) OR (7.5)
(b') “Copyright gives protection for the expression of an idea & not for the idea itself”. Comment? (CO-1,3) (7.5)

4. (a) Define Trademark and discuss its essentials. What steps are involved in the registration of Trademark under The Trademarks Act, 1999? (CO-3) (7)
OR
(a') Discuss the salient features of The Geographical Indication of Goods (Registration & Protection) Act, 1999.(CO-3) (7)

(b) Explain any two (02) of the following: (CO-1) (04)
(i) Passing Off (04)
(ii) How Geographical Indication is different from Trade Mark? (04)
(iii) Rights of registered Trademark owners (04)

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2017-18
B.TECH. (WINTER SEMESTER) EXAMINATION
ARCHITECTURE/CIVIL/ELECTRICAL/CHEMICAL/ELECTRONICS/
MECHANICAL/COMPUTER/PETRO-CHEMICAL)
NON-CONVENTIONAL ENERGY (OPEN ELECTIVE)
ME-462

Maximum Marks: 60 Credits: 04 Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question M.M.
1(a) Write note on the oil crisis of 1973 and its consequences in the world energy scenario. (CO-1) [04]
1(b) Define the terms (i) Levelized cost of energy (ii) Net energy ratio and (iii) Pigovian tax (CO-1) [03]
1(c) A solar powered heating system for a fishing pond gives maintenance free service during its useful life of 20 years and is expected to save Rs. 2400 worth of fuel each year. If the discount rate is 12%, determine the present worth of the life cycle fuel saving by the system. (CO-1) [05]
2(a) What is solar constant? Write note on attenuation of solar radiation. (CO-2) [04]
2(b) A flat plate collector having two glass covers facing due south and located at a place having coordinates (23.03° N, 72.6° E) has the following data: (CO-3) [08]

Collector tilt = 40°
Diffuse radiation = 150 W/m²
Plate absorptivity = 0.94
Thickness of each glass cover = 4 mm
Refractive index of glass with respect to air = 1.5
Beam radiation = 650 W/m²
Reflectivity of surroundings = 0.2
Extinction coefficient = 20 per m

On December 30th at 3:00 PM, Determine:
   a) Angle of incidence of beam radiation on the collector
   b) Total solar flux incident on the collector

3 With the help of schematic diagrams discuss any TWO (02) of the following: (CO-4) [6x2]

(i) Solar passive heating and cooling system
(ii) Solar refrigeration using vapour absorption system
(iii) Solar photovoltaic cell

Contd...2.
4(a) What are global and local winds, how they are formed? (CO-5) [04]

4(b) Define the terms: (i) Angle of attack (ii) Solidity (iii) Incident wind velocity (CO-5) [03]

4(c) Derive an expression for the axial thrust on wind turbine. (CO-5) [05]

4' For a two blade HAWT, the average free wind speed at a standard height of 10 m is 8 m/s [12] with $\alpha = 0.13$ (used in determining velocity) and air density as 1.226 kg/m$^3$. If the hub height from the ground is 80 m and rotor diameter is 60 m, assuming the downstream wind velocity to be half of the upstream velocity, find: (CO-5)

- Power available in the wind
- Power extracted by the turbine
- Axial force on the turbine
- Axial force on the turbine when maximum power is extracted

5 Answer any TWO (02) of the following: (CO-6) [6x2]

(i) Describe various biomass resources
(ii) Write note on geo-pressed resource of geothermal energy
(iii) With the help of neat sketch explain single basin tidal energy power generation system

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**DATA SHEET**

$$l_{on} = l_{sc} \left(1 + 0.033 \cos \frac{360n}{365}\right) \quad \delta = 23.45 \sin \left[360 \left(\frac{284+n}{365}\right)\right]$$

Equation of time, $E = 9.87 \sin 2B - 7.53 \cos B - 1.5 \sin B$, where $B = 360 \left(\frac{n-81}{364}\right)$

$$\cos \theta = \sin \delta \sin \varphi \cos \beta - \sin \delta \cos \varphi \sin \beta \cos \gamma + \cos \delta \cos \varphi \cos \beta \cos \omega + \cos \delta \sin \varphi \sin \beta \cos \gamma \cos \omega + \cos \delta \sin \beta \sin \gamma \sin \omega$$

$$r_b = \frac{\sin \delta \sin(\varphi - \beta) + \cos \delta \cos \omega \cos(\varphi - \beta)}{\sin \delta \sin \varphi + \cos \delta \cos \omega \cos \varphi}$$

Standard Location for IST: (25.15° N, 82.58° E)