Subject: Engineering Chemistry

Time: 3 Hours

Course: B.Tech.
Full Marks: 70
Pass Marks: 28

- Candidates are required to give their answers in their own words as far as practicable.
- Question Paper is divided into **Three Parts –A, B & C**
- **Part-A** is compulsory.
- **Part- B** contains **SIX** questions out of which **FOUR** questions are to be answered.
- **Part- C** contains **SIX** questions out of which **THREE** questions are to be answered.

PART A

Q.1)

ALL Questions are compulsory. [1 x 10 = 10]

[A] Multiple choice question.

(a) Which of the following is an addition Polymers ?

(i) Nylon-6   (ii) Nylon-6,6   (iii) High density polythene   (iv) Dacron

(b) Terylene is condensation Polymer of ethylene glycol and ---

(i) Phthalic acid   (ii) Terephthalic acid   (iii) Benzoic acid   (iv) Salicylic acid

(c) For the process to occurs under adiabatic conditions, the correct condition is :

(i) $\Delta T = 0$ (ii) $\Delta T = 0$ (iii) q = 0   (iv) w = 0

(d) The enthalpies of all elements in their standard state are :

(i) Unity elements   (ii) Zero   (iii) < 0   (iv) Different for each

(e) PVC polymer can be prepared by which of the following monomers ?

(i) $CH_3 - CH = CH_2$ (ii) $C_6H_5CH = CH_2$ (iii) $CH_2 = CH-Cl$ (iv) $CH_2 = CH_2$

(f) Dacron is an example of :

(i) Polyamide   (ii) Polypropylene   (iii) Polyurethane   (iv) Polymeres

(g) Steel is a alloys of :

(i) Fe & C   (ii) Fe & Ni   (iii) Fe & Cr   (iv) Fe & Cu

(h) Stainless steel is a alloys of :

(i) Fe, Ni, Cr   (ii) Fe, Cu, Zn   (iii) Fe, C, Ni   (iv) Fe, C, Cr

(i) A raw material used in making Nylon is :

(i) Ethylene   (ii) Butadiene   (iii) Adipic acid   (iv) Isoprene

(j) Nylon-6 is made from :

(i) Buta 1,3-diene   (ii) Chloroprene   (iii) Adipic acid   (iv) Caprolactum

[B] Very short Question. [5 x 2 = 10]

(a) What is the difference between thermoplastic and thermosetting polymers ? Give one example of each.

(b) What is vulcanization of rubber ? How does vulcanization improve the quality of natural & synthetic polymer ?

(c) What do you understand by heat capacity, specific heat capacity and molar heat capacity ?

(d) What do you understand for :

(i) UV-visible   (ii) IR-spectroscopy.

(e) Explain the following term :

(i) Fluorescence   (ii) Phosphorescence.

PART [B]

[4 x 5 =20]

Q.2) Answer any four :

(i) Explain following terms with suitable examples.

(a) Co polymers   (b) Addition polymers   (c) Condensation polymers   (d) Elastomers

(ii) What is Gibb's free energy ? How is free energy change related to enthalpy changes -use the relation to develop criterion of spontaneity process ?

(iii) Explain the following terms with suitable examples :

(a) Phase rule   (b) Components   (c) Degree of freedom.

(iv) Explain the following terms :

(a) Grothus – Draper law   (b) Stark-Einstein law   (c) Lambert-Beer law   (d) Quantum efficiency.

(v) Explain the following term :

(a) Nano cluster   (b) Nano rod   (c) Carbon nano tube (CNT)   (d) Nano wire

PART [C]

[3 x 10 = 30]

Answer any three.

Q.3) (a) What are free radical, cationic and nionic polymerization ? Explain with examples.

(b) Discuss the advantage of co polymerization over homo polymerization. Give the various types of co polymers along with their monomers units.

Q.4) (a) In a process 701J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy for the process ?

(b) Calculate the standard entropy change for a reaction $A \leftrightarrows B$ if the value of $\Delta H = 28.40$ kJ and equilibrium constant is 1.8×10^{-7} at 298 K.

Q.5) (a) Explain one component by Water-system.

    (b) Explain two components by Lead-silver system.

Q.6) (a) Distinction between molecules, nano- particles & bulk materials.

    (b) Explain CNT, properties & application of CNT.

Q.7) (a) Explain the following :

(i) Free energy & Gibb's – Helmholtz equation.

(ii) Clausins –Clapeyron equatiojn & Maxwell- relation – Van't Hoff isotherm & isochore.

Q.8) (a) Define polymers & classify into different category.

    (b) Write the different composition of Alloys- nichrome, stainless steel, Brass & Bronze.

Subject : Engineering Physics	**Course: B. Tech.**
	Full Marks : 70
Time : 3 Hours	**Pass Marks: 28**

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- Question Paper is divided into **Three Parts –A, B & C**
- **Part-A** is compulsory.
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PART A

Q.1)   **All questions are compulsory**

   A] Multiple Choice Questions :   **(10x1=10)**

   a)   How does a semiconductor behave at absolute zero?
      i)   Conductor
      ii) Insulator
      iii) Semiconductor
      iv) Production device

   b)   How is the resistance of semiconductor related to temperature?
      i) Resistance is directly proportional to temperature
      ii) Resistance is inversely proportional to temperature
      iii) Resistance does not depend upon temperature
      iv) None of the above

   c)   Lorentz transformation equations hold for
      i) Non-relativistic velocities only
      ii) Relativistic velocities only
      iii) All velocities: relativistic & non-relativistic
      iv) Photons only

   d)   Threshold frequency for a metal is 8×10^{14} Hz. Light of wavelength 5000 A° falls on
         its surface. Which of the following statement is correct ?
      i) No photoelectric emission takes place
      ii) Photoelectrons come out with zero speed.
      iii) Photoelectrons come out with 10^3 m/s speed.
      iv) Photoelectrons come out with 10^5 m/s speed.

   e)   Phase difference (Φ) and path difference (δ) are related by $\Phi =$

   i) $\dfrac{2\pi}{\lambda}\delta$ ii) $\dfrac{\lambda}{2\pi}\delta$

   iii) $\dfrac{\pi}{2\lambda}\delta$ iv) $\dfrac{2\lambda}{\pi}\delta$

f)   Mass of 700 N man moving in car at 66 km h^{-1} is
        i) 70 kg
        ii) 100 kg
        iii) Infinite
        iv) Zero

g)   The relative velocity of two photons moving with velocity c in opposite directions is
        i) c/2
        ii) c
        iii) 2c
        iv) zero

h)   The resolving power of a grating having N number of rulings exposed to the nth order is
        i) n/N
        ii) nN
        iii) N/n
        iv) N/n^2

i)   The required condition to achieve laser action in a system is
        i) state of population inversion
        ii) existence of metastable state
        iii) a resonant cavity
        iv) all of the above

j)   In Young's double slit experiment, the slit separation is doubled. To maintain the
same   fringe spacing on the screen , the screen-slit distance D must be changed to
        i) D/2   ii) D/$\sqrt{2}$
        iii) 2D   iv) D$\sqrt{2}$

B] Very Short question   (5x2=10)
   a) Explain stimulated emission.
   b) What is photoelectric effect.
   c) State Raleigh criterion of resolution of spectral lines.
   d) State what is Fermi level.
   e) What is population inversion?

PART B

Q2. **Answer any four:** (4x5=20)

   i) State some applications of nanotechnology.
   ii) State Heisenberg's uncertainty principle.
   iii) What is special theory of relativity.
   iv) What is wave-particle duality?
   The length of a rocket is measured to be 2/3 of its proper length. What is the speed of the rocket with respect to the observer on the ground?
   v) Derive de Broglie relation.
   An electron with a mass of 10^{-30} kg moves with a speed of about 6×10^6 m/sec. What is the de Broglie wavelength ?
   vi) In a Newton's rings experiment the diameter of the 15th ring was found to be 0.59

PART C

Answer any three: (3x10=30)

Q.3) Derive Hall co-efficient.

Q.4) Derive an expression for diffusion current in a semiconductor.

Q.5) (a) Derive Einstein's mass energy relation.

Q.6) Derive the expression for resultant intensity in a single slit diffraction pattern .

Q.7) (a) What is the expression for the Fermi level in an n type semiconductor.
   (b)The intrinsic carrier density is 1.5×10^{16} m^{-3}. If the mobility of electrons and holes are 0.13 m^2 V^{-1} s^{-1} and 0.05 m^2 V^{-1} s^{-1} respectively, calculate the conductivity.

Q.8) Derive the relation between particle velocity & group velocity.

Subject : Science, Society and Ethical Value	**Course: BTECH**
	Full Marks : 100
Time : 3 Hours	**Pass Marks:**

- Candidates are required to give their answers in their own words as far as practicable.
- Question Paper is divided into **Three Parts –A,B& C**
- **Part-A** is compulsory.
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- **Part- C** contains **SIX** questions out of which **THREE** questions are to be answered.

Set 1

PART A

Q.1) **All questions are compulsory**

A] **Multiple Choice Questions :**   (10x1=10)

i) A situation in which an engineer's loyalty and obligations may be compromised because of self interests or other loyalties and obligations

a) Conflict of interest   b) Conceptual issue   c) Concern of interest   d) Interaction rules

ii) The general and abstract concepts of right and wrong behavior culled from philosophy, theology, and professional societies

a) Ethics   b) Morals   c) Etiquette   d) Law

iii) The codes of behaviour and courtesy

a) Etiquette   b) Law   c) Morals   d) Ethics

iv) The main purpose of code of ethics is to
a) conform to the tradition established by the technical societies
b) conform to the tradition established by the other profession
c) protect the public
d) improve the image of the engineering profession

v) The method of science requires that independent observers must

a)   verify data   b) state a hypothesis in a form that can be tested
c) derive a hypothesis from theory   d) All of the above

vi)   Who is the ex officio chairman of Rajyasabha?

a)   President   b)Prime minister   c)Vice president   d)None of these.

vii) Untouchability is abolished under which of the following Article?
a)   Article 14   b)Article 15   c)Article 16   d)Article 17

viii) How many members are nominated by the president in the Lok Sabha?

    a) 1   b) 2   c) 4   d) 8

ix) Which article of constitution provides the right against Exploitation?

    a) article 22   b) article 23   c) article 24   d) article 25

x) Prohibition of employment of children in factories, etc below the age group of …….

    a) 12   b)13   c)14   d)15

B] Very Short question   (5x2=10)

    a) What do you mean by Intelligence?

    b) What is Personality?

    c) List down the Principles of time management.

    d) What are the Leadership Qualities of an individual?

    e) What is the meaning of Moral and Values?

PART B

Q.2) Answer any four: (4x5=20)

    i)   Define Engineering Ethics. Write down the dimensions of Engineering Ethics.

    ii)   Explain the nature of Intelligence.

    iii)   How to measure personality of an individual?

    iv)   Explain the role of Engineers in Industry.

    v)   Write short note on Simple living and high thinking.

    vi)   List down and explain the foundation of Human values.

PART C

Answer any three: (3x20=60)

Q.3) Explain Big Five model of Personality .

Q.4) Compare between Indian and Western culture.

Q.5) Write down the Ethical obligations of Engineering Professionals.

Q.6) What do you mean by Interpersonal Attraction? Explain in brief

Q.7) How many fundamental rights are there in Indian constitution? Explain in brief.

Q.8) Explain the basic Principle of Indian constitution.

Subject : Engg mathematics-II	Course: B tech
	Full Marks : 70
Time : 3 Hours	Pass Marks: 28

- Candidates are required to give their answers in their own words as far as practicable.
- Question Paper is divided into **Three Parts –A, B & C**
- **Part-A** is compulsory.
- **Part- B** contains **SIX** questions out of which **FOUR** questions are to be answered.
- **Part- C** contains **SIX** questions out of which **THREE** questions are to be answered.
- **Part-D** is compulsory

PART A

Q1.)   All questions are compulsory:-

A] Objective Answer Type   (5x1=5)

i) $\nabla \times (\nabla \emptyset) = ?$ where $\emptyset$ be scalar function
   a)   0
   b)   1
   c)   2
   d) none of these

ii) The standard form of the clairaut's equation is
   a)   y= px +f(p)

   b) $\frac{dy}{dx} + py = Qy^n$
   c)   Mdx+Ndy=0
   d)   None of these

iii) The particular integral of the equation $(D^2 -D+2)y=e^{3x}$
   a) $\frac{1}{8}e^{3x}$
   b) $\frac{1}{3}e^{3x}$
   c) $\frac{1}{8}e^x$
   d)   None of these

iv) The infimum of the sequence 1/2, 2/3, 3/4,……..

   a)   1
   b)   0
   c)   1/2
   d)   None of these

v) Auxiliary series $\frac{1}{1^p} + \frac{1}{2^p} + \frac{1}{3^p} … … … \infty$ is convergent if

   a)   p≥ 1
   b) $p > 1$
   c)   p<1
   d)   None of these

B] Short Answer Type

i) Solve $\frac{dy}{dx} = \frac{y}{x} + \tan\frac{y}{x}$

ii) Define Harmonic function?

iii) A die is rolled 20 times. getting a number greater than 4 is success. find the mean and variance of the number of success.

iv) Prove that $\vec{a} \times (\vec{b} \times \vec{c}) + \vec{b} \times (\vec{c} \times \vec{a}) + \vec{c} \times (\vec{a} \times \vec{b}) = 0$

v) State Cauchy's root test?

PART B

Q2.) Answer any four:

(4x5=20)

i) solve $e^y = p^3 + p$

ii) if $\vec{r} = \vec{a}\cos wt + \vec{b}\sin wt$ show that

    (i) $\vec{r} \times \frac{d\vec{r}}{dt} = w\vec{a} \times \vec{b}$

    (ii) $\frac{d^2\vec{r}}{dt^2} = -w^2\vec{r}$

iii) Show that the modulus of the sum of two complex numbers can never exceeds the sum of their moduli?

iv) Two cards are drawn successively with replacement from a well-shuffled pack of 52 cards . Find the mean and variance of the number of kings.

v) Show that an analytic function with constant modulus is constant?

vi) test the convergency of the series whose general term is $\frac{1}{(1+\frac{1}{n})^{n^2}}$

vii) solve $y = px + \sin^{-1}x$

PART C

Answer any Three:

(3x10=30)

Q3.) Solve $\frac{d^2y}{dx^2} + 4y = \cos 3x + e^{2x} + x^2$

Q4.) (i) Find the total work done in moving a particle in a force field given by $\vec{F} = 2xy\hat{i} - 3x\hat{j} - 5z\hat{k}$ along the Curve $x = t, y = t^2 + 1, z = 2t^2$ from t=0 to t=1

Q5.) Find the analytic function of which the real part is $e^{-x}\{(x^2-y^2)\cos y + 2xy\sin y\}$?

Q7.) Prove that the infinite series $\frac{1}{1^p} + \frac{1}{2^p} + \frac{1}{3^p} \ldots \ldots \ldots to \infty$ is convergent if p>1 and divergent if p≤ 1.

Q8.) Show that an analytic function with constant modulus is constant?

PART D

Q9) test the convergency of the series whose general terms is $\sqrt{n^5 + 1} - \sqrt{n^5}$ (5x1=5)

Subject: Engineering Mechanics

Time: 3 Hours

Course: B.Tech.
Full Marks: 70
Pass Marks: 28

- Candidates are required to give their answers in their own words as far as practicable.
- Question Paper is divided into **FOUR** Parts –**A, B , C & D**
- **Part-A** & D are compulsory.
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- **Part- C** contains **SIX** questions out of which **THREE** questions are to be answered.

PART A

Q.1) A) Multiple choice questions   (10X1=10)

i) When two forces P and Q act at right angles the resultant is

a) $\sqrt{P^2 + Q^2}$

b) $\sqrt{P^2 - Q^2}$

c) $\sqrt{PQ}$

d) $\sqrt{P + Q}$

ii) If a number of coplanar forces are acting simultaneously on a particle , the algebraic sum of the moments of all the forces about any point is equal to the moment of their resultant. This principle is known as.

a) principle of moments

b) principle of levers

c) principle of conservation of energy

d) none

iii) If the sum of all forces acting on a body is zero, the body may be in equilibrium provided the forces are

a) concurrent

b) parallel

c) like parallel

d) unlike parallel

iv) The moment of inertia of a circular section of diameter d about the x-x axis passing through centre of gravity is

a) $\frac{\pi}{64}$ d4

b) $\frac{\pi}{32}$ d4

c) $\frac{\pi}{16}$ d4

d) $\frac{\pi}{96}$ d4

v) The magnitude of force of friction between two bodies, one lying above the other depends on the roughne the

   a) upper body

   b) lower body

   c) both the bodies

   d) body having more roughness

vi) The efficiency of a screw jack may be increased by
   a) increasing its pitch

   b) decreasing its pitch

   c) increasing the load

   d) decreasing the load

vii) If the system is in equilibrium then the algebraic sum of virtual work for every virtual displacement is

   a) zero

   b) positive

   c) negative

   d) none

viii) The numerical ratio of displacement to distance may be

   a) greater than 1

   b) equal to 1

   c) less than 1

   d) none

ix) The product of inertia of an area is

   a) positive

   b) negative

   c) may be positive negative or zero

   d) none

x) The transfer formula for product of inertia is given by

   a) $Ix`y`=Ixy+abA$

   b) $Ix`y`=Ixy+(a+b)A$

   c) $Ix`y`=Ixy+(a-b)A$

   d) $Ix`y`=Ixy+(\frac{a}{b})A$

B) Very Short Question   (5x2=10)

   a) State Lami's theorem

   b) Difference between centre of mass, centroid and centre of gravity.

   c) Define angle of friction and angle of repose and establish a relation between them.

   d) Explain and prove the work-energy principle.

   e) Prove that when the axes are rotated through 90° in anti-clockwise direction the product of inertia
changes sign and becomes negative.

PART B

Q2) Answer any four   (4x5=20)

i) Two forces act an angle of 120°. The bigger force is 40N and the resultant is perpendicular to the smaller one.
   Find the smaller force.

ii) A body of weight 300N is lying on a rough horizontal plane having co-efficient of friction as 0.3. Find the
magnitude of force which can move the body while acting at an angle of 30°with the horizontal.

iii) The rectilinear motion of a car starting from rest is given by $a = \dfrac{6}{1.5v+2}$ where a is the acceleration in m/s² and v
the velocity in m/s. Calculate the time taken and the distance covered to attain a velocity of 6m/s.

iv) A motorcyclist travelling with a speed of 10 m/s feels the rain coming down at 45° to the vertical. On reducing
the speed to 6m/s he feels the rain to be at 30° with the vertical. Find the magnitude and direction of the actual
velocity of the rain.

v) A wooden block of weight 40N rests on a rough horizontal plane having coefficient of friction 0.3. The block is
struck by a bullet travelling horizontally with a velocity of 750 m/s and weighing 0.25N. Find the distance moved
by the block from its initial position.

vi) Obtain a relation for product of inertia of a rectangle of width b and height h with respect to the base.

PART C

Answer any three question

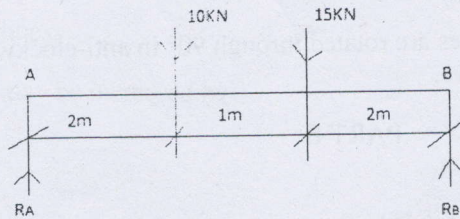   (3x10=30)

Q3) Two blocks A and B of weight 4KN and 2KN respectively are in equilibrium. coefficient of friction between
the two blocks and between block and the floor is 0.25. Find the force P required to move the block A.
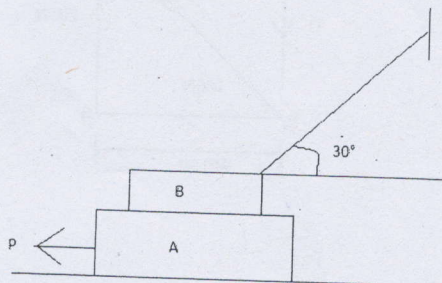
Q4) A beam has been loaded as shown below. Use the method of virtual work to determine the reactions at the supports.


Q5) A block of 50Kg mass is released from rest and slides down a 30° inclined plane. After sliding 1.5m down the plane it hits a spring of spring constant 25N/mm. Coefficient of friction between block and plane is 0.2. Find the maximum deformation of the spring and maximum velocity using work-energy principle.
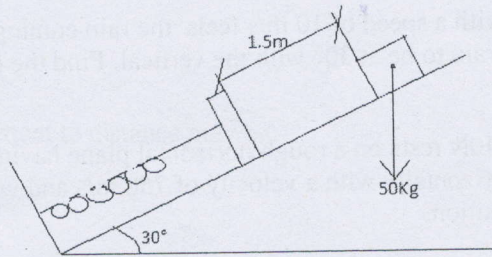
Q6) A square ABCD has forces acting along its sides as shown below. Find the value of P and Q if the system reducec to a couple. However, the net force is zero. Side of the square is 1m.
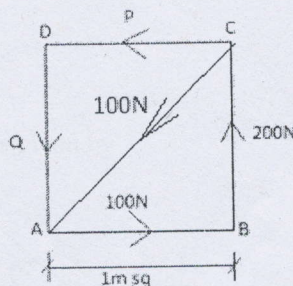
Q7) Find the product of inertia of a rectangular section shown below with respect to X and Y asxis. Also find the location and values of principle moment of inertia.
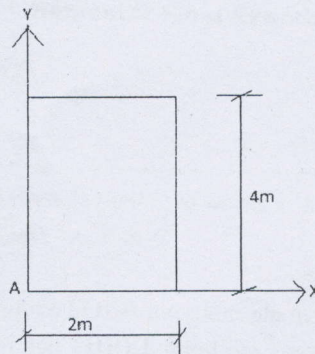
Q8) A particle moves along a horizontal direction and its position at any instant is given by $x=3t^3-5t^2$, where x is in meters and t is in seconds. Find displacement, average velocity and average acceleration duting t=2 to t=5 seconds. Also find the distance travelled in the first 4 seconds.