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

Q.No. | Question                                                                 | M.M. |
-----|--------------------------------------------------------------------------|------|
1(a) | Enlist the various steps involved in gravimetric analysis. Discuss the favourable conditions for precipitation. | [4]  |
1(b) | What is volumetric analysis? Describe the various types of titrations with the help of example. | [4]  |
1(c) | Differentiate between occlusion and inclusion impurities                  | [2]  |
OR   | 1'(a) | Discuss the factors for deviation from Beer's law.                      | [4]  |
1'(b) | Distinguish between the followings:                                      | [4]  |
1'(b-i) | Adsorption and partition chromatography                                   |      |
1'(b-ii) | Paper and thin layer chromatography                                      |      |
1'(c) | A sample of 0.05 M solution in 1.0 cm cell was found to transmit 80% light. Calculate the molar absorptivity of the solution. | [2]  |
2(a) | List the steps involved in municipal water treatment process. Explain the filtration process in detail. | [3]  |
2(b) | Distinguish between the followings:                                      | [3]  |
2(b-i) | Scale and sludge formation                                               |      |
2(b-ii) | Priming and foaming                                                      |      |
2(c) | A sample of water was found to contain the following impurities in mg/L:  | [4]  |
| Ca(HCO₃)₂ = 81, Mg(TlCO₃)₂ = 73, MgSO₄ = 15, CaSO₄ = 68, NaCl = 10       |      |
| Calculate the temporary, permanent and total hardness in degree clark.   |      |
| (At. Weight = Ca=40, Mg=24, Cl=35.5, S=32, O=16, C=12, H=1, Na=23)      |      |
2'(a) | Describe the softening of water by zeolite process. Discuss the advantages and disadvantages of the process. | [5]  |
2'(b) | A water sample on analysis gave the following data in mg/L:              | [5]  |
| MgCl₂=190, CaSO₄= 68, MgSO₄=240, H₂SO₄=98, NaCl=40                       |      |
| Calculate the amount of lime (80% pure) and soda (90% pure) needed for treating 10,000 litre of water. |      |

Contd.... 2.
3(a) Differentiate between proximate and ultimate analysis. [3]

(b) Describe the Bergius process for the production of synthetic petrol. [4]

(c) Write short note on LPG or CNG fuel. [3]

4(a) Describe the mechanism of hydrodynamic lubrication. [4]

(b) List the various types of greases and mention the conditions under which they are used. [4]

(c) Define the following terms: viscosity, flash and fire points, saponification value, aniline point. [2]

5(a) Define corrosion. Discuss the mechanism of electrochemical corrosion. [4]

(b) Distinguish between galvanizing and tinning. [3]

(c) What are the different constituents of organic paints? Explain the functions of drying oil in paint. [3]

6(a) Explain the mechanism of free radical addition polymerization with suitable example. [4]

(b) Distinguish between thermoplastic and thermosetting plastic. [3]

(e) Give the preparation, properties and uses of PVC or BUNA rubber. [3]
2014-2015
B.E. (I SEMESTER) EXAMINATION
(ELECTRICAL/MECHANICAL/CIVIL)
MATHEMATICS - I
(EAM - 111)

Maximum Marks: 60
Duration: 2 1/2 Hours

Note:
(i) Answer all questions.
(ii) Programmable calculators are not allowed.

1. (a) For what values of \( \lambda \) the equations \( x + y + z = 1, x + 2y + 4z = 2, 
\[ x + 4y + 10z = \lambda^2 \] 
have (i) unique solution and (ii) infinite solutions. Solve them in each case.

(b) Determine the eigen values and eigen vectors corresponding to each eigen value of the matrix given below:
\[
\begin{bmatrix}
8 & -6 & 2 \\
-6 & 7 & -4 \\
2 & -4 & 3
\end{bmatrix}
\]

OR

(b') Verify Cayley-Hamilton theorem for the matrix \( A = 
\begin{bmatrix}
3 & 4 & 1 \\
2 & 1 & 6 \\
-1 & 4 & 7
\end{bmatrix}
\]
Find \( A^{-1} \). Also express \( A^7 = 10A^6 - 11A^5 + 121A^4 + 133A^3 - 119A + 2I \) as a linear polynomial in \( A \).

2. (a) Write salient features and trace the curve \( y^2(x^2 - a^2) = x^2 + 1 \).

"OR"

(a') If \( y = e^{\tan^{-1} x} \), prove that \( (1 - x^2)y_{n+1} - (2n + 1)xy_{n-1} + (n^2 + a^2)y_n = 0 \) and hence find the value \( y_n \) when \( x = 0 \).

(b) Find all the asymptotes of the curve
\( x^2(y - 1) + y^2(y - x + 1) - 10x + 6y + 1 = 0 \).

(c) Expand \( f(x) = x^3 - 3x^2 \) in powers of \( (x - 2) \) by Taylor's theorem.

3. (a) Prove that the volume of the solid formed by revolution of the cycloid \( x = a(t - \sin t), y = a(1 - \cos t) \) about the tangent at the vertex is \( \pi^2 a^3 \).

(b) Find the curved surface of the solid formed by the revolution of the cardioid \( r = a(1 + \cos \theta) \) about the initial line.

(c) Find the intrinsic equation of the parabola \( y^2 = 4ax \).

OR

(c') Find the length of the arc of the curve \( x = e^{\theta} \sin \theta, y = e^{\theta} \cos \theta \) from the
\( \theta = 0 \) to \( \theta = \frac{\pi}{2} \).

Continued...
4. (a) Solve the following:

(i) \((\sin x \cos y + e^{2x})dx + (\cos x \sin y + \tan y)dy = 0\)

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

(iii) \(\frac{x^2}{d^2y}{dx^2} - 7x \frac{dy}{dx} + 13y = \log x\)

(b) A particle of mass \(m\), is projected vertically upward under gravity, the resistance of air being \(mk\) times the velocity. Show that the greatest height attained by the particle is \(\frac{v^2}{g} \{1 - \log(1 + \lambda)\}\), where \(V\) is the terminal velocity of the particle and \(\lambda V\) the velocity of its projection.
2014-15
B.E. I SEMESTER EXAMINATION
(ELECTRICAL/MECHANICAL/CIVIL)
BASICS OF ELECTRICAL & ELECTRONICS ENGG.
(EEE-111)

Maximum Marks: 60
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Answer PART-A & PART-B in separate copies.

PART-A

Q.No. Question M.M.
1(a) Define the following theorems as applicable to AC networks: [05]
   (i) Superposition theorem.
   (ii) Thévenin's theorem.

OR

1(a') Determine the voltage across the 2 Ω resistor in Figure-1 using Norton's theorem. [05]

1(b) A 3-phase voltage source has a phase voltage of 120V and supplies a balanced star-connected load having impedance 36+j48 Ω per phase. Calculate:
   (i) Line voltage.
   (ii) Line current.
   (iii) Total 3-phase power supplied to the load.

1(c) What are different types of losses in transformer? Explain B-H curve. [05]

OR

1(c') Derive an expression for the induced EMF of a single-phase transformer. [05]
2(a) What are the essential requirements for the proper working of indicating type instruments? Explain briefly each of them.

2(b) A three phase 16 pole alternator has a star connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, sinusoidally distributed and the speed is 375 RPM calculate:

(i) The frequency

(ii) Line induced emf

OR

2(b') Explain the working principle of three phase induction motor.

2(e) What are the basic elements of power system? Explain each in brief.

PART-B

3(a) A diode for which the forward voltage drop is 0.7 V at 1 mA and for which n=1 is operated at 0.5 V. What is the value of the current.

3(b) Explain the operation of npn transistor in the active mode of operation.

3(c) A junction diode is operated in a circuit, in which it is supplied with a constant current I. What is the effect on the forward voltage of the diode if an identical diode is connected in parallel. Assume \( n=1 \).

OR

3'(a) With the help of a circuit diagram, explain the operation of zener diode as voltage regulator.

3'(b) With the help of Input & Output characteristic curves, explain the operation of Common Emitter configuration.

3'(c) Calculate the values of I and V in Figure 1 when

(i) \( R_1 = 10 K\Omega \) and \( R_2 = 5 K\Omega \)

(ii) \( R_1 = 5 K\Omega \) and \( R_2 = 10 K\Omega \)

Assuming that the diodes are ideal and given that: \( V_{CC} = 10 V \), \( V_{SS} = -10 V \)
4(a) Explain the working of Enhancement type N-channel MOSFET in all the regions of operation with equations and conditions. Also draw its output characteristics with proper labelling of regions.

4(b) Derive the expression for closed loop gain of the op-amp based inverting and non-inverting amplifier.