2018-19  
B.E. (Autumn Semester) Examination  
Applied Chemistry  
EAC111/EACS1110

Maximum Marks: 60  
Credits: 04  
Duration: Two Hours

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

Q.No.  
1(a) What are disinfectants? Mention the requirements of good disinfecting agents.  
1(b) Calculate the amount of lime (86% pure) and soda (83% pure) needed for the treatment of 80,000 litres of water having following dissolved salts in mg/L: Mg(HCO₃)₂ = 84.0; CaCO₃ = 40.0; Mg(NO₃)₂ = 37.0; CaCl₂ = 55.5; Fe₂O₃ = 80.0 and NaCl = 20.0. (Atomic weights: Mg=24; Ca=40; Fe=56; C=12; O=16; H=1; Cl=35.5; Na=23; S=32, N=14).
1(c) Explain with chemical equations the demineralization of hard water and regeneration of ion exchange resin.

OR  
1(c’) Discuss the internal treatment of boiler feed water.

2(a) Calculate the gross and net calorific values of coal having the following Compositions: Carbon=85%, Hydrogen=8%, Nitrogen=3%, ash=3%, Sulphur=1%, Latent heat of steam=587cal/g.

OR  
2(a’) 0.82g of a fuel containing 80% carbon, when burnt in bomb calorimeter, increased the temperature of water from 27.3 to 29.1 °C. If the calorimeter contains 250g of water and its water equivalent is 150g, calculate the HCV of the fuel. Give your answer in kJ/Kg.

2(b) Explain the Bergius process for the synthesis of petrol from coal.

2(c) What are the advantages of compressed natural gas (CNG) over solid...
fueleds?
2(e) Discuss the mechanism of fluid film lubrication. (CO2) [4]

OR

2(e') What is the role of additives in lubricating oil? Discuss any two additives and their function. (CO2) [4]

3(a) Define corrosion and give its classification. Give the mechanism of oxidation corrosion. (CO3) [3]

3(b) Write short notes on any two of the followings: (CO3) [1.5x2]
   (i) Pilling-Bedworth rule
   (ii) Nernst equation
   (iii) Galvanic series

3(c) Discuss the cathodic protection by impressed current method. (CO3) [5]

3(d) Mention the essential constituents of paint. What are the functions of pigments? (CO3) [4]

OR

3(d') Explain the mechanism of drying of oil paint. (CO3) [4]

4(a) What are the different types of polymerization? Discuss the mechanism of free radical polymerization. (CO4) [6]

OR

4(a') Write a note on the classification of polymers. (CO4) [6]

4(b) What is vulcanization? What are the advantages of vulcanized rubbers over raw natural rubbers? (CO4) [5]

4(c) Write short notes on any two of the followings: (CO4) [4]
   (i) Buna-S
   (ii) Nylon 6,6
   (iii) Teflon
2018-19
B. E. (EVENING) (AUTUMN SEMESTER) EXAMINATION
ALL BRANCHES
MATHEMATICS-I
EAM-111

Maximum Marks: 60 Credits: 04 Duration: Two Hours

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

Q.No. | Question | M.M.
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1(a) | Test for consistency and solve the system of linear equations by matrix method
\[ x + 4y + 7z = 1, \quad 2x + 5y + 8z = 2, \quad x + 2y + 3z = 1. \] | [07] |
1(b) | Show that the matrix \[ A = \begin{bmatrix} 1 & 2 & -2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix} \] is diagonalizable. Find the matrix \( P \) such that \( P^{-1}AP \) is a diagonal matrix. | [08] |

**OR**

1(b') | Verify that the following matrix \[ A = \begin{bmatrix} 2 & 0 & -1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix} \] satisfies its characteristic equation and hence, find \( A^{-1} \) (if exists). | [08] |

2(a) | Find all the asymptotes of the curve \[ y^3 - x^2y - 2xy^2 + 2x^3 - 7xy + 3y^2 + 2x^2 + 2x + 2y + 1 = 0. \] | [08] |

**OR**

2(a') | Trace the curve giving its salient features \( y = (x^2 + 1)/(x^2 - 1) \). | [08] |

2(b) | If \( y = e^{a \sin^{-1} x} \), prove that
\[ (1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + a^2)y_n = 0, \] and hence find the value of \( y_n(0) \). | [07] |

\[ e_{\text{on} 1 = \ldots = -2}. \]
3(a) Find the length of the arc of the semicubical parabola \( ay^2 = x^3 \) from the vertex to the point \((a, a)\). \[07\]

3(b) The part of the parabola \( y^2 = 4ax \) cut off by the latus rectum revolves about the tangent at the vertex. Find the volume of the reel thus generated. \[08\]

OR

3(b') Find the area of the surface formed by the revolution about the \(x\)-axis of an arch of the cycloid
\[
x = a(\theta + \sin \theta), \quad y = a(1 + \cos \theta).
\]

4(a) Solve the following differential equations.

(i) \[
\frac{d^2y}{dx^2} + 4y = e^x + \sin 2x
\]

(ii) \[
x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = 2x^2.
\]

OR

4(a') Solve the following simultaneous linear differential equations
\[
\frac{dx}{dt} + 2y = -\sin 2t, \quad \frac{dy}{dt} - 2x = \cos 2t.
\]

4(b) A liquid in a test-tube cools from 70°C to 60°C in 4 minutes, the room temperature being 30°C. Determine the temperature of the liquid as a function of time, and the time taken in cooling down to 40°C. \[07\]
B. E. (EVENING) (AUTUMN SEMESTER) EXAMINATION
ALL BRANCHES
APPLIED MATHEMATICS-I
EAMS-1110

Maximum Marks: 60 Credits: 04 Duration: Two Hours

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

Q.No. Question M.M.
1(a) Examine whether the matrix $A$ is diagonalizable. If so, obtain the matrix $P$ such that $P^{-1}AP$ is a diagonal matrix.

\[
A = \begin{bmatrix}
2 & 1 & 1 \\
2 & 3 & 2 \\
3 & 3 & 4
\end{bmatrix}
\]

[08]

OR

1(a') Verify the Cayley-Hamilton theorem for the matrix

\[
A = \begin{bmatrix}
2 & -1 & 1 \\
-1 & 2 & -1 \\
1 & -1 & 2
\end{bmatrix}
\]

and hence find $A^3$ (if exists) and $A^4$.

[08]

1(b) Examine the consistency of the following system of equations and if consistent, solve the equations by matrix method:

\[
5x + 3y + 7z = 4, \quad 3x + 26y + 2z = 9, \quad 7x + 2y + 10z = 5.
\]

[07]

2(a) If $y = \sin[\log(x^2 + 2x + 1)]$, prove that

\[
(x + 1)^2 y_{n+2} + (2n + 1)(x + 1)y_{n+1} + (n^2 + 4) y_n = 0.
\]

[08]

OR

2(a') Trace the curve giving its salient features $y = (x - 2)(x + 1)^2$.

[08]

2(b) Test the convergence of the following series:

\[
\sum_{n=1}^{\infty} \frac{(n + 1)^n}{n!} \quad \text{(i)} \quad x + \frac{3}{5} x^2 + \frac{8}{10} x^3 + \frac{15}{17} x^4 \ldots
\]

[07]

Control... 2.
3(a) Show that the intrinsic equation of the semicubical parabola $3ay^2 = 2x^3$ is $9s = 4a(\sec^3 \psi - 1)$.

3(b) Find the area of the curved surface of the cup formed by the revolution about its axis of the smaller part of the parabola $y^2 = 4ax$ cut off by the line $x = 3a$.

OR

3(b') Find the volume of the solid of revolution of the loop of the curve $y^2(\alpha - x) = x^2(\alpha + x)$ about the $x$-axis.

4(a) Solve any two of the following differential equations.
   
   (i) $\frac{d^2y}{dx^2} + y = \sin x \sin 2x + x^3 e^{-x}$
   
   (ii) $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} - 3y = x^2 \log x$.
   
   (iii) $y'' - 4y' + 5y = 0$, $y(0) = 2$, $y'(0) = -1$.

4(b) Solve the following simultaneous linear differential equations $\frac{dx}{dt} - 3x - 6y = t^2$, $\frac{dy}{dt} + \frac{dx}{dt} - 3y = e^t$. 
Q1(a) Discuss the role of an individual in safeguarding natural resources.
Q1(b) Discuss the benefits of using renewable energy sources with the objective of protecting environment & energy conservation.

OR

Q1'(a) Explain the factors and concerns responsible for water conflict. Give few examples.
Q1'(b) Explain the significance of forests for environmental protection and conservation.

Q2(a) Discuss the classification of air pollutants on the basis of origin, chemical composition & state of matter.
Q2(b) Differentiate between food chain and food web? Give a detailed structure of an ecosystem.

Q3(a) Explain the various in-situ and ex-situ biodiversity conservation methods. What preventive measures should be adopted.
Q3(b) Discuss the different pathways in which biodiversity is affected.

OR

Q3'(b) Discuss the various sources and types of solid waste. Also discuss the various ways of managing the solid waste.

Q4(a) Explain the causes & effects of a nuclear accident. Suggest preventive measures.

OR

Q4'(a) Write in detail about global warming & its harmful effects.
Q4'(b) Discuss in brief about the importance & objectives of “Forest conservation Act”.

Q5(a) Discuss the factors responsible for population explosion and its effects on our environment.
Q5(b) Discuss the role of Information Technology on Environment and human health.
Q1(a) What are natural resources? Discuss about the uses & over-exploitation of forest resources. (6)
Q1(b) Discuss the benefits of using renewable energy sources for the conservation of energy resources & protecting the environment. (6)

OR

Q1'(a) Explain the importance of water resource with concerns of water conflict. Give few examples. (6)
Q1'(b) What are various mineral resources? Discuss the causes & consequences of overexploitation of minerals on environment. (6)
Q2(a) Classify the air pollutants based on origin, chemical composition. Discuss its health hazards. (6)
Q2(b) Discuss the structure and classification of an ecosystem? Explain marine ecosystem in detail. (6)
Q3(a) Explain the various causes of threats to biodiversity due to “man-wild animals” conflict. (6)
Q3(b) Discuss the importance of biodiversity & its conservation. Discuss the difference between endemic and endangered species. (6)

OR

Q3'(b) Explain disaster management and mitigation measures. Also write about its major consequences? (6)
Q4(a) Discuss in brief about the importance & objectives of “Water (Prevention and control of pollution) act, 1974”. (6)

OR

Q4'(a) Write in detail about causes and effects of ozone layer depletion. (6)
Q4(b) Discuss the term “Resettlement & Rehabilitation” with some natural and man-made causes. (6)
Q5(a) Explain the impact of Mortality, Natality, Doubling time and Population explosion. (6)
Q5(b) Discuss the effects of rising population on Environment and human health. (6)

OR

Q5'(b) Discuss urban poverty. Write down the methods for population control. (6)
Maximum Marks: 30  
Credits: 04  
Duration: Two Hours

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

Q. Nu. | Questions | CO | M.M.  
---|---|---|---
1(a) | With the help of phasor diagram, derive the relation between line and phase currents in delta connected three phase circuit. | CO1 | [07]  
1(b) | For the circuit shown in Fig. 1, find the current through 6 Ω resistor using Thevenin's theorem. | CO1 | [08]  

![Fig. 1](image1.png)

OR

1'(b) | Determine the current $I$ in the network of Fig. 2 using superposition theorem. | CO1 | [08]  

![Fig. 2](image2.png)
2 (a) A 500 KVA, single phase transformer working at unity power factor has an efficiency of 95% both at full load and 60% of full load.
   (i) Separate out the losses of the transformer
   (ii) Determine the efficiency at 75% full load

2 (b) With the help of a layout, briefly discuss the working of a hydro power plant.

OR

2' (b) With the help of a layout, briefly discuss the working of a thermal power plant.

contd...
END SEMESTER EXAMINATION AUTUMN SEMESTER 2018-19
Bachelor of Engineering (All Branches), 1 – Semester
Basic Electrical and Electronics Engineering (EEE–111)

Part B (Electronics Engineering)

Total marks: 30

- Use separate answer book for answering part (B)
- Answer all the questions.
- Assume suitable data if required.
- Symbols used have their usual meaning.

Q1 (a): Describe the principle of operation of a bipolar junction transistor. Draw output characteristic of NPN BJT in common emitter configuration and mark various regions of operation. [7 Marks]

Q1 (b): Determine $V_L$, $I_L$, $I_Z$ and $I_R$ for the network shown in Figure 1, if $R_L = 500 \, \Omega$. [8 Marks]

![Figure 1](image)

OR

Q1 (b’): For the circuit shown in Figure 2, determine the quiescent operating point $I_{EQ}$ & $V_{CEO}$.

$\beta = 180$; $V_{CC} = 16 \, V$; $R_B = 330K \, \Omega$; $R_C = 1100 \, \Omega$; $R_E = 550 \, \Omega$. [8 Marks]

cont'd...
Q 2(a): Explain the construction and working of n-channel enhancement type MOSFET. Also draw its drain characteristics. [7 Marks]

OR

Q 2(a'): Draw the OPAMP based electronic integrator circuit diagram? Derive the formula for its output voltage. Plot the output waveform with proper labelling for the inputs: (i) square wave (ii) sine wave. [7 Marks]

V_2 = 1.5 V

Q 2(b): For the circuit shown in Figure 3, V_1= 3.0 Volts, V_2= -1.0 Volts, V_3= 1.5 Volts, R_1=R_3=5kΩ, R_2= 10kΩ and R_f=20kΩ. Calculate the V_out. [8 Marks]
2018-19
B.E. (AUTUMN SEMESTER) EXAMINATION
BRANCH: ELECTRICAL/MECHANICAL/CIVIL
PRINCIPLES OF ELECTRICAL ENGINEERING
COURSE CODE: EEEA1110

Maximum Marks: 60
Credits: 03
Duration: Two Hours

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

Q. No. | Questions | CO | M.M.
--- | --- | --- | ---
1 (a) | With the help of phasor diagram, derive the relation between line and phase voltages in star connected three phase circuit. | CO1 | [08]
1 (b) | Determine the voltage across and current through the inductor in Fig. 1 using Thevenin's theorem. | CO1 | [12]

![Fig. 1](image1)

OR

1'(b) | For the circuit shown in Fig. 2, find the current through 6 Ω resistor using Superposition theorem. | CO1 | [12]

![Fig. 2](image2)
2 (a) In the magnetic circuit shown in the following figure (with all dimensions in mm), calculate the required current to be passed in the coil having 400 turns in order to establish a flux of 1.28 mWb in the air gap. Relative permeability of the magnetic material is 6000.

2 (b) The resistances and leakage reactances of a 15 kVA, 50 Hz, 4000/400 V distribution transformer are:

\[ r_1 = 3.96 \, \Omega \quad r_2 = 0.0396 \, \Omega \]
\[ x_1 = 15.8 \, \Omega \quad x_2 = 0.158 \, \Omega \]

It delivers rated kVA at 0.85 power factor lagging to a load on the LV side. Find the percentage voltage regulation of the transformer.

OR

2'(b) A 1000 kVA, single phase transformer working at unity power factor has an efficiency of 90% both at full load and 70% of full load. Determine the efficiency at 75% of full load.

3 (a) With the help of mathematical equation, explain how a rotating magnetic field is produced by the 3-phase stator winding of a 3-phase induction motor supplied with 3-phase ac supply.

OR

3'(a) With the help of a single line diagram, explain the various components of power system.

3 (b) With the help of a layout, briefly discuss the working and major components of a thermal power plant.

OR

3'(b) With the help of a layout, briefly discuss the working and major components of a nuclear power plant.
3(a) Draw pressure-volume diagram for a substance that (i) contracts on freezing and (ii) expands on freezing. Show lines of constant temperature.

3(b) Explain the working of throttling calorimeter. Show the process on h-s diagram.

3(c) A piston-cylinder device initially contains steam at 3.5 MPa, superheated by 5°C. Now, steam loses heat to the surroundings and the piston moves down hitting a set of stops at which point the cylinder contains saturated liquid water. The cooling continues until the cylinder contains water at 200°C. Determine (a) the initial temperature, (b) the enthalpy change per unit mass of the steam by the time the piston first hits the stops, and (c) the final pressure and the quality (if mixture).

4(a) What are the common characteristics of all heat engines?

4(b) Explain reversible and irreversible process. Write down the causes of irreversibility.

4(c) A completely reversible heat pump produces heat at a rate of 300 kW to warm a house maintained at 248°C. The exterior air, which is at 78°C, serves as the source. Calculate the rate of entropy change of the two reservoirs and determine if this heat pump satisfies the second law according to the increase of entropy principle.

OR

4'(a) Is the process that is internally reversible and adiabatic necessarily isentropic? Explain.

4'(b) What is Clausius inequality? Derive expression for the same.

4'(c) Write down the assumptions of air standard cycle. Draw the Otto cycle on T-s and P-v diagram. Write down the equations for heat supplied and work done in various processes.
2018-19
B.E. (AUTUMN SEMESTER) EXAMINATION
Thermal Sciences/ Engineering Thermodynamics
(EMEA-1110/EME-101)

Maximum Marks: 60
Credits: 04
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Use of thermodynamic tables is allowed.

Q.No.  Question                   M.M.
1 (a) Define thermodynamic system. What is the classification of systems? [04]
1 (b) With a suitable diagram, explain the working of a constant-volume gas thermometer. [04]
1 (c) The top part of a water tank is divided into two compartments, as shown in Figure. Now a fluid with an unknown density is poured into one side, and the water level rises a certain amount on the other side to compensate for this effect. Based on the final fluid heights shown on the figure, determine the density of the fluid added. Assume the liquid does not mix with water. [07]

2 (a) What is mechanical energy? How does it differ from thermal energy? What are the forms of mechanical energy of a fluid stream? [06]

2 (b) A six cylinder, four-stroke gasoline engine is run at a speed of 2520 rev/min. The area of the indicator card of one cylinder is 2.33 x 10³ mm² and its length is 62.1 mm. The spring number is 20 x 10⁶ Nm⁻³. The bore of the cylinders is 150 mm and the piston stroke is 160 mm. Evaluate the indicated power assuming that all cylinders contribute equal powers. [09]

OR

2 (b') Air at 300 kPa and 200°C enters an adiabatic nozzle with a velocity of 30 m/s and leaves at 100 kPa and 180 m/s. The inlet area of the nozzle is 80 cm². Determine (a) the mass flow rate through the nozzle, (b) the exit temperature of the air, and (c) the exit area of the nozzle.