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# S.E. (Chemical Engg.) (Semester - IV) (Revised) Examination, November - 2017
# ENGINEERING MATHEMATICS - IV
## Sub. Code : 63427

**Day and Date : Wednesday, 01 - 11 - 2017** **Total Marks : 100**

**Time : 10.00 a.m. to 1.00 p.m.**

**Instructions :**
1) **All questions are compulsory.**
2) **Figure to the right indicates full marks.**
3) **Use of non-programmable calculator is allowed.**
4) **Assume suitable data if necessary.**

## SECTION - I

**Q1)** Attempt any three of the following:

a) Find the divergence and curl of the vector

$\vec{F} = (x^2 + yz)i + (y^2 + zx)j + (z^2 + xy)k.$ **[6]**

b) If $\vec{a}$ is constant and $\vec{r} = xi + yj + zk$, prove that

$$\nabla\left(\frac{\vec{a}\cdot\vec{r}}{r^n}\right) = \frac{\vec{a}}{r^n} - \frac{n(\vec{a}\cdot\vec{r})\vec{r}}{r^{n+2}}.$$ **[6]**

c) Find the directional derivative of the function $f(x, y, z) = 2xy + z^2$ at the point $(1, -1, 3)$ in the direction of the vector $i + 2j + 2k$. **[6]**

d) 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). **[6]**

*P.T.O.*

**Q2)** Attempt any two of the following:

a) Find the Fourier transform of $f(x)=\begin{cases}1-x^2, & |x|\le 1\\ 0, & |x|>1\end{cases}$ and use it to evaluate $\int_0^{\infty}\left(\frac{x\cos x-\sin x}{x^3}\right)\cos\frac{x}{2}dx$. **[8]**

b) Find the cosine transform of a function of $x$ which is unity for $0<x<a$ and zero for $x\ge a$. What is the function whose cosine transform is $\frac{\sin as}{s}$. **[8]**

c) Find the finite sine transform of i) $\cos ax$ and ii) $x^3$. **[8]**

**Q3)** Attempt any two of the following:

a) Find the first and second order derivative of $y$ at $x = 1.1$ using following information. **[8]**

| x | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2 |
|---|---|---|---|---|---|---|
| y | 0 | 0.128 | 0.544 | 1.296 | 2.432 | 4 |

b) A slider in a machine moves along a fixed straight rod. Its distance $x$ cm along the rod is given below for various values of the time $t$ seconds. Find the velocity of the slider and its acceleration when $t = 0.3$ seconds. **[8]**

| t | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 |
|---|---|---|---|---|---|---|---|
| x | 30.13 | 31.62 | 32.87 | 33.64 | 33.95 | 33.81 | 33.24 |

c) From the following table of values of $x$ and $y$ obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for $x = 2.2$ **[8]**

| x | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 | 2.2 |
|---|---|---|---|---|---|---|---|
| y | 2.7183 | 3.3201 | 4.0552 | 4.9530 | 6.0496 | 7.3891 | 9.0250 |

## SECTION - II

**Q4)** Attempt any Three of the following.

a) The probability density function of random variable X is **[6]**

| x | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| P(X) | 0.1 | k | 0.2 | 2k | 0.3 | 3k |

Find i) k ii) $p(x \geq 2)$ iii) $p(-2 < x < 2)$

b) The probability that a missile will strike the target is $\frac{1}{5}$. If six missiles are fixed. Find the probability that: **[6]**

i) Exactly two will strike the target.

ii) At least two will strike the target.

c) If the probability that an individual suffers a bad reaction from a certain injection is 0.001. Determine the probability that our of 2000 individuals:**[6]**

i) Exactly 3.

ii) More than 2 will suffer a bad reaction.

d) The life time of certain type of battery has mean life of 400 hours and standard deviation of 50 hours. Assuming the distribution of life time to be normal find. **[6]**

i) the percentage of batteries which have life time of more than 350 hours,

ii) the percentage of batteries which have life time between 300 and 500 hours.

(Given: For a S.N.V.z area between z = 0 and z = 1 is 0.3413, that between z = 0 and z = 2 is 0.4772).

**Q5)** Attempt any Two of the following:

a) Find Fourier series for $f(x) = -\pi, -\pi < x < 0$
$= x, \quad 0 < x < \pi$

Hence, deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots$ **[8]**

b) Find Fourier series for $x + x^2$ in (-1,1). **[8]**

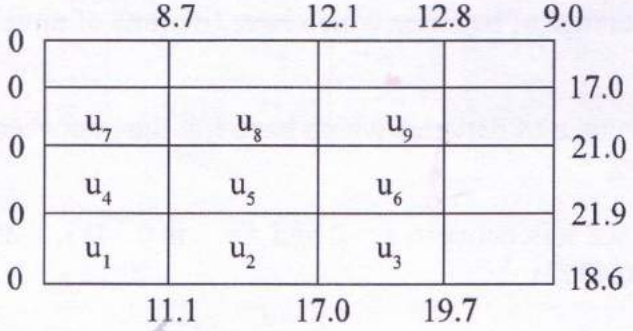
c) Find Fourier sine series for $e^{ax}$ in $0 < x < \pi$. **[8]**

**Q6)** Attempt any Two of the following.

a) A transversely vibrating string of length $l$ is stretched between two fixed points A and B, the string is initially at rest in its equilibrium position. The string is plucked such that velocity at a distance $x$ from A is $3x(l-x)$. Find the form of the string at any time $t$, given that the string satisfies the equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$. **[8]**

b) Determine the solution of one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 y}{\partial x^2}$ under boundary conditions $u(0, t) = 0$, $u(l, t) = 0$ and $u(x, 0) = x$, $(0 < x < l)$ $l$ being the length of the rod. **[8]**

c) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x^2} = 0$ for the following data. Calculate two iteration. **[8]**



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# S.E. (Chemical) (Part - II) (Semester - IV) (Revised) Examination, November - 2017

## CHEMISTRY - II

## Sub. Code : 63428

**Day and Date : Thursday, 02 - 11 - 2017** **Total Marks : 100**

**Time : 10.00 a.m. to 1.00 p.m.**

**Instructions :**
1) **Question no. 4 and 8 are compulsory.**
2) **Attempt any Two questions from remaining questions of section I and any Two questions from the remaining questions of section II.**
3) **Draw neat labelled diagrams wherever necessary.**
4) **Assume suitable data wherever required.**

## SECTION - I

**Q1)** a) Explain plant and process for manufacture of sulphuric acid by contact process. **[6]**

b) What do you mean by ligands? How do they form metal chelates? Explain with suitable examples. **[5]**

c) Describe fertility and pH value of soil mixed fertilizers. **[5]**

**Q2)** a) What is the need of fertilizers? Describe the role of macronutrients in the fertilizers? **[6]**

b) Give preparation of NaOH by electrolytic process and state it's applications. **[5]**

c) Explain Liquid ammonia as non-aqueous solvent. **[5]**

**Q3)** a) Give in detail classification of fertilizers. **[6]**

b) Describe applications of chelation with respect to EDTA. **[5]**

c) State and explain characteristics of non-aqueous solvent. **[5]**

*P.T.O.*

**Q4)** Write note on: (Any Four). **[18]**

a) Classification of chelating agent.

b) Haber's process for ammonia manufacture.

c) Complex Fertilizers

d) Differentiate between metal chelate and metal complex.

e) Pollution caused by fertilizers.

f) Preparation & applications of Ferrous Ammonium Sulphate (FAS).

## SECTION - II

**Q5)** a) What is compounding of plastics? What are the additives added in compounding of plastics. **[6]**

b) How is pyrrole synthesized? Give any two important reactions of pyrrole. **[5]**

c) What are nucleosides and nucleotides? Explain characteristics of $\alpha$ helical structure of DNA molecules. **[5]**

**Q6)** a) Give an account of Refining of petroleum with factors mentioning their applications. **[6]**

b) Explain Skraup's synthesis of quinoline. **[5]**

c) Give preparation properties and applications of polytetrafluoroethylene (Teflon). **[5]**

**Q7)** a) Explain Bulk polymerization technique. Give it's advantages and disadvantages. **[6]**

b) What are lipids? How lipids are classified? What are the functions of lipids being biomolecule? **[5]**

c) How is furan synthesized? Give any two important reactions of furan. **[5]**

**Q8)** Write note on: (Any Four). **[18]**

a) Catalytic cracking

b) Butyl Rubber

c) Analgesics

d) Applications of Biotechnology

e) Pyridine

f) Emulsion polymerization technique.

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