B.E. First Semester Examination – January 2018 (Make-Up)

Engineering Chemistry

Time: 3 hrs

[Maximum Marks: 100]

Note: Answer any FIVE full questions, selecting atleast ONE full question from each module.

Module – I

1. a) Define standard electrode potential. Derive Nernst’s equation. (07 Marks)
b) What are reference electrodes? Discuss construction and working of Calomel electrode. (07 Marks)
c) An electrochemical cell consists of Fe electrode dipped in 0.1 M FeSO₄ and Ag electrode dipped in 0.05 M AgNO₃. Write the cell reaction, cell representation and calculate the emf of the cell at 298 K. Given that E° of Fe and Ag are -0.44V and 0.8 V respectively. (06 Marks)

2. a) What is an ion selective electrode? Discuss working of glass electrode in determining pH. (08 Marks)
b) Define oxidation and reduction potential and explain determination of electrode potential using potentiometric method. (06 Marks)
c) What are concentration cells and explain emf of concentration cell. (06 Marks)

Module – II

3. a) Explain rusting of iron with the help of electrochemical theory of corrosion. (06 Marks)
b) What is cathodic protection? Explain sacrificial anode method. (05 Marks)
c) What is electroless plating? Explain the electroless plating of Nickel. (05 Marks)
d) Explain pitting corrosion. (04 Marks)

4. a) Explain the following factors effecting corrosion:
   i) Emf
   ii) Temperature
   iii) Anodic area
   b) Explain mechanism of electroplating and electroless plating. (09 Marks)
c) Explain the following factors effecting on electroplating:
   i) Decomposition potential
   ii) Over voltage
   (06 Marks)

Module – III

5. a) Explain glass transition temperature with factors affecting on it. (05 Marks)
b) Write preparation properties and application of following polymers:
   i) Teflon
   ii) Polymethyl methacrylate
   iii) Neoprene (09 Marks)
c) Define conducting polymers. Write structure and mechanism of conducting polycetylene. (06 Marks)

6. a) Explain techniques of bulk and suspension polymerization. (06 Marks)
b) Explain free radical mechanism of addition polymerization taking ethylene as an example. (05 Marks)
c) Define Adhesives. Write preparation, properties and application of epoxy resin. (05 Marks)
d) Explain deficiencies of natural rubber. (04 Marks)

Module – IV

7. a) What are primary batteries? Explain construction working and application of Zn-MnO₂ battery. (05 Marks)
b) Explain construction, working and application of Nickel metal hydride batteries. (06 Marks)
c) What are fuel cells and write construction working and application of H₂ – O₂ fuel cell. (05 Marks)
d) What is reforming of petrol write any three reforming reactions? (04 Marks)

8. a) Define calorific value? Discuss determination of calorific value of solid fuel using bomb calorimeter. (08 Marks)
b) Explain construction, working and application of Lead-acid storage battery. (07 Marks)
c) When 0.935 gm of fuel subjected for complete combustion in excess of oxygen, the increase in temperature of water in a calorimeter containing 1240 gm of water was 2.35°C, calculate the GCV and NCV of the fuel, if water equivalent of calorimeter is 130 gm, percentage of H₂ is = 6.5. (05 Marks)
Module – V

9. a) Write a note on Longmuir’s theory of unimolecular adsorption.  
    b) Explain optical properties of colloids.  
    c) Explain the sources and nature of impurities present in water.  

10. a) What are colloids? Explain the preparation of colloids using Bridg’s – Arc method.  
     b) What is potable water? Explain the reverse osmosis water purification method.  
     c) Explain lime soda process of water softening.  
     d) Differentiate between physical and chemical adsorption.
B.E. First Semester Examination – January 2018 (Make-Up)
Engineering Physics

Time: 3 hrs
Note: Answer any FIVE full questions, selecting at least ONE full question from each module.

Physics constants: Electron mass, $m = 9.11 \times 10^{-31}$ kg, Electron charge, $e = 1.6 \times 10^{-19}$ C
Velocity of light, $c = 3 \times 10^8$ $\text{m/s}$, Plank’s constant, $h = 6.63 \times 10^{-34}$ Js
Avogadro number $N_A = 6.025 \times 10^{23}$ $\text{mol}^{-1}$, Permittivity of vacuum, $\varepsilon_0 = 8.85 \times 10^{-12}$ F$m^{-1}$
Boltzmann’s constant, $K = 1.38 \times 10^{-23}$ J/K.

Module – I

1. a) Explain Compton effect and give its physical significance. (06 Marks)
b) Write a note on phase and group velocities. (09 Marks)
c) An electron initially at rest is accelerated through a potential difference of 100 V. Calculate i) The velocity of the electron  ii) Phase velocity of the electron  iii) de-Broglie wavelength and iv) Momentum of the electron wave. (05 Marks)

2. a) State and explain Heisenberg’s uncertainty principle. Give its physical significance. (08 Marks)
b) Set up time-independent one-dimensional Schrödinger wave equation. (08 Marks)
c) An electron is bound in one-dimensional infinite potential well of width 0.12 nm. Find the energy values on the ground state and also first two excited states in eV. (04 Marks)

Module – II

3. a) With a neat sketch label the requisites of a laser system and explain in brief. (05 Marks)
b) Discuss the conditions required for laser action. (05 Marks)
c) Describe the construction of the He-Ne laser and explain its working with the help of energy level diagram. (10 Marks)

4. a) Write a note on measurement of pollutants in atmosphere using laser. (06 Marks)
b) Discuss the different types of optical fibres with suitable diagrams. (09 Marks)
c) An optical fibre has a numerical aperture of 0.32. The R.I of cladding is 1.48. Calculate the R.I of the core, the acceptance angle of the fibre and the fractional index change. (05 Marks)

Module – III

5. a) Sketch the possible Bravais lattices in the seven crystal systems. (14 Marks)
b) Calculate the packing factor for SC, BCC and FCC. (06 Marks)

6. a) Explain the crystal structure of sodium chloride with a neat sketch. (06 Marks)
b) Explain how Bragg’s spectrometer is used for determination of interplanar spacing in a crystal. (09 Marks)
c) Draw the following planes in a simple cubic unit cell: i) $(3 2 1)$ ii) $(0 1 0)$ iii) $(0 0 1)$ iv) $(2 2 2)$ v) $(1 1 1)$. (05 Marks)

Module – IV

7. a) Write a note on dielectrics. (10 Marks)
b) Explain the frequency dependence of polarization in dielectrics. (05 Marks)
c) The electronic polarizability of $K^+$ is $1.264 \times 10^{-40}$ F$m^2$ and that of $\text{Cl}^-$ is $3.408 \times 10^{-30}$ F$m^2$. Calculate the dielectric constant of KCl at optical frequencies if it contains 1.607 $\times 10^{23}$ atoms $m^{-3}$. (05 Marks)

8. a) Derive an expression for internal field in case of one-dimensional array of atoms dielectric solids. (09 Marks)
b) Write a note on biomaterials. (11 Marks)
Module – V

9. a) Based on classical free electron theory derive an expression for electrical conductivity of metals. 
   b) Explain the three major failures of classical free electron theory. 
   c) A metallic wire has a resistivity of $1.42 \times 10^8 \Omega\text{m}$. For an electric field of 0.14 V/m, find 
      i) Average drift velocity of electrons and ii) Mean collision time assuming that there are 
      $6 \times 10^{28}$ electrons m$^3$. 

10. a) Describe how quantum free electron theory has been successful in overcoming the failures of classical free electron theory. 
    b) Describe with simple illustrations, the two methods of preparation of nanomaterials. 
    c) Write a note on carbon nanotubes.
B.E. First Semester Examination – January 2018 (Make-Up)
Constitution of India and Professional Ethics

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting at least ONE question from each Module.

Module - I
1. Enumerate in detail the sources and features of constitution. (20 Marks)

2. What are the Fundamental Rights? Enumerate in detail fundamental Rights as per Article 14 - 30. (20 Marks)

Module - II
3. "Directive Principles of the state policy one said to be" the soul of the constitution. Enumerate them as per Article 36-51. (20 Marks)

4. What are the qualifications, powers and functions of chief minister of a state? (20 Marks)

Module - III
5. Enumerate in detail, election, term, qualifications powers and functions of president of India. (20 Marks)

6. What are the main powers and responsibilities union council of ministers? (20 Marks)

Module - IV
7. What are the special provisions provided for children and women in the constitution? (20 Marks)

Write a detail note on the election commission of India. (20 Marks)

Module - V
9. What are the basis aims and responsibilities of engineers in the present context? (20 Marks)

10. Enumerate in detail the importance of safety measures to be observed by engineers in Industrial under takings. (20 Marks)
B.E. First Semester Examination – January 2018 (Make Up)

Engineering Mathematics – I

Time: 3 hrs

[Maximum Marks: 100]

Note: Answer any FIVE full questions, selecting at least ONE full question from each module.

Module – I

1. a) Find the \( n \text{th} \) derivative of \( e^x \cos(bx + c) \)  
   b) If \( y = e^{\cos^{-1}(x)} \), then prove that \( (1-x^2)y'' + (2n+1)xy' - (n^2 + m^2)y = 0 \)  
   c) Find the angle of intersection of the cardioids \( r = a(1 + \cos \theta) \) and \( r = b(1 - \cos \theta) \).

2. a) Find the pedal equation of the curve \( 2a \frac{r}{r} = 1 - \cos \theta \).  
   b) Prove that \( \rho = \frac{(1+y^2)^{\frac{3}{2}}}{y^2} \) for the Cartesian curve \( y = f(x) \).  
   c) Find the radius of curvature of curve \( r = a(1 + \cos \theta) \).

Module – II

3. a) If \( r^2 = (x-a)^2 + (y-b)^2 + (z-c)^2 \), prove that \( \frac{\partial^2 r}{\partial x^2} + \frac{\partial^2 r}{\partial y^2} + \frac{\partial^2 r}{\partial z^2} = \frac{2}{r} \).  
   b) If \( u = \tan^{-1}\left(\frac{x^2 + y^3}{x - y}\right) \), show that \( x \frac{\partial^2 u}{\partial x^2} + y \frac{\partial^2 u}{\partial y^2} + 2xy \frac{\partial^2 u}{\partial y^2} = \sin 4u - \sin 2u \).  
   c) State and prove Euler's theorem on homogeneous functions.

4. a) If \( u = f(x-y, y-z, z-x) \) prove that \( \frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0 \).  
   b) If \( u = x + 3y^2 - z^2, \ v = 4x^2yz, \ w = 2z^2 - xy \). Evaluate \( \frac{\partial (u, v, w)}{\partial (x, y, z)} \) at \( (1, -1, 0) \).  
   c) The radius of a sphere is found to be 10 cm with a possible error of 0.02 cm. What is the relative error in computing the volume?

Module – III

5. a) Derive the reduction formula of \( \int_0^\pi \cos^9 x \, dx \) and find the value of \( \int_0^\pi \cos^8 x \, dx \).  
   b) Evaluate \( \int_0^\pi x \sin^2 x \, \cos^4 x \, dx \).  
   c) Evaluate \( \int_0^\pi \frac{x^2}{(1 + x^2)^{\frac{3}{2}}} \, dx \).
6. a) Find the rank of matrix
\[
A = \begin{bmatrix}
4 & 0 & 2 & 1 \\
2 & 1 & 3 & 4 \\
2 & 3 & 4 & 7 \\
2 & 3 & 1 & 4 \\
\end{bmatrix}
\]
(06 Marks)

b) Show that the system \[ \begin{align*}
x + y + z &= 4 \\
2x + y - z &= 1 \\
x - y + 2z &= 2
\end{align*} \]
is consistent, solve the system.
(07 Marks)
c) Solve by Gauss-Jordan method
\[ \begin{align*}
2x + 5y + 7z &= 52 \\
2x + y - z &= 0 \\
x + y + z &= 9
\end{align*} \]
(07 Marks)

**Module - IV**

7. a) Test for convergence of the series
\[
\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \cdots + \infty
\]
(06 Marks)

b) Test for convergence the series
\[
x + \frac{x^2}{1.2} + \frac{x^3}{2.3} + \frac{x^4}{3.4} + \cdots
\]
(07 Marks)
c) Find the nature of the series
\[
\sum_{1}^{n} e^{\frac{x^n}{n}}
\]
(07 Marks)

8. a) Trace the curve \[ y^2(a - x) = x^2(a + x), \quad a > 0. \]
(06 Marks)

b) Find the total length of the perimeter of the astroid \[ x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}} \]
(07 Marks)
c) Find the volume of the solid generated by the revolution of \[ r = 2 \cos \theta \] about the initial line.
(07 Marks)

**Module - V**

9. a) Solve \[ 3e^x \tan y \, dx + (1 - e^x) \sec^2 y \, dy = 0. \]
(06 Marks)

b) Solve \[ \frac{dy}{dx} = \frac{y - x}{y + x}. \]
(07 Marks)

c) Solve \[ \frac{dy}{dx} + \frac{y}{x} = x^2 y^6 . \]
(07 Marks)

10. a) Solve \[ (1 + e^y) dx + e^y (1 - \frac{x}{y}) dy = 0. \]
(06 Marks)

b) Find the orthogonal trajectories of the family of astroids \[ x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}. \]
(07 Marks)
c) A voltage \[ E e^{at} \] is applied at \[ t = 0 \] to a circuit containing inductance \[ L \] and resistance \[ R . \] Determine the current at any time \[ t . \]
(07 Marks)
B.E. First Semester Examination – January 2018

Engineering Chemistry

Time: 3 hrs

Note: Answer any FIVE full questions, selecting at least ONE full question from each module.

Module – I

1. a) What are reference electrodes? Explain construction and working of calomel electrode. (06 Marks)
   b) Explain potentiometric method of determining electrode potential. (06 Marks)
   c) Calculate how much voltage is producing in a cell consisting of Zn and Cu electrodes. Zn electrode is dipped in 0.07 m solution of Zn²⁺ and Cu electrode in 0.6 m solution of Cu²⁺. $E_{cell} = 1.50$ Volts. Write half cell, complete cell and cell representation. (04 Marks)
   d) Define concentration cell and discuss emf of concentration cells. (04 Marks)

2. a) Define ion-selective electrode. Explain construction working of glass electrode and its application in pH determination. (08 Marks)
   b) Define emf and derive Nernst’s equation. (08 Marks)
   c) What are standard electrodes? Discuss construction and working of Ag/AgCl electrodes. (04 Marks)

Module – II

3. a) Define corrosion. Explain the electrochemical theory of corrosion by taking iron as an example. (06 Marks)
   b) Explain the following factors effecting corrosion:
      i) emf  ii) pH  iii) Anodic area (09 Marks)
   c) What is metal finishing? Give a brief account of electroplating of copper. (05 Marks)

4. a) Explain mechanism of electroplating and electroless plating. (06 Marks)
   b) Explain differential aeration corrosion with examples. (06 Marks)
   c) Differentiate between electroplating and electroless plating. (04 Marks)
   d) Explain the following factors effecting electroplating:
      i) Decomposition potential  ii) Polarization (04 Marks)

Module – III

5. a) Define conducting polymers. Explain synthesis and mechanism of conducting polyacetylene. (06 Marks)
   b) Explain technique of bulk and suspension polymerization. (08 Marks)
   c) Write preparation, properties and application of
      i) Teflon  ii) Polyurethane (06 Marks)

6. a) Define adhesive. Explain preparation, properties and application of epoxy resin. (04 Marks)
   b) Write preparation, properties and application of
      i) Nitrile rubber  ii) Butyl rubber (06 Marks)
   c) Define glass transition temperature. Explain the factors affecting on it. (04 Marks)
   d) Explain synthesis and application of conducting poly aniline. (06 Marks)

Module – IV

7. a) What are secondary batteries? Explain construction working and application of Nickel-cadmium cells. (06 Marks)
   b) Define fuels cells. Explain construction, working and application of methanol – oxygen fuel cells. (06 Marks)
   c) Define calorific value. Explain the determination of calorific value of a solid fuel using bomb calorimeter. (08 Marks)

8. a) Define cracking. Explain fluidized bed catalytic cracking. (06 Marks)
   b) Discuss construction, working and application of lead acid storage battery. (08 Marks)
   c) Define primary batteries. Explain construction, working and application of HgO -- Zn cell. (06 Marks)
Module – V

9. a) Define BOD. Explain its determination.
b) Explain lime-soda process of water softening.
c) Write a note on electrophoresis.
d) Differentiate between physical and chemical adsorption.

10. a) What are colloids? Explain preparation of colloids (any two).
b) Define adsorption isotherm. Explain Langmuir’s theory of unimolecular adsorption.
c) Write a note on optical properties of colloids.
B.E. First Semester Examination – January 2018
Engineering Physics

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting at least ONE full question from each module.

Physics constants:
Electron mass, m = 9.11 x 10^{-31} kg; Electron charge, e = 1.6 x 10^{-19} C; Velocity of light, c = 3 x 10^{8} ms^{-1};
Plank’s constant, h = 6.63 x 10^{-34} Js; Avagadro number N_{A} = 6.025 x 10^{23}/Kmole;
Permittivity of vacuum = \varepsilon_{0} = 8.85 x 10^{-12} Fm^{-1}; Boltzmann constant, k = 1.38 x 10^{-23} J/K^{-1};

Module – I

1. a) Describe Photoelectric effect along with Einstein’s explanation and give its physical significance.
   (07 Marks)
b) Derive an expression for group velocity and obtain a relation between phase velocity and group velocity.
   (09 Marks)
c) A particle of mass 0.5 M_{e}V/C^{2} has K.E 100eV. Find its de-Boeigle wavelength.
   (04 Marks)

2. a) State Heisenberg’s uncertainty principle. Give its physical significance.
   (06 Marks)
b) Assuming the time-independent Schrödinger wave equation, discuss the solution for a particle in one dimensional potential well of infinite height.
   (09 Marks)
c) Compare the momentum and the total energy of an electron with a de-Boeigle wavelength of 2 Å with that of a photon of same wavelength.
   (05 Marks)

Module – II

3. a) Explain with sketches the basic principles involved in LASER.
   (09 Marks)
b) Describe the construction and working of a Gallium Arsenide semiconductor laser.
   (07 Marks)
c) The ratio of population of two energy levels out of which upper one corresponds to a metastable state is 1.059 x 10^{-30}. Find the wavelength of light emitted at 330 K.
   (04 Marks)

4. a) Describe the recording and reconstruction process in holography with the help of suitable diagrams.
   (09 Marks)
b) Define acceptance angle and N.A. With a neat diagram derive an expression for numerical aperture in an optical fibre.
   (07 Marks)
c) A fibre has a core diameter of 6 μm and its core R.I is 1.45. The R.I of the cladding is 1.448. Determine the maximum number of modes allowed to propogate through the fibre, if the wavelength of light used is 1 μm.
   (04 Marks)

Module – III

5. a) What are Miller indices? How do you find Miller indices of a given plane. Give an example.
   (09 Marks)
b) Derive an expression for interplanar spacing in a cubic system.
   (07 Marks)
c) Draw the following planes in a simple cubic unit cell:
   i) (1 2 3)  ii) (1 0 0)  iii) (1 1 1)  iv) (0 2 0)
   (04 Marks)

6. a) Write a note on continuous and characteristics X-rays.
   (10 Marks)
b) Derive Bragg’s law for X-ray diffraction.
   (05 Marks)
c) Lead in FCC with atomic radius of 1.746 Å. Find the spacing of (i) (2 0 0) plane
   (ii) (2 2 0) plane and (iii) (1 1 1) plane.
   (05 Marks)

Module – IV

7. a) Describe the different polarization mechanisms in dielectrics with the help of neat diagrams.
   (12 Marks)
b) Derive the expression for the internal field in case of dielectric solids and liquids.
   (08 Marks)
8. a) Write a note on dielectrics.
   b) Explain piezoelectricity in crystals.
   c) A parallel plate capacitor is charged by connecting it to a 90 V battery. The battery is then disconnected and an insulating liquid is poured between the plates to fill the air gap. The potential difference is now 30 V. What is the dielectric constant of the liquid?

9. a) Explain any three drawbacks of classical free electron theory.
    b) State the assumptions of quantum free electron theory.
    c) Define Fermi energy and Fermi factor.
    d) Calculate the Fermi energy in eV for silver at 0°K, given that the density of silver is 10500 Kgm⁻³, atomic weight is 107.9 and it has one conduction electron per atom.

10. a) Discuss any three major success of quantum free electron theory.
    b) Write a note on nanomaterials.
B.E. First Semester Examination – January 2018

Engineering Mathematics – I

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting at least ONE full question from each module.

Module – I

1. a) Find the nth derivative of log(ax+b).
   b) If \( y = e^{\sin^{-1}(x)} \), prove that \( (1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2 + m^2)y_n = 0 \)
   c) Find the angle between the radius vector and the tangent to the curve \( r^2 = a^2 \cos 2\theta \).

2. a) Find the pedal equation for the curve \( \frac{2a}{r} = 1 - \cos \theta \).
   b) Find the radius of the curvature of the curve \( x^3 + y^3 = 3axy \) at \( \left( \frac{3a}{2}, \frac{3a}{2} \right) \).
   c) Find the radius of curvature of the curve \( r = a(1 + \cos \theta) \).

Module - II

3. a) If \( z = \frac{x^2 + y^2}{x + y} \), prove that \( \left( \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} \right)^2 = 4 \left( 1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} \right) \).
   b) If \( u = \tan^{-1} \left( \frac{x^3 + y^3}{x - y} \right) \), find \( x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} \).
   c) If \( z = f(x,y); x = e^x + e^{-y} \) and \( y = e^{-x} + e^y \) show that \( \frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y} \).

4. a) If \( u = x \log(xy) \) and \( x^3 + y^3 + 3xy = 1 \), find \( \frac{du}{dx} \).
   b) If \( u = x^2 - 2y^2 \), \( v = 2x^2 - y^2 \) where \( x = r \cos \theta \), \( y = r \sin \theta \), show that \( \frac{\partial (u,v)}{\partial (\theta, r)} = 6r^3 \sin 2\theta \).
   c) Find the percentage error in the volume of a right circular cone when an error of +1% is made in measuring its height h and radius r of its circular base.

Module – III

5. a) Evaluate the integral \( \int_0^\frac{\pi}{2} \sin^n(x)dx \).
   b) Evaluate \( \int_0^a x^2 (a^2 - x^2)^{\frac{3}{2}} dx \).
   c) Evaluate \( \int_0^\frac{\pi}{2} x \sin^6 x \cos^8 x dx \).

(06 Marks)

(07 Marks)

(07 Marks)

(06 Marks)

(07 Marks)

(07 Marks)

(07 Marks)

(07 Marks)

(07 Marks)

(06 Marks)
6. a) Find the rank of matrix
\[
A = \begin{bmatrix}
2 & 3 & -1 & -1 \\
1 & -1 & -2 & -4 \\
3 & 1 & 3 & -2 \\
6 & 3 & 0 & -7
\end{bmatrix}
\]

b) Examine for consistency and uniqueness of the system of equations
\[
3x + y + 2z = 3, 2x - 3y - z = -3, x + 2y + z = 4
\]

c) Apply Gauss-Jordan method to solve the equations
\[
x + y + z = 9, 2x - y + 4z = 13, 3x + 4y + 5z = 40
\]

(06 Marks) (07 Marks) (07 Marks)

7. a) Trace the curve \( y^2(a-x) = x^2(a+x), a > 0 \).

b) Find the perimeter of the curve \( x^{3/5} + y^{3/5} = a^{3/5} \).

c) The cycloid \( x = a(t - \sin t), y = a(1 - \cos t) \), \( \pi \leq t \leq \pi \), revolves about the tangent at the vertex. Find the volume of the solid generated.

(07 Marks) (07 Marks) (06 Marks)

8. a) Test the convergence of the series
\[
\sum_{n=1}^{\infty} \left( \frac{1}{1} + \frac{1}{1.2} + \frac{1}{1.2.3} + \frac{1}{1.2.3.4} + \ldots \right)
\]

b) Discuss the convergence of the series
\[
\sum_{n=1}^{\infty} \left( \frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \ldots \right)
\]

c) Find the nature of series
\[
\sum_{n=1}^{\infty} \left( 1 - \frac{3}{n} \right)^n
\]

(06 Marks) (07 Marks) (07 Marks)

Module - V

9. a) Solve \( (3y - 7x + 7)dx + (7y - 3x + 3)dy = 0 \).

b) Solve \( (1 + x^2) \frac{dy}{dx} + y = e^{\tan^{-1}x} \).

c) Solve \( (y(1 + \frac{1}{x}) + \cos y)dx + (x + \log x - x \sin y)dy = 0 \).

(06 Marks) (07 Marks) (07 Marks)

10. a) Find the orthogonal trajectories of the family of \( x^{3/5} + y^{3/5} = a^{3/5} \).

b) Determine the equation for the orthogonal trajectories of confocal and co-axial parabolas \( r = \frac{2a}{1 + \cos \theta} \).

c) When a pan cake is removed from a frying pan its temperature is measured at 250°F. Four minutes later its temperature is 200°F. How long it take to cool-off to a room temperature of 70°F.

(06 Marks) (07 Marks) (07 Marks)
B. E. First Semester Examination – January 2018
Constitution of India and Professional Ethics
(Common to CV, ME, IPE, CC, AU)

Time: 3 hrs]

Note: Answer any FIVE full questions, selecting at least ONE full question from each module.

Module-I
1. a) Explain the salient features of Constitution of India (10 Marks)
b) Write about Preamble to the Constitution of India (10 Marks)

2. a) Explain the salient features of RTE Act. (10 Marks)
b) What are the various Sources of Constitution of India? (10 Marks)

Module-II
3. a) Explain about 4 broad categories of Directive principles of State policy? (10 Marks)
b) Explain the Powers and jurisdictions of High Courts (10 Marks)

4. a) What is Eligibility requirement to become Chief minister, MLA & MLC? (10 Marks)
b) Explain the Powers and Functions of Governor (10 Marks)

Module-III
5. a) What are the Power & Function of Prime minister of India? (10 Marks)
b) What is Eligibility requirement to become Prime minister and Supreme Court Judge? (10 Marks)

6. a) Explain in detail the Powers of President of India (10 Marks)
b) Explain the powers and jurisdiction of Supreme court of India. (10 Marks)

Module-IV
7. a) Explain the various Constitutional provisions for Children (08 Marks)
b) What are various types of Emergencies under Constitution of India? (12 Marks)

8. a) Explain the various Constitutional provisions for SC/ST (10 Marks)
b) Explain the appointment and Powers of Election Commission Of India (10 Marks)

Module –V
9. a) What is Ethics? Explain the aims of Engineering Ethics (05 Marks)
b) What are the various responsibilities of Engineers? (10 Marks)
c) What are the various liabilities of Engineers? (05 Marks)

10. a) What are the Fundamental Cannons of Engineering Ethics? (10 Marks)
b) Explain the types of Impediments towards responsibilities of Engineers (10 Marks)
B.E. First Semester Examination – January 2018 (Make-Up)
Fundamentals of Electrical Engineering

Time: 3 hrs] [Maximum Marks: 100
Note: Answer any FIVE full questions, selecting ONE full question from each module.

Module - I

1. a) What is an ideal voltage and current source? Derive an expression for current division formula for a circuit consisting of three resistors in parallel. (06 Marks)
   b) Apply Kirchoff’s law to find current through 50 Ω resistor in the circuit shown.

   ![Circuit Diagram]

   c) Two 1000 turns air cored coils, 100 cm long, having a cross sectional area of 5 cm² are placed side by side. The mutual inductance between them is 25 mH. Find the self inductance of the coils and the coefficient of coupling. (06 Marks)

2. a) Find the equivalent resistance between A and B for the circuit shown using "Y - Δ" transformation. All are 4 Ω resistors.

   ![Circuit Diagram]

   b) Derive an expression for energy stored in a magnetic field. An iron cored electromagnet has a length of 100 cm and diameter of 4 cm. Calculate its inductance if the coil has 2000 turns and also calculate the energy stored, when the current rises from 0 to 10A. Assume μ₀ = 500. (08 Marks)
   c) In the network shown find the current flowing in milli-ammeter A, having resistance of 10 Ω.

   ![Circuit Diagram]

Module - II

3. a) Define phase, phase difference, leading quantity, lagging quantity and power factor as applied to alternating quantities. (05 Marks)
   b) A circuit consists of resistance 10Ω, an inductance 16 mH and a capacitance of 150 µF connected in series. A supply of 100 V at 50 Hz is given to the circuit. Find the current, power factor and power consumed by the circuit. Draw phasor diagram. (07 Marks)
   c) Explain with neat diagram, measurement of 3 phase power in a balanced 3-phase circuit. (08 Marks)
4. a) What are advantages of 3 phase system over single phase system?  
   b) Show that power consumed by pure capacitor is zero.  
   c) Find the reading of each of the two single phase wattmeter connected to measure  
      the input given to a 3 phase, 400 V, 40 kW motor at 0.45 power factor. 

5. a) With neat diagram explain the constructor, principle and working of a  
    dynamometer type wattmeter. 
   b) What is earthing? Explain with neat diagram pipe earthing.  
   c) A single phase transformer working at 0.8 pf has an efficiency of 94% at both  
      three-fourth load and full load of 600 kW. Determine the efficiency at half load.  

6. a) Explain with neat diagram, construction and operation of induction type  
    wattmeter. 
   b) What is a electric shock? What are the precautions against it?  
   c) Derive the emf equation of a transformer.  
   d) A single phase, 20 kVA transformer has 1000 primary turns and 2500 secondary  
      turns. The net cross-sectional area of the core is 100 cm². When the primary  
      winding is connected to 500 V, 50 Hz supply, calculate maximum value of flux  
      density in the core, the voltage induced in the secondary winding and primary  
      and secondary full load currents. 

7. a) Explain the classification of D.C machines. 
   b) An 8 pole wave wound DC shunt generator has 36 slots, 10 conductors in each  
      slot. The flux per pole is 0.01 wbs. It runs at 1200 rpm. The armature and field  
      resistances are 0.1 Ω and 100 Ω respectively. Calculate the terminal voltage  
      when the load current is 120 A. Neglect armature reaction. 
   c) Draw and explain the characteristics of DC shunt motor and series motor. 

8. a) Derive the expression for armature torque in a DC motor. 
   b) Explain the constructional details of DC machine with neat sketch. 
   c) A 4 pole, 220 V, lap connected DC shunt motor has 576 conductors. It draw a  
      current of 40 A from the supply. The field and armature resistance are 110 Ω and  
      0.1 Ω respectively. The motor develops an output power of 6 KW. The flux per  
      pole is 40 m wbs. Calculate the speed, torque developed by the armature and the  
      shaft torque. 

9. a) Explain with neat sketch, the salient pole and smooth cylindrical rotor of a 3  
    phase alternator. 
   b) A 6 pole, 3 phase star connected alternator has an armature with 90 slots and 12  
      conductors per slot. It rotates at 1000 rpm, the flux per pole is 0.5 wbs.  
      Calculate the emf generated if the winding factor is 0.97 and coil is full pitched. 
   c) Explain the working of 3 phase induction motor with neat sketch. 

10. a) Show that when stator winding of a 3-phase induction motor is fed by 3-phase  
      supply, a rotating magnetic field of constant magnitude is produced.  
   b) A 10 pole induction motor is supplied by a 6 pole alternator, which is driven at  
      1200 rpm. If the motor runs with a slip of 3%, what is its speed?  
   c) A 3 phase 50 Hz, 10 pole alternator has star connected armature and generates a  
      line voltage of 11 kV. The flux per pole is 0.1 wbs. Assume Kp and Kd 0.96 and  
      1 respectively. Calculate the number of armature conductors.
B. E. First Semester Examination – January 2018
Fundamentals of Electrical Engineering

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting at least ONE full question from each module.

**MODULE - I**

1. a) State and explain Kirchhoff's laws.
   b) A circuit shown in figure 1(b) is connected by a 20V supply. If the total current is 1.5A, find the resistance ‘R’.
   c) Deduce an expression for stored energy in a magnetic field.

2. a) State and explain Faraday's laws of electromagnetic induction and state Lenz's law.
   b) In the network shown in fig 2(b), find the current flowing in each branch using Kirchhoff's laws.

![Fig. 1(b)](image1)

![Fig. 2(b)](image2)

   c) A coil of 1000 turns is wound on a silicon steel ring of relative permeability 1200. The ring has a mean diameter of 10cm and cross sectional area of 12 sq.cm. A current of 4A flows through the coil. Find i) Flux in the core ii) Inductance of the coil iii) The emf induced in the coil, if the flux falls to zero in 15 ms and iv) If another similar coil is placed such that 70% magnetic coupling exists between the coils. Find the mutual inductance.

**MODULE - II**

3. a) Show that the power consumed in an R-C series circuit is \(VICos\phi\). Draw the waveform for voltage, current and power.
   b) Obtain the relation between line current and phase current in case of 3-\(\phi\) delta connected system.
   c) A current \(i = 10Sin(314t - 10^\circ)A\) produces a potential drop \(v = 220Sin(314t + 20^\circ)V\) in a circuit. Find the values of the circuit parameters assuming a series combination.

4. a) What are the advantages of 3-\(\phi\) systems over a single phase system?
   b) Show that only Two watt meters are sufficient to measure power in a 3phase circuit.
   c) A circuit consists of a resistance of 20\(\Omega\) and an inductance of 0.05H connected in series. A supply of 230V at 50 Hz is applied across the circuit. Find the current, power factor and power consumed by the circuit. Draw the vector diagram.
MODULE - III

5. a) Derive an expression for electromotive force induced in the secondary winding of a transformer.
   b) Explain with neat diagram, the working of dynamometer type wattmeter.
   c) A single phase, 20 kVA transformer has 1000 primary turns and 2500 secondary turns. The net cross sectional area of the core is 100 cm². When the primary winding is connected to 500V, 50Hz supply. Calculate i) The maximum value of flux density in the core ii) The voltage induced in the secondary winding iii) The primary and secondary full load currents.
   
   (06 Marks) (08 Marks) (06 Marks)

6. a) With a neat diagram explain plate earthing.
   b) A 600 kVA 1-φ transformer has an efficiency of 92% both at full load and half load, unity power factor. Determine its efficiency at 75% full load, 0.9 p.f.
   c) Explain with neat diagram the working of a single phase induction type energy meter.
   
   (06 Marks) (08 Marks) (06 Marks)

MODULE - IV

7. a) Derive an e.m.f. equation of a DC generator.
   b) A 4 pole, 220V, lap connected DC shunt motor has 36 slots, each slot containing 16 conductors. It draws a current of 40A from the supply. The field resistance and armature resistance are 110Ω and 0.1Ω respectively. The motor develops an output power of 6kW. The flux per pole is 40mwb. Calculate i) the speed ii) The torque developed by the armature iii) The shaft torque.
   c) What is back emf? What is its significance?
   
   (08 Marks) (06 Marks) (06 Marks)

8. a) Explain the various characteristics of a DC series motor.
   b) A lap wound 4 pole DC generator has 672 conductors. It has flux per pole of 21mwb. If its speed is 1120 rpm, calculate the emf generated. Also find the speed at which it should be run to generate same emf, with wave wound armature.
   c) Derive an expression of armature torque developed in a DC motor.
   
   (08 Marks) (06 Marks) (06 Marks)

MODULE - V

9. a) A 6 pole induction motor is supplied by a 10 pole alternator which is driven at 600 rpm. If the motor is running at 970 rpm, determine the percentage of slip.
   b) Derive EMF equation of an alternator.
   c) Distinguish between salient and non-salient pole type of alternator rotors.
   
   (06 Marks) (08 Marks) (06 Marks)

10. a) A 3-phase star connected synchronous generator driven at 900 revol/min is required to generate a line voltage of 460V at 60 Hz on open circuit. The stator has two slots per pole per phase and 4 conductors per slot. Calculate i) The no. of poles ii) The useful flux per pole.
    b) Explain the construction and working principle of Star – Delta starter.
    c) Explain why induction motor can not run at synchronous speed.
    
    (08 Marks) (08 Marks) (04 Marks)
Basic Electronics

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting at least ONE full question from each module.

Module – I

1. a) Derive an expression for conductivity of an intrinsic semiconductor. (06 Marks)
   b) Draw a diagram to illustrate diffusion current in a semiconductor. Briefly explain. (05 Marks)
   c) Explain the working of a P-N junction. Discuss forward and reverse biasing of P-N junction diode. (09 Marks)

2. a) With a neat circuit diagram and relevant waveforms, explain the working of a half-wave rectifier. (06 Marks)
   b) A full wave rectifier has a load of 2 kΩ. The ac voltage applied to the diodes is 200-0-200 V. Assuming ideal diodes calculate i) Average load current ii) Average load voltage iii) Ripple voltage. If a capacitor of value 500 μF is connected across the load, what is the new value of ripple voltage? Frequency of input is 50 Hz. (08 Marks)
   c) Explain how a zener diode can be used for voltage regulation. (06 Marks)

Module – II

3. a) With a neat diagram, explain the working of a bipolar junction transistor. (06 Marks)
   b) Draw the output characteristics of transistor in common-emitter configuration. Indicate the various regions of operation and account for the shape of characteristics qualitatively. (08 Marks)
   c) For the circuit shown in Fig.3c draw the d.c load line and mark the d.c operating point on it. Assume β = 100 and neglect V_{BE}. (06 Marks)

   ![Fig.3C](image)

4. a) Draw and explain the voltage divider bias circuit. (06 Marks)
   b) Discuss thermal runaway in transistors. (04 Marks)
   c) With a neat circuit diagram and waveforms at different points, explain the working of a two-stage R-C coupled amplifier. Account for the nature of frequency response. (10 Marks)

Module – III

5. a) Discuss the merits of negative feedback amplifier. (05 Marks)
   b) State and explain Barkhausen criterion to get sustained oscillations. (05 Marks)
   c) With a neat circuit diagram, explain the working of RC phase shift oscillator. (06 Marks)
   d) Calculate the frequency of oscillations of Hartley oscillator having L_1 = 0.5 mH, L_2 = 1 mH and C = 0.22 μF. (04 Marks)

6. a) Write any four characteristics of an ideal op-amp. (04 Marks)
   b) Draw the block diagram of an op-amp and explain the function of each stage. (06 Marks)
   c) Explain how an op-amp can be used as:
      i) Non inverting amplifier  
      ii) Integrator (10 Marks)
Module – IV

7. a) Define modulation and discuss the need for modulation. (06 Marks)
   b) A carrier of 750 W, 1 MHz is amplitude modulated by sinusoidal signal of 2 kHz to a depth of 50%. Calculate the bandwidth, power in sidebands and total power transmitted. (06 Marks)
   c) With a neat diagram, explain the working of a superheterodyne receiver. (08 Marks)

8. a) Explain the construction and working of LVDT. (07 Marks)
   b) Explain the construction and working of a cathode ray tube. (07 Marks)
   c) Explain how a CRO can be used to measure amplitude and frequency of a signal. (06 Marks)

Module – V

9. a) Perform the following subtraction using 2's complement method
   i) $11010 - 10011$  ii) $10011 - 11100$ (06 Marks)
   b) Simplify the following Boolean expressions and realize using basic gates:
   i) $Y = (A + B + C)(\overline{A} + B + \overline{C})(A + B)$   ii) $AB\overline{C} + \overline{A}B\overline{C} + B\overline{C} + A\overline{C}$ (08 Marks)
   c) Realize 2-input OR gate and AND gate using diodes. (06 Marks)

10. a) Explain with a neat circuit diagram the working of RTL NOR gate and write the truth table. (07 Marks)
    b) Realize a full adder using two half adders and an OR gate. (07 Marks)
    c) Design a half subtractor and realize using basic gates. (06 Marks)
B. E. First Semester Examination – January 2018

Basic Electronics [Maximum Marks: 100]

Time: 3 hrs

Note: Answer any FIVE full questions, selecting at least ONE full question from each module.

Module-I

1. a) Explain the intrinsic and extrinsic semiconductors. Also explain the importance of doping. (06 Marks)
b) What is drift current? Derive an expression for drift current in a semiconductor. (06 Marks)
c) Draw a neat and labeled I-V characteristics of a PN junction and explain. Mention the diode current equation. (08 Marks)

2. a) A half wave rectifier is supplied from 230 V, 50 Hz supply with a step down ratio of 3:1 to a resistive load of 10 kΩ. The diode forward resistance is 75Ω while transformer secondary resistance is 10Ω. Calculate maximum, average, RMS value of load current, D.C output voltage, efficiency of rectification and ripple factor. (08 Marks)
b) With a neat circuit diagram and waveforms at different points explain the working of a full wave rectifier. (08 Marks)
c) With a neat circuit diagram explain the working of Zener voltage regulator. (04 Marks)

Module-II

3. a) Explain the working of a PNP transistor. (04 Marks)
b) What are CB, CE and CC configurations of transistor? Compare their performance in terms of voltage gain, current gain, input impedance and output impedance. (08 Marks)
c) Draw the output characteristics of a transistor in CE configuration. Indicate the different regions of operation and mention the biasing requirements for each. (08 Marks)

4. a) For the circuit shown below draw D.C load line and mark the ‘Q’ point (operating point) on it. Assume β = 100, V_{BE} = 0.7 V

\[
\begin{align*}
R_C &= 5 \text{k} \\
R_O &= 1.5 \text{ MΩ}
\end{align*}
\]

b) Draw and explain the voltage divider bias circuit. How stability is achieved in voltage divider bias circuit? (06 Marks)
c) With a neat circuit diagram and frequency response characteristics explain the working of a two-stage R-C coupled amplifier. (08 Marks)
Module-III

5. a) List the different merits of negative feedback. (05 Marks)
b) With a neat circuit diagram explain the working of BJT RC phase shift oscillator. Mention the expression for frequency of oscillations. (08 Marks)
c) With a neat circuit diagram explain the working of a crystal oscillator. (07 Marks)

6. a) List the characteristic of an Ideal operational amplifier. (05 Marks)
b) Draw the circuit diagram of op-amp non inverting amplifier. Obtain the expression for output voltage. (08 Marks)
c) Draw the circuit diagram of op-amp integrator. Derive the expression for output voltage. (07 Marks)

Module-IV

7. a) What is modulation? Mention the different needs for modulation. Write the expression for FM wave. (06 Marks)
b) A 500 W, 100 kHz carrier is amplitude modulated to a depth of 60% by a modulating signal of frequency 1 kHz. Calculate side band frequencies, power in sidebands and total power transmitted. (07 Marks)
c) With a neat block diagram explain the working of a superheterodyne receiver. (07 Marks)

8. a) Explain with neat sketch the working of LVDT. (09 Marks)
b) With a neat diagram explain the working principle of cathode ray tube. (07 Marks)
c) Explain how a CRO can be used for measuring the frequency of a signal. (04 Marks)

Module-V

9. a) Perform the following subtraction using $2^8$ complement arithmetic $(100)_2 - (1100)_2$ (05 Marks)
b) Simplify the following Boolean expressions,
   i) $ab + bc + \bar{a}c$
   ii) $ab + a(b + c) + b(b + c)$
   iii) $ab + \bar{a}b + \bar{a}$ (07 Marks)
c) Realize OR, AND logic gates using diodes. (08 Marks)

10. a) With a neat circuit diagram explain the working of DTL NAND gate. (08 Marks)
b) Write the truth table for a full adder and realize it using logic gates. (06 Marks)
c) Write the truth table of a half subtractor and realize it using logic gates. (06 Marks)
B.E. First Semester Examination – January 2018
Mechanical Engineering Science

Time: 3 hrs
[Maximum Marks: 100]

Note: Answer any Five full questions, selecting at least One full question from each Module.

Module – I

1. a) What are the advantages and disadvantages of renewable energy sources. (10 Marks)
b) Explain briefly the conversion of Nuclear Energy into electrical energy in Nuclear power plant. (10 Marks)

2. a) Write a short note on Hydel source and its conversion. (10 Marks)
b) Explain briefly the conversion of solar energy directly into electrical energy in solar cell. (10 Marks)

Module – II

3. a) With the help of a neat sketch explain the working of a Lancashire boiler and state its advantages. (10 Marks)
b) Name any three boiler mountings and mention their functions. (06 Marks)
c) 6 kg of wet steam contains 0.56 kg of water particles in it. What is the dryness fraction of the steam? (04 Marks)

4. a) Explain the principle of working of impulse turbines. (08 Marks)
b) With a neat sketch explain the working principle of gas turbine working on open cycle. (06 Marks)
c) Explain briefly with a sketch the working of Francis turbine. (06 Marks)

Module – III

5. a) Define i) Indicated power  ii) Brake power  iii) Mechanical efficiency. (04 Marks)
b) A four-stroke IC engine running at 450 rpm has a bore diameter of 100mm and stroke length 120 mm. The indicator diagram details are: area of the diagram 4cm², length of indicator diagram 6.5 cm and spring value of the spring used is 10 bar/cm. Calculate the indicated power of the engine. (06 Marks)
c) Explain the working of 4-stroke diesel cycle engine with neat sketches. (10 Marks)

6. a) Explain with a neat sketch the working of vapor compression refrigerator. (10 Marks)
b) Draw a neat sketch of room-air conditioner and explain its working principle. (10 Marks)

Module – IV

7. a) With a neat sketch explain the construction of a Radial drilling machine. (08 Marks)
b) With the help of a neat sketch explain the working of vertical milling machine. (08 Marks)
c) Briefly explain the following operations performed on lathe i) Plain turning  ii) Facing. (04 Marks)

8. a) Differentiate between soldering and brazing. (04 Marks)
b) With the help of a neat sketch explain the gas welding process. (08 Marks)
c) With a neat explain the working of a cylindrical grinding machine. (08 Marks)

Module – V

9. a) Define i) Slip and ii) Creep in belt drives why it occurs explain. (04 Marks)
b) With neat sketch explain the fast and loose pulley. (08 Marks)
c) Draw a neat sketch and explain a simple gear train. (06 Marks)
d) Two gear wheels having 80 teeth and 30 teeth mesh with each other if the smaller gear wheel runs at 480 rpm, find the speed of the larger wheel. (02 Marks)

10. a) Explain open loop and closed loop systems. (04 Marks)
b) Describe the following methods of lubrications with neat sketches. i) Ring oiling  ii) Splash lubricator. (08 Marks)
c) Explain with sketches the operation of sliding contact and rolling contact bearings. (08 Marks)
B.E. First Semester Examination – January 2018 (Make-Up)
Environmental Studies

Time: 3 hrs

Note: Answer any FIVE full questions choosing at least one full question from each module.

Module - I

1. a) Write in brief on:
   i) Environment  ii) Ecosystem  iii) Balanced Ecosystem  
   b) List different ecosystems. Explain any one ecosystem in detail.

2. a) Explain i) Food security  iii) Social and economic security.
    b) List different human activities and explain consequences of these activities on
       environment (any four).

Module - II

3. a) Explain physical and chemical parameters that define the quality of water.
    b) With neat diagram explain:
       i) Carbon cycle  ii) Hydrological cycle

4. a) Define EIA. Explain the procedure involved in EIA.
    b) Explain i) Floride problems associated with drinking water  ii) Water induced
       diseases.

Module - III

5. a) Differentiate between renewable and Non renewable energy sources.
    b) Explain in detail advantages and problems associated with environment in
       production of  i) Thermal energy  ii) Hydroelectric power.

6. a) Differentiate conventional and non conventional energy sources (any five
    differences)
    b) Explain solar power as non conventional energy resource.
    c) Explain advantages and disadvantages of wind power.

Module - VI

7. a) Explain water pollution. Explain causes and effects of ground water pollution.
    b) Define air pollution. Explain sources and effects of air pollution.

8. a) What is sound pollution? Explain the causes.
    b) Explain in detail effects of urbanization on environment.

Module - V

9. Explain the following:
   a) Global warming and climate change
   b) Ozone layer depletion
   c) Air pollution due to automobiles.

10. a) Explain importance of women education in environment protection.
     b) Write a note on NGO role in environment protection.
Environmental Studies

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting at least One full question from each Module.

**Module - I**

1. a) Define i) Ecosystem ii) Environment. Explain the structure and functioning of ecosystem. (08 Marks)
   b) List different ecosystems and explain any one. (07 Marks)
   c) Write a note on balanced ecosystem. (05 Marks)

2. a) Write a note on the following:
   i) Food Security ii) Social and economic security. (10 Marks)
   b) List different human activities and explain the effects of these on the environment (Any Four). (10 Marks)

**Module - II**

3. a) List different parameters that define quality of water. Explain physical parameters. (08 Marks)
    b) Write a note on water borne diseases. (05 Marks)
    c) Explain Nitrogen cycle. (07 Marks)

4. a) Explain the importance of forest on the health of earth ecosystem. (05 Marks)
    b) Write a note on fluoride problems in drinking water. (08 Marks)
    c) Explain environmental impacts of mining. (07 Marks)

**Module - III**

5. a) Explain advantages and disadvantages of production of i) Thermal Power ii) Hydroelectric power (10 Marks)
    b) What is Environmental Impact assessment? Explain the procedure. (10 Marks)

6. a) List and explain different non-conventional energy resources. (10 Marks)
    b) Explain solar power generation and utilization. (10 Marks)

**Module - IV**

7. Explain in detail i) Air pollution ii) Land pollution iii) Noise pollution. (20 Marks)

8. a) Explain issues of population growth with respect to society and environment. (08 Marks)
    b) Define water pollution. Explain effects of water pollution. (07 Marks)
    c) Write a note on global warming and climate change. (05 Marks)

**Module - V**

9. a) Explain the effect of following on environment:
   i) Urbanization ii) Automotive pollution. (10 Marks)
   b) Write a note on i) Acid rain ii) Ozone layer depletion. (10 Marks)

10. a) Explain the role of environmental education in environmental protection. (10 Marks)
    b) Explain the role of following in environment protection i) Role of Govt ii) NGO. (10 Marks)
B. E. First Semester Examination – January 2018 (Make-Up)
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting at least ONE full question from each module.

MODULE – I

1. a) Explain briefly the scopes of i) Geo-technical engineering ii) Irrigation engineering. (06 Marks)
   b) Differentiate between gravity dam and earthen dam. (06 Marks)
   c) What are the various infrastructural developments required for a country to develop on socio-economic basis. (08 Marks)

2. a) Draw the cross-section of road and explain the various components. (06 Marks)
   b) What are the various classification of Dams? Give examples. (06 Marks)
   c) Sketch and label the parts of i) Suspension bridge ii) Bow-string girder bridge. (08 Marks)

MODULE - II

3. a) State i) Parallelogram law of forces ii) Law of Transmissibility of forces iii) Law of physical independence. (06 Marks)
   b) What is a couple? What are the characteristics of couple? (06 Marks)
   c) Four concurrent forces are acting at point ‘A’ of a rectangle as shown in Fig.No.1. Find the magnitude and direction of the resultant force. (08 Marks)

   Fig.No.1

4. a) Explain: i) Force and its characteristics ii) Co-planar non-concurrent forces iii) Composition and resolution of forces. (06 Marks)
   b) A system of forces are acting as shown in Fig.No. 2. Find the moment of all forces about point ‘O’. (06 Marks)
   c) A system of forces are acting as shown in Fig.No. 3. Determine the equivalent force and couple system at point ‘A’. (08 Marks)

   Fig.No.2
   Fig.No.3

MODULE - III

5. a) State and prove Varignon’s principle of moments. (06 Marks)
   b) Explain i) Free body diagram ii) Conditions of equilibrium. (04 Marks)
Environmental Studies

Module – I

1. a) Define i) Ecosystem ii) Environment. Explain the structure and functioning of ecosystem. (08 Marks)
b) List different ecosystems and explain any one. (07 Marks)
c) Write a note on balanced ecosystem. (05 Marks)

2. a) Write a note on the following:
 i) Food Security ii) Social and economic security. (10 Marks)
b) List different human activities and explain the effects of these on the environment (Any Four). (10 Marks)

Module – II

3. a) List different parameters that define quality of water. Explain physical parameters. (08 Marks)
b) Write a note on water borne diseases. (05 Marks)
c) Explain Nitrogen cycle. (07 Marks)

4. a) Explain the importance of forest on the health of earth ecosystem. (05 Marks)
b) Write a note on fluoride problems in drinking water. (08 Marks)
c) Explain environmental impacts of mining. (07 Marks)

Module – III

5. a) Explain advantages and disadvantages of production of
   i) Thermal Power ii) Hydroelectric power (10 Marks)
b) What is Environmental Impact assessment? Explain the procedure. (10 Marks)

6. a) List and explain different non-conventional energy resources. (10 Marks)
b) Explain solar power generation and utilization. (10 Marks)

Module – IV

7. Explain in detail i) Air pollution ii) Land pollution iii) Noise pollution. (20 Marks)

8. a) Explain issues of population growth with respect to society and environment. (08 Marks)
b) Define water pollution. Explain effects of water pollution. (07 Marks)
c) Write a note on global warming and climate change. (05 Marks)

Module – V

9. a) Explain the effect of following on environment:
   i) Urbanization ii) Automotive pollution. (10 Marks)
b) Write a note on i) Acid rain ii) Ozone layer depletion. (10 Marks)

10. a) Explain the role of environmental education in environmental protection. (10 Marks)
b) Explain the role of following in environment protection i) Role of Govt ii) NGO. (10 Marks)

Note: Answer any FIVE full questions, selecting atleast One full question from each Module.
B. E. First Semester Examination – January 2018(Make-Up)
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs]
[Maximum Marks: 100

Note: Answer any FIVE full questions, selecting atleast ONE full question from each module.

**MODULE – I**

1. a) Explain briefly the scopes of i) Geo-technical engineering ii) Irrigation engineering. (06 Marks)
b) Differentiate between gravity dam and earthen dam. (06 Marks)
c) What are the various infrastructural developments required for a country to development on socio-economic basis. (08 Marks)

2. a) Draw the cross-section of road and explain the various components. (06 Marks)
b) What are the various classification of Dams? Give examples. (06 Marks)
c) Sketch and label the parts of i) Suspension bridge ii) Bow-string girder bridge. (08 Marks)

**MODULE - II**

3. a) State i) Parallelogram law of forces ii) Law of Transmissibility of forces iii) Law of physical independence. (06 Marks)
b) What is a couple? What are the characteristics of couple? (06 Marks)
c) Four concurrent forces are acting at point ‘A’ of a rectangle as shown in Fig.No.1. Find the magnitude and direction of the resultant force. (08 Marks)

4. a) Explain: i) Force and its characteristics ii) Co-planar non-concurrent forces iii) Composition and resolution of forces. (06 Marks)
b) A system of forces are acting as shown in Fig.No. 2. Find the moment of all forces about point ‘O’. (06 Marks)
c) A system of forces are acting as shown in Fig.No. 3. Determine the equivalent force and couple system at point ‘A’. (08 Marks)

**MODULE - III**

5. a) State and prove Varignon’s principle of moments. (06 Marks)
b) Explain i) Free body diagram ii) Conditions of equilibrium. (04 Marks)
c) Determine the resultant magnitude, direction and distance from ‘A’ for the system of forces shown in Fig.No.4.

Fig.No.4

6.  
   a) State and prove Lami’s theorem.
   b) Find the tension in the strings AB, BC and CD for the Fig.No.5, shown carrying loads at B and C.
   c) Two identical spheres are placed on smooth horizontal surface and are tied with a string PQ. A third cylinder is placed over them as shown in Fig.No.6. Find the tension in the string and reactions at points of contact A, B, C and B.

Fig.No.5  Fig.No.6.

**MODULE - IV**

7.  
   a) What are the various types of supports? Sketch with types of reactions.
   b) Define i) Co-efficient of friction  ii) Angle of friction  iii) Angle of repose
   c) Find the support reactions for the beam carrying loads as shown in Fig. No 7.

Fig.No.7

8.  
   a) State the Laws of Static friction.
   b) A block weighing 1000 N is placed on rough horizontal plane with coefficient of Friction 0.3. Find the force ‘D’ required to impend motion to right. Fig No 8.
c) A ladder of length 4m is leaning against a wall at an angle of 60° and weighs 200N. The co-efficient of friction between wall and ladder is 0.25 and between floor and ladder is 0.3. A man weighing 600N climbs up the ladder for a distance of 3m. Find the horizontal force ‘P’ to be applied at bottom of ladder to prevent slipping. 

(10 Marks)

**MODULE - V**

9. a) Locate the centroid of a semi-circle of radius ‘r’ from the diameter.
   b) State and prove parallel axis theorem.
   c) Locate the centroid of the shaded area shown in Fig. No. 9 with respect to ‘O’.

(06 Marks) (06 Marks) (08 Marks)

10. a) Find the moment of inertia of a triangle of base ‘b’ and height ‘h’ about the base and about the axis parallel to base.
    b) Determine the Polar Radius of gyration of the shaded Fig No. 10.

(06 Marks) (14 Marks)
B. E. First Semester Examination – January 2018

Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting at least ONE question from each module.

MODULE - I

1. a) What is meant by infrastructure? What are the different types of infrastructure provided for the development of nation? (10 Marks)
   b) What is a dam? What are its purposes? Draw the sketch of an earthen dam (10 Marks)

2. a) Discuss the advantage and disadvantage of flexible pavements. (08 Marks)
   b) What are deck, through and semi-through types bridges. Explain with sketches. (12 Marks)

MODULE - II

3. a) Explain the
   i) Principle of physical independence of force ii) Principle of superposition (06 Marks)
   iii) Principle of transmissibility
   b) What is a couple? What are the characteristics of couple? (06 Marks)
   c) Replace the system of forces and couple in figure 1 by a single force couple system at A. (08 Marks)

4. a) State and prove the parallelogram law of forces. (06 Marks)
   b) Find the magnitude and direction of force ‘F’ if the resultant is 100kN and is acting along y-axis. Fig. 2. (07 Marks)
   c) Find the value of resultant of the system of forces shown in fig. 3. (07 Marks)

MODULE - III

5. a) State and prove Varignon’s theorem. (06 Marks)
   b) Compute the magnitude, position and direction of the resultant force of the system of forces from A. (refer Fig. 5) (14 Marks)
6. a) Explain the
   i) Equilibrant ii) Free body diagram iii) Conditions for static equilibrium
b) Find the value of W1 for the equilibrium of the system as shown in fig. 6.
c) Two identical roller each of weight Q = 500N are supported by an inclined plane
   and vertical wall as shown in fig. 7. Assuming smooth surfaces, find the reactions
   induced at the points of support A, B and C.

   ![Fig. 6](image)
   ![Fig. 7](image)

   **MODULE - IV**

7. a) Explain the different types of supports and reactions in the analysis of beams.
    b) A beam AB is hinged at support ‘A’ and on roller at B carrying loads as shown in
       fig. 8. Determine support reactions.

   ![Fig. 8](image)

8. a) Explain the terms
   i) Angle of repose ii) Angle of friction iii) Cone of friction
   b) A ladder 5m long weighing 200N is resting against a vertical wall with the angle
      of inclination of 30°. The co-efficient of friction at both the wall and the ground is
      0.3. Determine how high a man weighing 800N climb before the ladder slips.

   **MODULE - V**

9. a) Determine the centroid of a semicircle of radius r.
    b) Determine the co-ordinates of the centroid of the area shown in fig. 9. All
       dimensions in mm.

10. a) State and prove parallel axes theorem.
    b) Determine the second moment of area about x-axis. All dimensions are in
        millimeters. (Fig. 10.)

   ![Fig. 9](image)
   ![Fig. 10](image)