2012 – 2013
B.TECH. (WINTER SEMESTER) EXAMINATION
OPEN ELECTIVE
HIGHER MATHEMATICS
(AM – 224)
Credits: 04

Maximum Marks : 60

Note: Answer ALL the questions.
Notations used have their usual meaning.

1. (a) Prove that
\[ \text{Curl} \left( \mathbf{u} \times \mathbf{v} \right) = \nabla \times \mathbf{u} - \mathbf{u} \cdot \nabla \times \mathbf{v} + \mathbf{v} \times \mathbf{u} \times \mathbf{v} \]
or
\[ \text{div} (\mathbf{u} \times \mathbf{v}) = \mathbf{v} \cdot \text{curl} \mathbf{u} - \mathbf{u} \cdot \text{curl} \mathbf{v}. \]

Hence prove that if \( \mathbf{A} \) and \( \mathbf{B} \) are irrotational then \( \mathbf{A} \times \mathbf{B} \) is solenoidal.

(b) Fluid motion is given by
\[ \nabla = a \mathbf{i} + b \mathbf{j} + c \mathbf{k}. \]

(i) Is it possible to find out the velocity potential? If so, find it.
(ii) Is the motion possible for an incompressible fluid?

(c) Find the values of \( a, b, c \) so that the directional derivative of \[ \phi = axy^2 - byz + cz^2x^2 \]
at \((1, 2, -1)\) has maximum magnitude 64 in the direction parallel to z-axis.

2. (a) Verify the divergence theorem for \( \mathbf{A} = 4x \mathbf{i} - 2y^2 \mathbf{j} + z^2 \mathbf{k} \) taken over the region bounded by \( x^2 + y^2 = 4, z = 0 \) and \( z = 3 \).

(b) Verify Green's theorem in the plane for \[ \int_C \left( x^2 - y^2 \right) dx + xy^2 dy \], where \( C \) is the boundary of the region enclosed by the circles \( x^2 + y^2 = 4 \) and \( x^2 + y^2 = 16 \).

(b') Verify Stoke's theorem for \( \mathbf{F} = (2x - y) \mathbf{i} - yz^2 \mathbf{j} - y^2z \mathbf{k} \) where \( S \) is the upper half of the sphere \( x^2 + y^2 + z^2 = 1 \) and \( C \) is its boundary.

3. (a) (i) Find the Laplace transform of
\[ \frac{1 - \cos t}{t^2} \]
or

(a) (i') Find the inverse Laplace transform of \[ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \] using convolution theorem, \( a, b \) being constants.

Contd.....2
(ii) Find the inverse Laplace transform of \( \frac{s}{k} \), where \( k \) is a constant.

(b) Find the Laplace transform of the triangular wave as depicted in the figure below:

![Figure](image)

OR

(b') An alternating e.m.f. \( E \) sin \( \omega t \) is applied to an inductance \( L \) and a capacitance \( C \) in series. Use Laplace transform method to show that the current in the circuit is

\[
\frac{E}{L(R^2 - n^2)} (\cos \omega t - \cos n\omega), \text{ where } n^2 = \frac{1}{LC}.
\]

(c) (i) Using Laplace transform method, solve the differential equation

\[ y''(t) + 9y(t) = 18t \text{ given that } y(0) = 0 = y' \left( \frac{\pi}{2} \right). \]

(ii) Using Laplace transform method solve the integral equation

\[ y + \int_0^t y \, dt = 1 - e^{-t}. \]

4. (a) The points of trisection of a string are pulled aside through a distance \( b \) on opposite sides of the position of equilibrium, and the string is released from rest. Find an expression for the displacement of the string at any subsequent time and show that the mid-point of the string always remains at rest.

OR

(a') The equation for the conduction of heat along a bar of length \( l \) is

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

neglecting radiation. Find an expression for \( u \), if the ends of the bar are maintained at zero temperature and if, initially, the temperature is \( t \) at the centre of the bar and falls uniformly to zero at its ends.

(b) Find the particular solution of the Laplace equation \( \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0 \) by the method of separation of variables [10.5].
B.TECH. (WINTER SEMESTER) EXAMINATION
(MECH./ARCH./CIVIL./CHEMICAL./PETROCHEMICAL./ELECTRICAL./ELECTRONICS./COMPUTER ENGINEERING)
(OPEN ELECTIVE)
SOLID WASTE MANAGEMENT
(CHE-337)

Maximum Marks: 60  Credits: 04  Duration: Three 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) Identify and discuss briefly the issues that you feel will be important in the field of solid waste management in the coming decades. [07]

OR

1(b) State and explain various physical and chemical properties along with their significance in selecting an appropriate disposal technique. [07]

1(c) For a weekly waste production data from an industrial account for a calendar quarter of operation shown in Table I, determine the statistical characteristics and explain its physical significance. [08]

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Waste (m$^3$/wk)</th>
<th>Week No.</th>
<th>Waste (m$^3$/wk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
<td>10</td>
<td>27</td>
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<tr>
<td>4</td>
<td>26</td>
<td>11</td>
<td>25</td>
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<td>5</td>
<td>29</td>
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<td>24</td>
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<tr>
<td>6</td>
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<td>23</td>
</tr>
<tr>
<td>7</td>
<td>30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2(a) What is a Hauled Collection System (HCS)? Discuss along with their types and personnel requirements. [08]

(OR)

2(a') Explain the following terms with reference to waste collection operation. [08]
(i) Pickup
(ii) Haul
(iii) At Site
(iv) Off Route

Contd....2
2(b) The following average speeds (Table II) were obtained for various round trip distances to a disposal site. Find the haul speed constants, a and b, and the round trip haul time for a site that is located 18 km away.

**Table II : Round Trip Distance and Average Haul Speed**

<table>
<thead>
<tr>
<th>Round Trip Distance (x), km/trip</th>
<th>Average Haul Speed, km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>27</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>8</td>
<td>52</td>
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<tr>
<td>12</td>
<td>58</td>
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<tr>
<td>16</td>
<td>65</td>
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<tr>
<td>20</td>
<td>68</td>
</tr>
<tr>
<td>25</td>
<td>73</td>
</tr>
</tbody>
</table>

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

3(a') Explain the Water Balance Method for estimation of the quantity of landfill leachate. For an organic waste represented by $C_{620}H_{1355}O_{710}N_{79}S$, determine water consumed in the formation of landfill gas.

3(b) A colony having a population of 500,000 generates solid wastes at the rate of 1.2 kg/capita/day. The compacted specific weight of solid wastes in landfill is 650 kg/m$^3$ and the average depth of compacted solid wastes in landfill is 5 m. Determine the required landfill area including buffer zone for 20 years of operation.

4(a) Draw a neat sketch of Flash Pyrolysis system and discuss its working along with the products obtained.

4(a') Discuss the design and operational considerations for the aerobic composting system.

4(c) Determine the amount of oxygen required to oxidize 1000 kg of an organic solid waste aerobically. Assume that the initial composition of the organic material to be decomposed in given by $[C_6H_3O_2(OH)_3]_5$, that the final composition of the residual organic matter is estimated to be $[C_4H_2O_5(OH)_3]_3$, and that 400 kg of material remains after the oxidation process.
2012-13
B.TECH. (WINTER VI SEMESTER) EXAMINATION
(CIVIL/ELECTRICAL/MECHANICAL/ELECTRONICS/COMPUTER/ARCHITECTURE/
CHEMICAL/PETRO-CHEMICAL ENGINEERING)
ATMOSPHERIC CHEMISTRY
(OPN ELECTIVE) AC-308

Maximum Marks: 60 Credits: 04 Duration: Three Hours

Answer all the questions.
Marks allotted are indicated against each question.
Notations used have their usual meaning.

Q.No. Question M.M.

1(a) Classify air pollutants. Write names of the criteria pollutants established by
Environmental Protection Agency (EPA).
[04]

1(b) What are the favourable conditions for the formation of carbon monoxide? Discuss
its sources and physiological effects.
[06]

2(a) Explain the terms: aerosols; fumes and smoke. Describe the physical, chemical and
biological characteristics of particulate matter.
[06]

2(b) Describe with the help of diagram the working of cyclone separator or spray tower.
[04]

3 Write short notes on any two of the following
a) PRA method for SO\textsubscript{2} determination
b) Ethylene blue method for H\textsubscript{2}S
c) Nessier’s method for ammonia
[05\times2]

4 Attempt any two of the following
a) Discuss the significance of different zones of atmosphere.
b) Discuss with example the role of free radicals in the formation of photochemical
smog.
c) Discuss the advantages and disadvantages of methanol and ethanol as alternative
fuels.
d) Explain the harmful effects of indoor pollutants.
[05\times2]

5(a) Explain electronic transition in a molecule when electromagnetic radiation (e.m.r.)
of UV and visible range is absorbed.
[05\times2]

5(b) What is the basic principle of IR spectroscopy? Discuss in very brief the different
components IR spectrometer.

OR

5(b') Write the principle of atomic absorption spectrometry. Discuss in very brief the
different components of atomic absorption spectrometer.

6(a) Discuss the role of biologically important UV regions (action spectra) of radiations
on exposure to living organisms.
[05]

6(b) Explain the role of chlorine released from Chloro-flouro carbons (CFCS) in
catalytic destruction of stratospheric Ozone.
[05]
2012-13
B.TECH. (WINTER SEMESTER) EXAMINATION
OPEN ELECTIVE
BIOPHYSICS
AP-304

Maximum Marks: 60 Credits: 04 Duration: Three Hours

Answer all the questions.

Q.No. Question M.M.
1(a) Define Ionization energy, Electron affinity, and Electronegativity. [03]
1(b) Describe interatomic potentials for strong and weak bonds. [05]
1(c) Explain the principle of Nuclear Magnetic Resonance (NMR). [03]
1(d) Give the name of three common methods for the determination of chemical structure. What are the basic features of XRD experiment? [04]

OR

1(d') State the differences between electron microscopes and optical microscopes. [04]
2(a) Is heart really a pump? Show the pathway of blood circulation through it. [05]
2(b) Write the names of essential and non essential proteins. Why too much protein intake is bad for health? [05]

OR

2(b') Explain the chemical (primary) structure of DNA in detail. Why G-C base pairing is stronger than A-T base pairing? [05]
2(c) How does a nerve signal passes through a nerve cell? What is the role of booster system in this passage? [05]
3(a) What are the different types of molecular spectra? [05]
3(b) How can you use rotational spectra to find intermolecular separation? In which region of e.m spectrum these spectra are located? [05]
3(c) Describe Raman effect and deduce an expression for Raman shift. Discuss the dependence of Raman spectral lines on particle size. [05]
4(a) What do you understand by ‘tracer’ and what are the requirements of a tracer? [07]
4(b) Find the rate of a chemical exchange reaction from the rate at which a tracer atom is exchanged. [08]
Graduating Paper
2012 – 13
B.Tech. (VII semester) Examination
(Open Elective)
STRUCTURE PROPERTY RELATIONSHIP
(PK – 428D)
Credits: 04
Duration: Three Hours

Maximum Marks: 60

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

1(a) What do you mean by the intra-molecular forces in polymers? Classify the polymers on the basis of intra-molecular forces. 05

Or

(a') Differentiate the polymerization reaction on the basis of (a). Stoichiometry and (b). Mechanism. Give suitable examples. 05

(b) Write the name of polymer, monomer and structure of the following;

(c) Explain the PVT properties of semi-crystalline polymer. Also describe its significance in injection molding process. 05

2(a). Differentiate between the stress-strain curve for metals and polymers. Also explain the effect of temperature, elongation and moisture on SSC of polymers. 05

(b) What do you mean by mechanical properties of polymers? Explain the following terms with their units in MKS system.
(a). True stress, (b). Modulus of Elasticity, (c). Tensile strength at break, (d). Toughness. 05

Or

(b'). What do you mean by thermal properties of polymers? Explain the various transitions observed in polymers. 05

(c) Calculate the relaxation time for given Maxwell model. Also calculate the residual stresses in material after 50 seconds of loading. Initial stress developed due to constant strain loading is 250MPa. 05

\[ \varepsilon = 10 \text{ GPa}; \eta = 45 \text{ GPa} \]

Or

(c'). What do you mean by dynamic loading? How energy dissipation is dependent on frequency of loading? Explain with the help of DMA curve. 05

Contd.....2
3(a). What do you mean by solubility parameter of a polymer, what is its unit?
What are the conditions of two or more polymer forming a miscible or immiscible blend?

Or

(a'). Explain the PVT properties of semi-crystalline polymer. Also describe its significance in injection molding process.

(b). Explain the basic principal of differential Thermo-gravimetric analysis (DTG). Mark the temperature point for possible degradation of polymer on plot.

(c). How Thermo-gravimetric Analyzer (TGA) characterize the thermal stability of polymer.

4(a). Explain the electrical properties required from a polymeric insulation for cable containing high frequency telecommunication signals.

Or

(a'). What will happen to a dielectric (polymer) subjected to a varying electrical field? Differentiate between dielectric dissipation factor (\(\tan \delta\)) and dielectric loss factor (\(\varepsilon''\)).

(b). What do you mean by polarization? Explain the types of polarization in a dielectric (polymer). Explain the type of polarization a non polar polymer will undergo and why?

(c). What do you mean by energy dissipation during dynamic loading? You are required to tailor a polymeric material for:
(a). Shoes for Long Jumper
(b). Laptop carry bag
2012-13
B.TECH. (WINTER SEMESTER) EXAMINATION

(Civil/Mechanical/ Electrical/Electronics/Computer/Chemical/Petrochemical/Architecture
Engineering)

WATER RESOURCES AND WATERSHED MANAGEMENT
Open Elective

(CF-483)

Maximum Marks: 60
Credits: 04
Duration: Three Hours

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

Q.No. Question M.M.
1 Discuss the various sectors of water utilization and management [12]

OR

1'(a) What is a watershed? Discuss in brief the following characteristics of a watershed. [05]

1'(b) (i) Slope (ii) Shape (iii) Elevation.
Enlist different forms of precipitation and explain with a neat diagram, the Hydrologic Cycle. [07]

2(a) Define the following terms used in water resources. [05]
(i) Run off (ii) Environmental impact assessment
(iii) Soil erosion (iv) Reservoir sedimentation (v) Rainwater harvesting

2(b) Enumerate different types of rain gauges. What are the considerations for selecting the site for a rain gauge.

In a catchment area daily precipitation was observed by 11 rain gauge stations.
On July 2012, The observation indicates that one rain gauge was out of order.
The observation taken by 10 rain gauges are as follows.

Contd......2
<table>
<thead>
<tr>
<th>Rain Gauge Station</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitation</td>
<td>19</td>
<td>18</td>
<td>20</td>
<td>21</td>
<td>23</td>
<td>22</td>
<td>24</td>
<td>21</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Estimate the precipitation of rain gauge station ‘H’.

OR

2'(a) Discuss the physical and chemical characteristics of water fit for drinking.

2'(b) Define lag time and time of concentration. Estimate the lag time and time of concentration for the following data pertaining to a watershed:

Hydraulic length = 900 m, contour interval = 1.5 m, land slope = 1.9 %

The curve number for the soil and vegetative cover of the watershed = 80

3 Discuss the various steps involved in the planning of water-resources engineering projects.

OR

3' How does the economic viability of water resources project is determined?

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%.

1st Alternative:

**Initial cost of the lined tunnel**  = Rs 2,00,000.00

**Useful life**  = 100 years

**Annual maintenance cost**  = Rs 15,000.00

2nd Alternative:

(i) **cost of power channel**  = Rs 500,000.00

    **useful life**  = 100 years

    **annual maintenance cost**  = Rs 10,000.00

Contd......3
(ii) cost of lining
useful life
annual maintenance cost

iii) cost of penstocks
useful life
annual maintenance cost

= Rs 150,000.00
= 50 years
= Rs 7000.00
= Rs 225,000.00
= Rs 8000.00

4 What is meant by flood? What are causes of flood? Discuss structural and non structural measures of flood control.

From a watershed the following information is available.
Area of watershed = 15 km\(^2\). Calculate the flood discharge using Dicken's formula.
The value of Dicken's coefficient = 28.

5(a) Explain with neat diagram concept of global hydrological system.

5(b) Discuss preventive and curative measures of watershed management.

5(c) Comment on groundwater balance and artificial groundwater recharge.
2012-13
B.TECH. (WINTER SEMESTER) EXAMINATION
ALL BRANCHES
RENEWABLE ENERGY SOURCE (OPEN ELECTIVE)
EE-472

Maximum Marks: 60Credits: 04Duration: Three Hours

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

Q.No. Question M.M.
1 (a) Justify the statement “All energies originate from Sun”. Draw the energy conversion chart in support of this statement. [05]
(b) Show that the energy consumption has increased with historic progress of civilization and that prosperity of nations is linked with per capita energy consumption. [05]
(c) What is greenhouse effect? Give the composition of greenhouse gases. [02]

OR:
1' (a) Discuss in brief the energy growth rate. What is doubling effect? [4]
(b) Discuss the need of energy alternatives and energy planning. [4]
(c) Classify the energy storage systems. With a neat sketch describe the compressed air storage system. [4]

2 (a) Draw a neat sketch showing the spectral solar irradiation curve for terrestrial and extraterrestrial radiations and explain why solar radiations reaching earth surface are different from those received outside the earth atmosphere [6]
2 (b) Write short notes on the following: [6]
(i) Solar pond
(ii) Solar refrigeration.

OR

2' (a) What is a solar cell and when it was discovered? Explain with neat Sketch I-V characteristics of a solar cell. [5]

Contd........2
(b) Explain what is meant by energy payback period of a solar cell? Give the payback period for a solar cell.

(c) Define and explain the terms as used in solar energy (i) Beam radiation (ii) Diffuse radiation (iii) albedo (iv) Air mass

3 (a) Classify the Fuel Cells based on operating temperatures and applications. [4]
(b) Draw the VI Characteristics of a fuel cell and describe different polarizations. [5]
(c) Classify the biomass conversion technologies. Explain what is incineration? [3]

4 (a) Define the term Magneto hydro dynamics and discuss the principles of MHD power generation. [5]
(b) Discuss the environmental aspects of MHD. [4]
(c) Give the major applications of MHD systems. [3]

OR

4’(a) Define what is the wind power and give the origin of winds. Describe the major factors that have lead the accelerated development of wind power [6]
(b) Classify the wind turbines based on (i) placement of rotor (ii) number of blades used (iii) blade material [3]
(c) Calculate the air density for standard temperature and pressure conditions [3]

Take the gas constant = 287J/kg.Kal

5 a) Classify the hydrothermal resources. With neat sketch explain the electrical power generation using Vapor Dominated (Dry Steam) System. [6+6]
b) Classify the ocean thermal energy convension. With a neat sketch discusses the Andersen cycle OTE power generation.
2012-13
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: Three Hours

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

Q.No. Question M.M.
1(a) What are primary and secondary energy sources? [03]
1(b) Explain the terms: energy audit and cogeneration of power. [02]
1(c) What is meant by energy storage? Under what circumstances does storage of energy become necessary? Name different energy storage methods. [04]
1(d) What are the advantages and disadvantages of renewable energy sources? [03]

2 Explain: Solar Time, Solar constant, Air mass, Threshold intensity of solar radiation, Optical efficiency and instantaneous efficiency of flat plate solar collector, Acceptance angle and concentration ratio of a focusing collector. [12]

OR

2' A flat plate collector of size 2.1 m x 1.1 m with single glass cover is installed at Aligarh with a tilt of 45° towards south. The glass is 4 mm thick and has thermal conductivity 0.78 W/m-K. The air gap spacing between the absorber plate and glass cover is 25 mm. Mean temperature of the absorber plate, glass cover and ambient air are 77 °C, 43 °C and 27 °C, respectively. The emissivities of the absorber plate and glass cover are 0.92 and 0.88, respectively. Back and side insulations are 50 mm and 25 mm with k_{insulation} = 0.04 W/m-K. If the wind velocity, V_w, is 1.2 m/s, calculate the overall heat loss coefficient. [12]

The following relations may be used for obtaining the relevant parameters:

h_w = 5.7 + 3.8 V_w; \quad Nu = 0.229 \left(Gr \ Pr \ cos \ \beta \right)^{0.252}

The properties of air at 60 °C are: k =0.029 W/m-K, \nu =18.97 \times 10^{-6} \ m/s, Pr =0.696.
3 With the help of schematic diagrams, discuss any three (03) of the following:
   (i) solar space heating with rock bed storage  (ii) solar still  (iii) solar pond  and
   (iv) solar refrigeration using vapour absorption system.

4(a) Derive an expression for energy available in the wind.  [03]
4(b) What is the environmental impact of wind energy?  [03]
4(c) What is solidity? What are its effects on the performance of a wind turbine?  [03]
4(d) With the help of a diagram, discuss the power output versus wind speed characteristics of
       a wind turbine.

OR

4' Calculate the total axial thrust and aerodynamic power developed in a 3-blade wind turbine at a wind velocity of 9 m/s. The machine specifications are as follows:
   Diameter = 9 m  Rotational speed = 100 rpm  Blade length = 4 m
   Tip Speed Ratio = 5.23  Chord length = 0.45 m  Pitch angle = 5°
   Aerofoil section = NACA 23018  Distance from shaft to inner edge = 0.5 m
Note: Calculate by dividing each blade into four sections.

Also draw the force vector diagram for a blade section.

<table>
<thead>
<tr>
<th>Angle of attack, ( i )</th>
<th>24.81°</th>
<th>10.98°</th>
<th>5.81°</th>
<th>3.15°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lift Coefficient, ( C_l )</td>
<td>0.95</td>
<td>1.20</td>
<td>0.75</td>
<td>0.46</td>
</tr>
<tr>
<td>Drag Coefficient, ( C_D )</td>
<td>0.0105</td>
<td>0.0143</td>
<td>0.0092</td>
<td>0.0078</td>
</tr>
</tbody>
</table>

5 Answer any three (03) questions:
   (i) Explain the working of a floating drum type biogas plant. What is meant by energy farming? [04]
   (ii) What is meant by flashing of steam? How is it used in Wet Steam Geothermal power plants? Explain with the help of a neat diagram. [04]
   (iii) Explain the working of a double basin tidal power plant. Also show the change in water level of sea, the upper basin and lower basin with time on a diagram. [04]
   (iv) Discuss the open cycle MHD generating system. Why is seeding done in MHD? [04]
Maximum Marks: 60  
Credits: 04  
Duration: Three Hours

**Q.No.**  
**Question**  
**M.M.**

1(a) Describe internal structure of earth and list five important rock forming minerals  
[07]

1(b) Discuss different categories of Basins for finding oil and gas reserves.  
[08]

**OR**

1(b') Describe migration and accumulation of oil and gas.  
[08]

2(a) Discuss the Geological conditions conductive for generation and accumulation of Oil and Gas.  
[10]

**OR**

2(a') Differentiate between gravity and seismic methods of oil exploration and, also name some non-explosive & environmental friendly techniques of Seismic surveys.  
[10]

2(b) Describe the principle of Radioactive method of Petroleum exploration with neat sketch.  
[05]

3(a) What are different basic types of rigs? Differentiate between Kelly and Top Drive Systems.  
[09]

**OR**

3(a') Name different types of drill fluids and describe their functions. Why crew members add some additives in drill fluids?  
[09]

3(b) Classify different types of Bits. Differentiate between Roller cone bit and Fixed cutter bit.  
[06]

4(a) Discuss briefly enhanced oil recovery. Explain any two methods of Enhanced oil recovery in detail.  
[09]

4(b) Differentiate between Proven, Probable and Possible oil and Gas reserves.  
[06]
Maximum Marks: 60
Duration: Three Hours

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

Q. No.  

1(a) Perform two iterations of Bairstow method to extract a quadratic factor \( x^2 + px + q \) from the polynomial:
\[
x^3 - 3.7x^2 + 6.25x - 4.069 = 0.
\]
Take \( p_0 = -2.5 \) and \( q_0 = 3 \).

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

(c) Estimate the Eigen values of the matrix
\[
\Lambda = \begin{bmatrix}
1 & 2 & -1 \\
1 & 1 & 1 \\
1 & 3 & -1
\end{bmatrix}
\]
using Gerschgorin's bounds.

(c') Obtain the Chebyshev linear polynomial approximation to the function \( f(x) = \frac{1}{x^2} \) on \([1,2]\). Also estimate the maximum error.

2(a) Evaluate \( \int_0^1 \left(1 + \frac{\sin x}{x}\right) dx \) correct to 3-decimals, using Simpson's rule with the number of points 3, 5 & 9. Improve the result by using Romberg integration.

OR

(a') Obtain an approximate value of
\[
I = \int_{-1}^{1} (1 - x^2)^{\frac{1}{2}} \cos x \, dx
\]
By using Gauss- Legendre and Gauss -Chebyshev 3-point formulae.
(b) Use Runge-Kutta method of fourth order to solve the system
\[ \frac{dx}{dt} = 2x + y ; \quad \frac{dy}{dt} = x - 3y \]
with \( x(0) = 0 \) and \( y(0) = 0.5 \) at \( t = 0.2 \).

(c) Solve the boundary value problem \( y'' = y \) with \( y(0) = 0 \) and \( y(1) = 1 \) by shooting method up to \( 4 \)-decimals.

3(a) Find an approximate solution of the Laplace equation \( \Delta^2 u = 0 \) in the square,
\[ R = \{(x, y) : 0 \leq x \leq 4, 0 \leq y \leq 4\} \]
with boundary conditions:
\[ u = 0 \text{ at } x = 0 \text{ and } u = 12 + y \text{ at } x = 4 \]
\[ u = 3x \text{ at } y = 0 \text{ and } u = x^2 \text{ at } y = 4, \]
with \( h = 1 = k \). Use one iteration of Gauss-Seidel's method to improve the values of \( u \) at the internal mesh points up to \( 2 \)-decimals.

(b) Solve the heat conduction equation
\[ \frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \]
Subject to the boundary conditions:
\[ u = \sin \pi x \text{ at } t = 0, \ 0 \leq x \leq 1 \text{ and } u(0, t) = 0 = u(1, t). \]
By using four iterations of Gauss-Seidel method up to one time level.
Take \( h = 0.2 \) and \( k = 0.02 \).

OR

(b') Solve the wave equation
\[ \frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2} \]
With boundary conditions:
\[ u(0, t) = 0 = u(1, t), \ \frac{\partial u}{\partial t}(x, 0) = 0 \text{ and } u(x, 0) = x - x^2, \text{ up to two time levels.} \]
Take \( h = 0.25 \) and \( k = 0.2 \) and write answers correct to two decimals.

4(a) Obtain a two parameter solution of the boundary value problem:
\[ y'' + y + 1 = 0, \quad y(0) = 0 = y(1); \]
By Galerkin and collocation methods.

(b) Solve the boundary value problem:
\[ u'' - u = x, \quad u(0) = 0 = u(1). \]
By finite element method for \( h = \frac{1}{4} \).
2012-2013
B.Tech (VIII SEMESTER / WINTER) EXAMINATION
Electrical/Mechanical/Civil/Electronics/Computer/Architecture/Chemical/Petro Chemical Engineering
(Open Elective)
Fundamentals of Environmental Engineering
(CE-481)

Duration 3 hours
Credits - 04
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 Data provided by the water analyst indicates that raw water has high hardness, alkalinity, turbidity, solids, color, pathogens and to some extent organic matter.

(i) What is the possible raw water source on the basis of the data provided? [01]
(ii) Neatly prepare a flow diagram showing various units to treat this water for potable purpose and briefly describe the function of each unit. [05]

Q.No.1b

(i) What is the significance of BOD test? On what principle this test is based upon? Explain the procedure in brief. [03]
(ii) Three samples were collected from a drain carrying sewage flow. Initial and final DO of each sample was found to be 7.4, 7.5, 7.3 and 3.1, 3.2, 3.4 mg/l respectively. The volume of sample taken in each BOD bottle was 7ml. Determine the average BOD of this sewage water.

OR

Q.No.1'b

(i) What are the different disinfection methods? [02]
(ii) What is the total amount of chlorine needed in kg/d and its cost to treat 30 MLD of water to satisfy 2 ppm of chlorine demand? Use Bleaching powder having available chlorine as 45% @ Rs. 575 per bag of 10 kg. [04]

Q.No.2a

(i) List some common technologies for wastewater treatment while classifying them on the basis of aerobic and anaerobic processes. [02]
(ii) Explain the historical development of UASB Technology for sewage treatment in India. [02]
(iii) With the help of neat sketch, briefly describe the process of UASB treatment system. [02]

Q.No.2b A sewage treatment plant of capacity 12500 m³/day is to be designed to treat incoming BOD of 210 mg/l and TSS concentration of 400 mg/l to the level of outlet BOD as 30 mg/l and TSS 50 mg/l respectively. Design the following units while ensuring to meet the above effluent quality:

Contd......2
i. Primary Sedimentation Tank
ii. Aeration Tank
iii. Secondary Clarifier

Q.No.3a Write a field trip note on the sewage treatment plant which you visited in the AMU campus and your observations about this facility.

Q.No.3b (i) How recycle and reuse of wastewater are important steps towards conservation of fresh water resource?
(ii) Write your rational views to promote water reclamation and reuse and to what extent, in the context of integrated water resources management.

OR

Q.No.3’b (i) What are the natural and anthropogenic sources of air pollution? List some examples of each.
(ii) Discuss the effect of air pollution on human health, vegetation and property.

Q.No.4a (i) What is adiabatic lapse rate? Show graphical representation how ambient temperature changes with altitude.
(ii) Two coal-fired furnaces discharges into one stack, 105 m tall. Each furnace stack having dia of 1.85m is fired with coal at the rate of 225 tons every 24 hrs. The combustion air is supplied at the rate of 4.53 kg for each kg of coal. The gases exit from the stack with a velocity of 609 cm/sec at 127°C. The atm. temperature is 14°C. The wind velocity is 10 miles/hr. Calculate plume rise in meters.
(Barometric pressure = 1000 mbar)

Q.No.4b (i) What are the different methods for disposal of municipal solid waste (MSW)? Explain any one in brief.
(ii) Write typical characteristics/properties of Indian MSW

Q.5 Write brief notes on any four of the following:
   a) Climate Change and Carbon Credits
   b) Factors related to type & generation of MSW
   c) Gaussian Model for prediction of plume fall
   d) Attached and Suspended Growth Culture System
   e) Effects of Noise Pollution and their remedial measures