



Subject : Applied Chemistry

Branch & Semester: CSE & I/II

Faculty

: Dr Ch.Nageswara Rao,

Department: Humanities & Basic Sciences

Designation:

:Associate professor

UNIT-1

1. Explain the mechanism of (a) Free radical polymerisation 4M
(b) Ionic Polymerisation 3M
(c) Compounding of plastics? 3M
2. (a) Write the (a) Suspension and Emulsion polymerisation? 4M
(b) stereo specific polymers? 4M
3. Write the (a) Preparation and properties of Bakelite and BUNA-S 6M
(b) Vulcanisation 4M
4. (a) Write the differences between thermo plastics and thermosetting plastics. 4M
(b) Explain the fabrication methods of Plastics? 6M
5. Explain the (a) Biodegradable polymers? 5M
(b) Fibre Reinforced plastics? 5M

UNIT - II

1. (a) Define the Calorific Value, LCV and HCV of a fuel? 4M
(b) Describe how the Calorific value of a solid fuel is determined using a bomb calorimeter? 6M
2. Explain the a) Proximate analysis of coal? 5M
b) Ultimate analysis of coal? 5M
3. (a) Write a note on (a) Octane Number and Cetane Number? 5M
(b) Catalytic Cracking methods .6M
4. Define the (a) Petrol Knocking and Diesel Knocking ? 4M
(b) Refining of petroleum. 6M
5. (a) Write a brief note on RDX and TNT ? 4M
(b) Explain the Natural gas, LPG and CNG? 6M

UNIT- III

1. Explain the (a) Standard hydrogen electrode and Calomel electrode. 7M
(b) Electrochemical series? 3M
2. Define the (a) Single electrode potential and give its significance? 3M
(b) Lithium cells? 7M
3. (a) Explain the galvanic cell? 5M
(b) Define corrosion? Write the factors effecting the corrosion? 5M
4. Discuss the mechanism of corrosion? 10M
5. Explain the (a) Cathodic protection? 6M
(b) Galvanization and Tinning? 4M



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UNIT-IV

1. Explain the (a) BET and TEM for the preparation of Nano materials? 6M
(b) Types of Liquid Crystals 4M
2. Write a detailed account on the (a) Types of superconductors.6M
(b) R₄M₄ principles in green chemistry?4M
3. Write a detailed account on the (a)Preparations, and properties of carbon nano tubes.6M
(b)Preparations of Fullerene 4M
4. (a)What is the green Chemistry? Write the principles of green chemistry?6M
(b) Write any two methods of synthesis of compounds by using green chemistry? 4M
5. Write the (a) Sol-gel method for the preparation of Nano materials? 5M
(b) Engineering application of superconductors? 4M

UNIT-V

1. Write a note on (a) p-n Junction diode (6M)
(b) Structure of NaCl and CsCl (4M)
2. Explain (a) Controlled valency semiconductors.5M
(b) Spinel and Inverse spinels. 5M
2. Write the (a) four types of crystalline solids.5M
(b) Simple Cubic, BCC, FCC packing of metals?.5M
3. Explain (a) What are the magnetic materials? 6M
(b) Zone refining 4M
4. (a) Discuss about the (a) Hall Effect and its applications? 6M
(b) Characteristics of insulators? 4M

UNIT-VI

1. Discuss about (a) Photovoltaic cells. 7M
(b) Fuel cell and example 3M
2. Discuss briefly about the (a) Methanol-Oxygen fuel cell 5M
(b) Geothermal energy? 5M
3. Write about (a) the types of cycles in OTEC plant? 7M
(b) Biomass. 3M
4. Explain the (a) Tidal and Wave power 5 M
(b) Biodiesel? 5M
5. Write a brief note (a) Hydro power? 5M
(b) Hydrogen-Oxygen fuel cell 5M



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ENGINEERING MECHANICS QUESTION BANK

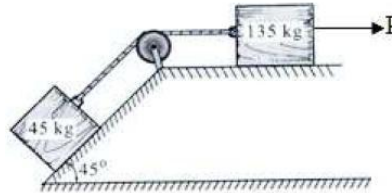
Branch: CSE (A & B)

Name of the faculty: K.PADMAJA

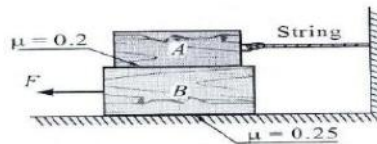
1. a) Two forces of magnitude 50 N and 30 N are acting at a point. If the angle between the two forces is 60° , determine the magnitude and direction of the resultant force. (5M)
- b) In the Figure 1, the two blocks (A=30 N and B=50 N) are placed on rough horizontal plane. Coefficient of friction between the block A and the plane is 0.3 and that between B and plane is 0.2. Find the minimum value of the force P to just move the system. Also find the tension in the string.



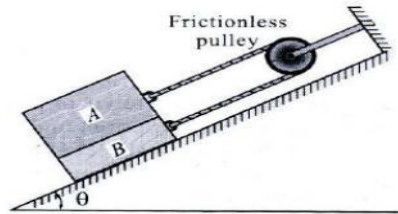
2. a) Two forces of 80N and 70N act simultaneously at a point. Find the resultant force, if the angle between them is 150° . (5M)
- b) Determine the necessary force P acting parallel to the plane to cause motion to impend as shown in the Figure 1. Assume coefficient of friction as 0.25 and the pulley to be smooth. (5M)



3. a) Three collinear horizontal forces of magnitude 150N, 450N and 300N are acting on a rigid body. Determine the resultant of forces when (i) all the forces are acting in the same direction; (ii) the force of 300N act in the same direction. (5M)
- b) In the given Figure 1, weights of two blocks A and B are 100N and 150 N respectively. Find the smallest value of the horizontal force F to just move the lower block B if (i) the block is restrained by a string; (ii) When the string is removed. (5M)



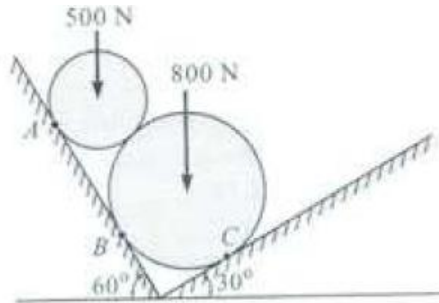
4. a) The resultant of two concurrent forces is 2500N and the angle between the forces is 90° . The resultant makes an angle of 46° with one of the forces. Find the magnitude of each force. (5M)
- b) Block A has a mass of 20 kg and block B has a mass of 10 kg in the Figure. Knowing that $\mu_s=0.15$ between all surfaces of contact, determine the value of for which for which motion will impend. Take acceleration due to gravity = 10 m/s^2 . (5M)



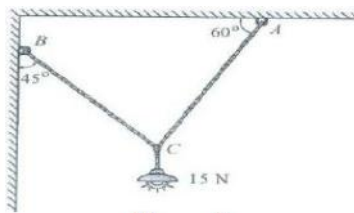
5. a) Define the terms: (i) Friction; (ii) Coefficient of friction. (iii) Coulomb Friction; (iv) Angle of friction. (v) Angle of repose. (5M)
- b) Forces P_1, P_2, P_3, P_4 of magnitudes 10KN, 20KN, 25KN and 40 KN are concurrent in space and are directed through the points A(3,2,5), B(1,7,4), C(4,-2,4) and D(-2,4,-3) respectively. Determine the resultant of system of forces. Given the system of forces are concurrent at origin. (5M)

UNIT-2

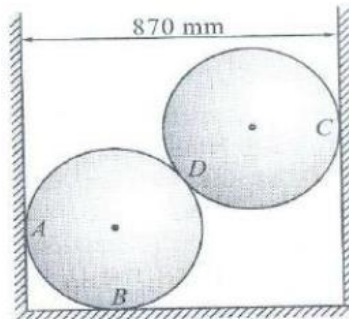
1. a) A force has the components $F_x=100\text{N}$; $F_y=65\text{N}$; $F_z=-80\text{N}$. Find the magnitude of the force and the angles θ_x , θ_y and θ_z from the axes X, Y and Z respectively. (5M)
- b) Two smooth cylinders with diameters 250 mm and 400 mm respectively are kept in a groove with slanting surfaces making angles 60° and 30° as shown in the Figure. Determine the reactions at contact points A, B and C. (5M)



2. a) The force acts at the origin in a direction defined by the angles $\theta_y=60^\circ$ and $\theta_z=35^\circ$. Knowing that the X-component of force is -80 kN, determine (i) the other components and magnitude of forces; (ii) the value of θ_x (5M)
- b) An electrical light weighing 15N hangs from a point C by the two strings AC and BC as shown in the Figure. AC is inclined at 60° to the horizontal and BC at 45° to the vertical. Using Lami's theorem, find the forces in the strings AC and BC. (5M)

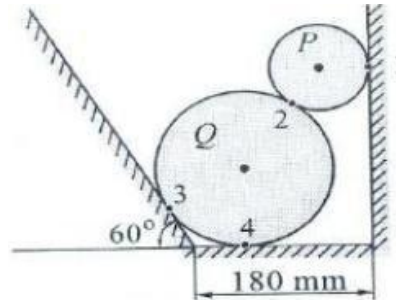


3. a) The x, y and z components of a force are 30 kN, -25kN and 20 kN respectively. Find the component of this force along the line joining A(2,3,-4) and B(-2,-3,3). (3M)
- b) Two smooth spheres of weight 100N and radius 250 mm each are in equilibrium each are in equilibrium in a horizontal channel of width 870 mm as shown in the Figure. Find the reactions at the surfaces of contact A, B, C, D assuming all surfaces to be smooth.



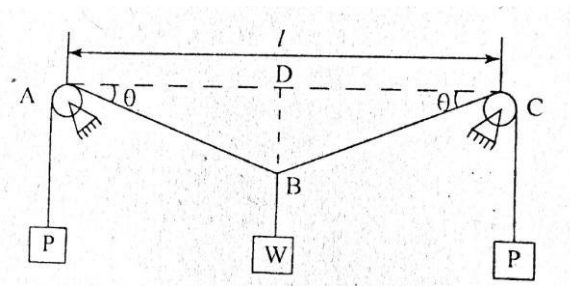
4. a) A force of 450N forms angles of 45, 120 and 60 with X, Y and Z axes respectively. Find the components F_x , F_y and F_z of the force. (3M)

b) Two cylinders P and Q in a channel are as shown in the Figure 2. The cylinder P has a diameter of 100 mm and weight 200 N and Q has 180 mm and 500 N. Determine the reaction at all contact surfaces.



5. a) i) State Lami's theorem. ii) What do you understand by a "Free Body Diagram"? How free body diagram is constructed? [4M]

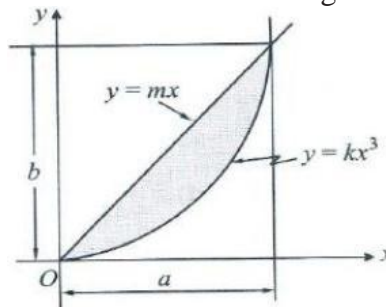
b) A weight of W is suspended from a point B of a cable ABC . The ends of the cable are pulled by equal weights P overhanging small pulleys A and C , which are on the same level. Neglecting the radii of the pulleys. Determine the sag BD if $l = 3m$, $P = 80N$, $W = 40N$.



UNIT-3

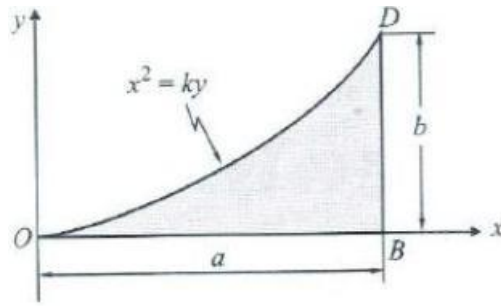
1. a) Determine an expression for the center of gravity of a right circular solid cone about its base from first principles.

b) Find the center of gravity of the shaded area as shown in the Figure.



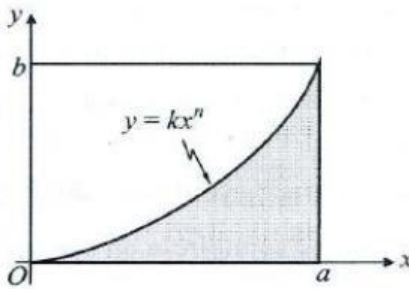
2. a) Determine the centroid of the semi-circle whose radius is R . (M)

b) Determine the position of the center of gravity of the shaded area OBD as shown in the Figure. The curve OD is parabolic.



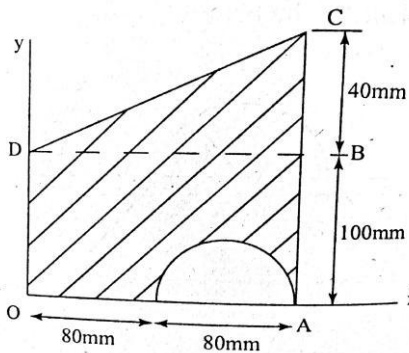
3. a) Deduce an expression to determine the centroid of a triangle of base 'b' and height 'h'. (5M)

b) Find the center of gravity of the shaded area under the curve as shown in Figure (5M)



4. a) State parallel axis theorem and perpendicular axis theorem (3 M)

b) A semicircle is removed from the trapezoid as shown. Determine the centroid of the remaining area [7M]



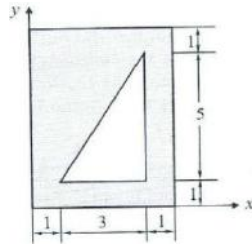
5. a) State and prove Pappus Theorem – I

b) State and prove Second theorem of Pappus

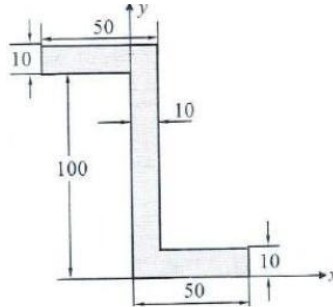
UNIT -4

1. a) Derive an equation for moment of inertia of a Quarter circle. (5M)

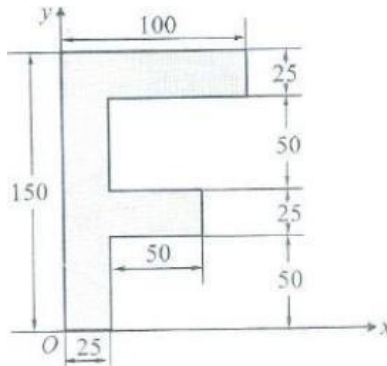
b) Find the Moment of Inertia about the centroidal axis in the given Figure. (5M)



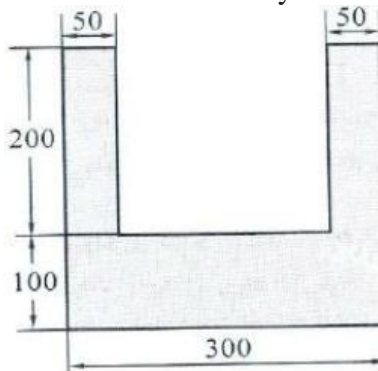
2. a) Describe the method of finding Moment of Inertia of composite areas. (5M)
 b) Find the Moment of Inertia about the centroidal axis in the given Figure (5M)



3. a) Derive an equation for moment of inertia of a Rectangle. (5M)
 b) Find the Moment of Inertia of the centroidal axis as shown in the Figure



4. a) Derive an equation for moment of inertia of a Circle. (5M)
 b) Calculate the Moment of Inertia about the centroidal x and y for the section shown in the Figure (5M)



5. a. What is polar moment of inertia? [3]
 b. Derive the Mass Moment of inertia of a rectangular plate [7]

1. a) A wheel has an initial clock wise angular velocity of 8 rad/s and a constant angular acceleration of 2 rad/s². Determine the number of revolutions the wheel must undergo to acquire a clockwise angular velocity of 15 rad/s. What is the time required? (5M)
- b) Two trains P and Q leave the same station on parallel lines. Train P starts at rest with uniform acceleration of 0.2 rad/s² attains a speed of 10 m/s. Further the speed is kept constant. Train Q leaves 30 seconds later with uniform acceleration of 0.5 m/s² from rest and attains a maximum speed of 20 m/s, when will train Q overtake train P. (5M)
2. a) A wheel accelerates uniformly from rest to a speed of 200 rpm in 1/2 sec. It then rotates at that speed for 2 sec before decelerating to rest in 1/3 sec. How many revolutions does it make during the entire time interval? (5M)
- b) Two trains R and S start from rest simultaneously from stations A and B facing each other with accelerations 0.5 m/s² and 2/3 m/s² reaching their maximum speeds of 90 kmph and 72 kmph respectively. If they cross each other midway between the stations, find the distance between the stations and the time taken by each other. (5M)
3. a) The motion of a flywheel around its geometrical axis is described by the equation: $\omega = 15t^2 + 3t + 2$ rad/s and angular displacement is 160 radians at t=3 seconds. Find the angular acceleration, velocity, displacement at t = 1 second. (5M)
- b) An aircraft moving horizontally at a speed of 360 kmph and at a height of 490 m towards a target on the ground, releases a bomb, which hits a target. Find (i) Time required for the bomb to reach the target on the ground; (ii) the velocity and the direction with which the bomb hits the target. (5M)
4. a. A stone is vertically thrown upwards from the top of a building with a velocity of 20m/s. If it reaches the ground after 5 seconds, determine the height of the building [5]
- b. The maximum range of a projectile is 2000m. What should be the angle of elevation so as to obtain a range of 1400m if the initial velocity remains unchanged? [5]
5. a. A motorist is travelling at 80kmph, when he observes a traffic light 200m ahead of him turns red. The traffic light is timed to stay red for 10sec. If the motorist wishes to pass the light without stopping, just as it turns green, determine (1) the required uniform deceleration of the motor
(2) The speed of the motor as it passes the light. [7] b.
- Write about D'Alembert's principle [3]

UNIT – 6

1. a) Determine the work done in stretching a spring to an elongation of x from its unscratched position [5]
b) Discuss the impulse momentum principle [5]
2. a) What is the work energy equation for translation [5]
b) Discuss about connected bodies [5]
3. a) Discuss (i) Work (ii) Power [4+2]
b. What is the work energy equation in the case of fixed axis rotation [4]
4. A flywheel weighing 50kn and having radius of gyration 1m loses its speed from 400rpm to 280rpm in 2 minutes. Calculate i. The retarding torque acting on it
ii. Change in its kinetic energy during the above period [10]
5. A 1500 N block is in contact with a level plane, the coefficient of friction between two contact surfaces being 0.1. If the block is acted upon by a horizontal force of 300n, what time will elapse before the block reaches a velocity of 16m/sec starting from rest? If 300N force is then removed, how much longer with the block continue to move? Solve the problem using impulse momentum equation? [10]
6. A 20kN automobile is moving at a speed of 70kmph when the brakes are fully applied causing all four wheels to skid. Determine the time required to stop the automobile
A. On concrete road for which coefficient of friction is 0.75 B.
On ice for which coefficient of friction is 0.08 [10]



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ENGLISH- II QUESTION BANK- I B. TECH (CSE-A)

Unit- I

- 1) **A.** Why does the author say that the Know how produced by Science and technology is an unfinished sentence?
B. What is hovercraft?
C. Give synonyms for the following:
 - i.** Strengthen
 - ii.** Resource
- 2) **A.** Explain Schumacher views on education?
B. What was the objective of the SLV project?
C. Give the synonyms of the following:
 - i.** Precipitate
 - ii.** Antecedent
- 3) **A.** What are the arguments which the author put forward to show that education is necessary?
B. Who helped Kalam design the guidance systems for Agni Missile?
C. Give synonyms for following:
 - i.** Apprehension
 - ii.** Brink
- 4) **A.** What should be done to overcome the problems of modern life?
B. Why Abdul Kalam is called the Missile Man of India?
C. Give Antonyms for the following words:
 - i.** Decline
 - ii.** Civilized
- 5) **A.** Write a letter to the editor of a leading newspaper on the problem of eve - teasing in your city.
B. Explain the work Kalam did at DRDO.
C. Give Antonyms for the following words:
 - i.** Inferior
 - ii.** Conceal
- 6) **A.** How is positive attitude helpful for the students?
B. Name a few awards that Kalam won.
C. Give antonyms for the following words:
 - i.** Culminate
 - ii.** Persuade

- ii. She --- (like) coffee compared to tea.
- 2) A. How does the author define 'culture shock'? What are the symptoms according to him?
 B. What was the most devastating event during the World War II?
 C. Fill in each blank with an appropriate form of the verb given in brackets:
 i. When he --- (come) home I was taking shower.
 ii. He --- (finish) homework before I called him.
- 3) A. Write the four stages of cultural shock.
 B. Note contributions of Ernest Rutherford.
 C. Fill in the blank with an appropriate form of the verb given in brackets:
 i. The train --- (have left) before I reached the station.
 ii. She --- (lost) the key just now.
- 4) A. Prepare a 5 minutes speech expressing your views on the following topic: ***Betting in sports.***
 B. Who was Dirac? What was his major contribution?
 C. Fill in the blank with an appropriate form of the verb given in brackets:
 i. She --- (play) football every day.
 ii. She --- (go) to church every Sunday.
- 5) A. Explain Non - Verbal Communication.
 B. What were Bhabha's efforts to set up research institute in India?
 C. Fill in the blank with an appropriate form of the verb given in brackets:
 i. She --- (see) Delhi many times.
 ii. She --- (have work) a lawyer since 2000.
- 6) A. What is Body Language?
 B. What is the message of Bhabha to the youth?
 C. Fill in the blank with an appropriate form of the verb given in brackets:
 i. Summer----- (come) after winter.
 ii. She----- (meet) the principal yesterday.

UNIT- IV

- 1) A. What seems to have been the original purpose of the lottery? What do people believe about it?
 B. What was Bose's attitude towards education as he grew up?
 C. In questions given below out of four alternatives, choose the one which can be substituted for the given word/sentence:
 i. That which cannot be corrected

- A. Unintelligible B. Indelible C. Illegible D. Incurable
- ii. The study of ancient societies
- A. Anthropology B. Archaeology C. History D. Ethnology
- 2) A. Is it important that the original paraphernalia for the lottery had been lost? What do you suppose the original ceremony was like? Why have some of the villages given up this practice? Why hasn't this one?
- B. Why did Bose shift his interest? What were his contributions to the two fields he worked in?
- C. In questions given below out of four alternatives, choose the one which can be substituted for the given word/sentence:
- i. A person of good understanding knowledge and reasoning power
- A. Expert B. Intellectual C. Snob D. Literate
- ii. A person who insists on something
- A. Disciplinary B. Stickler C. Instantaneous D. Boaster
- 3) A. Is the lottery a collective act of murder? Is it morally justified? Is tradition sufficient justification for such actions? How would you respond to cultures that are different from ours that perform "strange" rituals?
- B. Give an account of Bose's experiments relating to plant responses.
- C. In questions given below out of four alternatives, choose the one which can be substituted for the given word/sentence:
- i. State in which the few govern the many
- A. Monarchy B. Oligarchy C. Plutocracy D. Autocracy
- ii. A style in which a writer makes a display of his knowledge
- A. Pedantic B. Verbose C. Pompous D. Ornate
- 4) A. Write an essay on- "Global Warming"
- B. Write the views of the author on J.C. Bose.
- C. In questions given below out of four alternatives, choose the one which can be substituted for the given word/sentence:
- i. A person who knows many foreign languages
- A. Linguist B. Grammarian C. Polyglot D. Bilingual
- ii. One who possesses many talents
- A. Versatile B. Nubile C. Exceptional D. Gifted
- 5) A. Write a newspaper report about an accident that took place on the main road in your town.
- B. Explain the childhood and early life of J.C. Bose.

C. In questions given below out of four alternatives, choose the one which can be substituted for the given word/sentence:

- i. One who eats everything
A. Omnivorous B. Omniscient C. Irascible D. Insolvent
- ii. The custom or practice of having more than one husband at same time
A. Polygyny B. Polyphony C. Polyandry D. Polychromic

UNIT- V

- 1) A. How does climate change affect human health?
B. Explain the early life of Prafulla Chandra Ray.
C. Fill the blank with suitable preposition.
 - i. Peter is playing tennis _____ Sunday.
 - ii. What are you doing _____ the afternoon?
- 2) A. Write a short note on aeroallergens.
B. What are the contributions and achievements of Prafulla Chandra Ray?
C. Fill the blank with suitable preposition.
 - i. The shops open _____ nine.
 - ii. She has never seen the sea _____ winter.
- 3) A. How can we prevent climate change?
B. Explain Assertiveness.
C. Fill the blank with suitable preposition.
 - i. I have been waiting for you _____ seven o'clock.
 - ii. I will have finished this essay _____ Friday.
- 4) A. How are morality and excessive heat related?
B. Write an essay on – “Climate Change”.
C. Fill the blank with suitable preposition.
 - i. We are going to see my parents _____ the weekend.
 - ii. In 1666, a great fire broke out _____ London.
- 5) A. What is public health surveillance and why is it important?
B. Write an article on- “Air Pollution”.
C. Fill the blank with suitable preposition.
 - i. My brother's birthday is _____ the 5th of November.
 - ii. My birthday is _____ May.

UNIT- VI

- 1) **A.** What does SMART mean in goal setting?
B. Who is Paul Allen? Write the achievements of Allen with Gates.
C. Fill the gap with the suitable verb.
- i.** One of my friends _____gone to France. (has / have)
 - ii.** Each of the boys _____ given a present. (was / were)
- 2) **A.** Why IBM approached Bill Gates? Explain the problems and prospects of their agreement.
B. Who is Srinivasa Ramanujan?
C. Fill the gap with the suitable verb.
- i.** Neither of the contestants_____ able to win a decisive victory. (was / were)
 - ii.** Oil and water _____ not mix. (do / does)
- 3) **A.** Explain the family details of Bill Gates.
B. Explain the education and research career of Srinivasa Ramanujan?
C. Fill the gap with the suitable verb.
- i.** He and I _____ at Oxford together. (was / were)
 - ii.** Slow and steady _____the race. (win / wins)
- 4) **A.** What are the advantages of team work?
B. Explain the achievements of Ramanujan at Cambridge.
C. Fill the gap with the suitable verb.
- i.** Neither Peter nor James _____ any right to the property. (has / have)
 - ii.** No prize or medal _____ given to the boy, though he stood first in the examination. (was / were)
- 5) **A.** Why did Bill Gates and Allen sue a case against the new owner of MITS?
B. Write a report on- “Blood donation camp”.
C. Fill the gap with the suitable verb.
- i.** Either Mary or Alice responsible for this. (is / are)
 - ii.** Neither the Minister nor his colleaguesgiven any explanation for this. (have / has)



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Question Bank(2018-2019)

Subject-Environmental studies

Branch: CSE&ECE

Year/Sem: I/II

Name of the faculty: M.Lalitha

Department: H & BS

Unit-1

1. a) Discuss the scope of environmental education? 5m
b) What is the role of IT on environment and human health? 5m
2. Why is environmental studies considered as a multidisciplinary subject? 10m
3. Discuss the causes and effects of global warming. 10m
4. a) Discuss the causes and effects of Acid rains. 5m
b) Discuss the causes and effects of Ozone depletion. 5m
5. a) What are ecological pyramids? Write about different types of pyramids. 5m
b) Give an account of energy flow in an ecosystem. 5m
6. Write about structure and function of ecosystem. 10
7. a) Write a short note on food web. 5m
b) Discuss the phenomenon of ecological succession. 5m
8. Explain the structure and functioning of Forest or grassland ecosystem. 10
9. Describe the structure and functioning of a pond ecosystem. 10m
10. Effect of human activity on ecosystem.10m

Unit-2

1. What are renewable and non –renewable energy resources? Explain. 10m
2. What are the major causes and consequences of deforestation? 10m
3. a) Write about crises and conflict over water. 5m
b) Write a short note on Soil erosion. 5m

4. **What is mining? What are the impacts of mining on environment? 10m**
5. a) **What is the role of an individual in conservation of natural resources? 5m**
b) **Describe few modern agricultural methods and their consequences. 5m**
6. a) **Write a short note on Forest resources. 5m**
b) **Write a short note on Rehabilitation problems. 5m**

Unit-3

1. a) **Define biodiversity. Write about threats of biodiversity. 5m**
b) **What are the three levels of biodiversity? 5m**
2. **What are the hot spots of biodiversity? 10m**
3. **Explain in-situ and ex-situ conservation of biodiversity? 10m**
4. a) **What are the different values of biodiversity? 5m**
b) **Write about Endemic and Endangered Species. 10m**

Unit-4

1. a) **Mention briefly about the various types of pollution. 5m**
b) **Briefly describe sources, effects and control of noise pollution. 5m**
2. **Discuss adverse effects and control of water pollution. 10m**
3. **Briefly describe sources, effects and control of various Air pollutants. 10m**
4. **What are the various types of solid waste and methods of safe disposal of solid waste? 10m**
5. a) **Role of an individual in the prevention of environmental pollution? 5m**
b) **Write a note on Bhopal Gas Tragedy. 5m**

Unit -5

1. a) **What do you understand by environmental ethics? 5m**
b) **Discuss the salient features of Wild life protection Act. 5m**
2. a) **Discuss the salient features of Forest Conservation Act. 5m**
b) **What are the major limitations to successful implementation of all environmental legislation? 5m**
3. **What is rain water harvesting? What are the purposes served by it? 10m**
4. a) **Methods to propagate environmental awareness in society? 5m**

b) Write a note on Water act. 5m

5. Write a short note on urban problems related to:

a) Energy 5m b) Water conservation 5m

Unit -6

- 1. Write about EIA, its significance at various stages. 10m**
- 2. a) Explain about environmental audit? 5m**
b) Discuss about environmental management plan. 5m
- 3. a) Discuss the concept of ecotourism, its principles and merits. 5m**
b) Write a short note on EIS. 5m
- 4. Write a short note on Green business, green politics and green campus. 10m**



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I B.TECH IISem Question Bank

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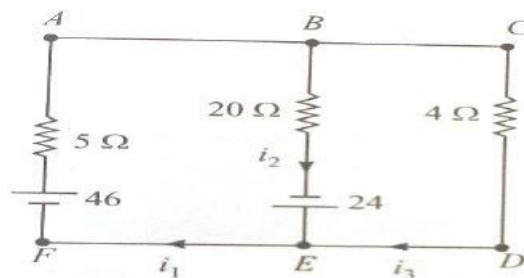
UNIT -I

1(a) Solve the system of equations $20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$ by Gauss Jacobi method 5M

(b) Reduce the matrix A to normal form and hence find the rank of the matrix

$$A = \begin{bmatrix} 2 & -2 & 0 & 6 \\ 4 & 2 & 0 & 2 \\ 1 & -1 & 1 & 2 \end{bmatrix} \quad \text{5M}$$

2(a) Find the currents in the following circuits 5M



(b) solve the system of equations $10x + y + z = 12$, $2x + 10y + z = 13$ and $2x + 2y + 10z = 14$ using Gauss-seidel method. 5M

3(a) Find the non singular matrices P and Q such that the normal form of A is PAQ where

$$A = \begin{bmatrix} 1 & 3 & 6 & -1 \\ 1 & 4 & 5 & 1 \\ 1 & 5 & 4 & 3 \end{bmatrix}. \text{ Hence find its rank.} \quad \text{5M}$$

(b) Find the rank of $\begin{pmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{pmatrix}$ after reducing it to Echelon form 5M

4(a) Find the values of 'a' and 'b' for which equation $x + y + z = 3$; $x + 2y + 2z = 6$; $x + ay + 3z = b$ have unique solutions. 5M



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(b) using Gauss-jordan method solve the system of equations $2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$. 5M

5(a) Reduce the matrix A to normal form and hence find the rank of the matrix. 5M

$$A = \begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & 3 & 4 & 1 \\ 2 & 3 & 7 & 5 \end{bmatrix}$$

(b) prove that the following set of equations are consistent and solve them.

$$2x - y - z = 2 ; x + 2y + z = 2 ; 4x - 7y - 5z = 2 ;$$

UNIT – II:

1(a) Find Eigen values and Eigen vectors of $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ 5M

(b) Reduce the quadratic form $10x^2 + 2y^2 + 5z^2 - 4xy - 10xz + 6yz$ into canonical form and find the nature, rank, index and signature. 5M

2(a) Reduce the Quadratic form $3x_1^2 + 3x_2^2 + 3x_3^2 + 2x_1x_2 + 2x_1x_3 - 2x_2x_3$ into sum of squares form by an orthogonal transformation and give the matrix transformation. 5M

(b) Find A^{-1} using Cayley –Hamilton theorem, where $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$ 5M

3(a) what is the nature of the quadratic form X^TAX , if $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ 5M

(b) Prove that if τ is an Eigen value of a matrix A then τ^{-1} is an Eigen value of matrix A^{-1} if it exists. 5M



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4(a) If τ is an Eigen value of a non singular matrix A then show that $\frac{|A|}{\tau}$ is an Eigen value of matrix adjoint A(adjA) 5M

(b) Find A^{-1} using Cayley –Hamilton theorem, where $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ 5M

5(a) state Cayley-Hamilton theorem and find A^8 if $A = \begin{pmatrix} 1 & 2 \\ 2 & -1 \end{pmatrix}$ 5M

(b) Diagonalize the matrix $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ -1 & 2 & 2 \end{bmatrix}$ 5M

6(a) Show that if λ is an eigen value of A, then prove that the eigen value of

$B = a_0A^2 + a_1A + a_2I$ is $a_0\lambda^2 + a_1\lambda + a_2$. 5M

(b) Is the matrix $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 2 & 5 & 7 \end{bmatrix}$ diagonalizable? 5M

UNIT –III :

1(a) Evaluate $\int_{y=0}^2 \int_{x=0}^3 xy \, dx dy$ 5M

(b) Evaluate $\int_0^a \int_{\frac{x^2}{a}}^{2a-x} xy^2 dy dx$ by changing the order of integration. 5M

2(a) Evaluate $\int_{x=0}^a \int_{y=0}^b (x^2 + y^2) dy dx$ 5M

(b) By changing the order of integration, evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2 dx dy$ 5M

3(a) Find the moment of inertia about the initial line of the cardioid $r = a(1 - \cos\theta)$. 5M

(b) Evaluate $\iiint dx dy dz$ V is the finite region of space formed by the planes

$x = y = z = 0$ and $2x + 3y + 4z = 12$ 5M

4(a) Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{a \sin\theta} \int_0^{\frac{a^2-r^2}{2}} r dz dr d\theta$. 5M



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(b) Evaluate $\int_0^4 \int_{\frac{y^2}{4}}^y \frac{y}{x^2+y^2} dx dy$ 5M

5(a) Evaluate $\int_0^a \int_x^a (x^2 + y^2) dy dx$ by changing the order of integration. 5M

(b) Evaluate $\iint (x^2 + y^2) dx dy$ in the positive quadrant for which $x + y \leq 1$. 5M

UNIT – IV:

1(a) Show that $\int_0^\infty \sqrt{x} e^{-x^3} dx = \frac{\sqrt{\pi}}{3}$ 5M

(b) Show that $\int_0^\infty \frac{x^{m-1}}{(a+bx)^{m+n}} dx = \frac{\beta(m,n)}{a^n b^m}$ 5M

2(a) Prove that $\Gamma\Gamma(n)\Gamma\Gamma(n-1) = \frac{\pi}{\sin n\pi}$ 5M

(b) Prove that $\int_0^{\frac{\pi}{2}} \sqrt{\cos x} dx \int_0^{\frac{\pi}{2}} \frac{dx}{\sqrt{\cos x}} = \pi$ 5M

3(a) Evaluate $\int_0^1 \frac{x^4(1+x^5)}{(1+x)^{15}} dx$ 5M

(b) Evaluate $\int_5^7 (x-5)^6(7-x)^3 dx$ using β and $\Gamma\Gamma$ functions. 5M

4(a) Show that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$ 5M

(b) Show that $B(m, n) = \frac{\Gamma\Gamma(m)\Gamma\Gamma(n)}{\Gamma\Gamma(m+n)}$ where $m > 0, n > 0$. 5M

5(a) Evaluate $\int_0^{\pi/2} \sin^5 \theta \cos^{7/2} \theta d\theta$. 5M

(b) Evaluate $\int_0^1 x^4 \left(\log \frac{1}{x}\right)^3 dx$ 5M

6(a) Evaluate $\int_0^1 \frac{xdx}{\sqrt{1-x^5}}$. 5M

(b) Evaluate $\int_0^\infty x^2 e^{-x^2} dx$. 5M



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UNIT- V :

1(a) Find unit normal vector to the surfaces $x^2y + 2xz^2 = 8$ at the point (1,0,2) 5M

(b) Prove that $\text{div.}(gradr^m) = m(m+1)r^{m-2}$ 5M

2(a) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point (2, -1, 2). 5M

(b) If \vec{A} is irrotational, evaluate $\text{div}(\vec{A} \times \vec{r})$ where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ 5M

3(a) Find $\text{div}\vec{F}$, where $\vec{F} = r^n\vec{r}$. Find n if it is solenoidal. 5M

(b) Show that $\vec{F} = (y^2 - z^2 + 3yz - 2x)\vec{i} + (3xz + 2xy)\vec{j} + (3xy - 2xz + 2z)\vec{k}$ is both irrotational and Solenoidal. 5M

4(a) Find the directional derivative of $\phi = x^2yz + 4xz^2$ at (1,-2,-1) in the direction of $2\vec{i} - \vec{j} - 2\vec{k}$ 5M

(b) Show that the vector $(x^2 - yz)\vec{i} + (y^2 - zx)\vec{j} + (z^2 - xy)\vec{k}$ is irrotational and find its scalar potential. 5M

5(a) Show that $\nabla^2(f(r)) = \frac{d^2f}{dr^2} + \frac{2}{r} \frac{df}{dr}$ or $f''(r) + \frac{2}{r} f'(r)$ where $r = |\vec{r}|$. 5M

(b) Prove that $\text{div}(\vec{a} \times \vec{b}) = \vec{b} \cdot \text{curl}\vec{a} - \vec{a} \cdot \text{curl}\vec{b}$ 5M

UNIT – VI

1(a) Use Greens theorem to evaluate $\int (2xy - x^2)dx + (x^2 + y^2)dy$, where c is the closed curve of the region bounded by $y = x^2$ and $y^2 = x$. 5M

(b) State Gauss divergence theorem and verify $\vec{F} = 4xz\vec{i} - y^2\vec{j} + zy\vec{k}$ over the cube $x = 0$ & $x = 1, y = 0$ & $y = 1, z = 0$ & $z = 1$. 5M

2(a) Evaluate $\int (e^x dx + 2ydy - dz)$ where c is the curve $x^2 + y^2 = 9, z = 2$, by using Stoke's theorem. 5M

(b) Compute $\int (ax^2 + by^2 + cz^2)ds$ over the surface of the sphere $x^2 + y^2 + z^2 = 1$. 5M



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3(a) If $\vec{F} = (3x^2 + 6y)\vec{i} - 14yz\vec{j} + 20xz\vec{k}$ then evaluate $\int \vec{F} \cdot \vec{dr}$ from (0,0,0) to (1,1,1) along $x = t, y = t^2, z = t^3$. 5M

(b) Apply stoke's theorem to evaluate $\int (ydx + zdy + xdz)$ where c is the curve of intersection of the sphere $x^2 + y^2 + z^2 = a^2$ and $x + z = a$. 5M

4(a) State stoke's theorem, and verify for $\vec{F} = (x + y)\vec{i} + (y + z)\vec{j} - x\vec{k}$ and S is the Surface of the plan $2x + y + z = 2$ which is in the first octant. 5M

(b) Using divergence theorem to evaluate $\iint \vec{F} \cdot \vec{ds}$ where $\vec{F} = x^3\vec{i} + y^3\vec{j} + z^3\vec{k}$ and S is surface of the sphere $x^2 + y^2 + z^2 = r^2$. 5M

5(a) Verify Green's theorem in the plan for $\int (x^2 - xy^3)dx + (y^2 - 2xy)dy$ where C is the square with vertices (0,0), (2,0), (2,2), (0,2) 5M

(b) Evaluate by Green's theorem $\oint (y - \sin x)dx + \cos x dy$ where C is the triangle enclosed by the lines $y = 0, x = \frac{\pi}{2}, \pi y = 2x$. 5M