

SUBJECT CODE NO:- P-15
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(ALL-BRANCHES) Examination May/June 2017
Engineering Mathematics - III
(Revised)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- Q. No. 1 and Q. No.6 are compulsory
 - Solve any two questions from Q. Nos. 2, 3, 4 and 5.
 - Solve any two questions from Q. Nos. 7, 8, 9 and 10.
 - Use of non-programmable calculator is allowed.
 - Figures to the right indicate full marks.

Section A

Q.1 Solve any five from the following

10

- Solve $(D^2 - 4D - 12)y = 0$
- Solve $(D^2 + 2\pi D + \pi^2)y = 0$
- Find the P.I. of the equation $(D^2 + D - 6)y = e^{2x}$
- Find the P.I. of the equation $(D^3 + 4D)y = \sin 2x$
- Find the mean of the following data

Class	5-10	10-15	15-20	20-25	25-30	30-35	35-40
f:	6	5	15	10	5	4	3

- Find the area under the normal curve between $Z = -1.24$ to 1.24
- For a binomial distribution the mean is 12 and the variance is 4, find all the constants of the distribution.
- A 2 lb weight – suspended from a spring stretches it 1.5 inches. If the weight is pulled 3 inches below the equilibrium position and released set up a differential equation of motion.

Q.2 a) Solve $(D^2 + 2)y = e^x \cos 2x$

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b) Calculate the mean deviation from the median for the following data

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Class	50-100	100-150	150-200	200-250	250-300	300-350
f:	7	18	25	31	15	4

c) An emf of 200V is in series with a 10 ohm resistor, a 1 henry inductor and 0.02 Farad capacitor At $t=0$, the charge Q and current I are zero. Find Q and I at any time t.

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Q.3 a) Calculate the mean and standard deviation for the data

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Class	68-74	75-81	82-88	89-95	96-102	103-109
f:	5	31	40	20	3	1

b) Solve without using method of variation of parameters $(D^2 + 9)y = \sec 3x$

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c) The differential equation of a cantilever beam of length l and weighing w kgs/unit, subjected to a horizontal compressive force P applied at the free end is given by

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$$EI \frac{d^2y}{dx^2} + Py = \frac{-1}{2} Wx^2, \text{ if } y = \delta$$

$$\text{And } \frac{dy}{dx} = 0 \text{ at } x=l \text{ and}$$

$$\frac{d^2y}{dx^2} = 0 \text{ at } x=0, \text{ find the maximum deflection of the beam}$$

2017

Q.4 a) Solve by method of variation of parameters

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$$(D^2 + 1)y = \frac{1}{1 + \sin x}$$

b) The income distribution of a group of 10000 persons was found to be normal with mean Rs.7500 and the standard deviation Rs.500. What is the number of persons of this group which have income

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i) exceeding Rs.6680 ii) exceeding Rs.8320.

c) If a weight 6 lbs hangs from a spring with constant $K = 12$ and no damping force exists, find the motion of weight when an external force $3 \cos 8t$ acts, initially $x=0, \frac{dx}{dt} = 0$ Determine whether resonance occurs.

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Q.5 a) Solve $x^2 \frac{d^3y}{dx^3} + 3x \frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 \log x$

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b) Fit the curve $y = ae^{bx}$ for the data

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X:	1	2	3	4	5	6
Y:	1.6	4.5	13.8	40.2	125	300

c) The first three moments of a distribution about the value 2 are 1, 16 and -40. Find mean, variance and

05

μ_3

Also find the first three moments about $x=0$

Section B

Q.6 Solve any five

10

a) Find the first approximate value of the root (i.e. X_1) by Newton – Raphson method for $x e^x - 2 = 0$, correct to 3 decimal place.

b) find $f(8)$ for the data

x	5	6	9
f(x)	12	13	14

c) Find the values of x, y, z in the first iteration by Gauss seidel method for

$$54x + y + z = 110$$

$$2x + 15y + 6z = 72$$

$$-x + 6y + 27z = 85$$

d) Find grad ϕ at $(1, -2, -1)$, if

$$\phi = 3x^2y - y^3z^2$$

e) show that the vector

$$\vec{v} = e^x \sin y i + e^x \cos y j \text{ is irrotational}$$

f) Evaluate $\int_C \vec{F} \cdot d\vec{r}$ Where $F = x^2i + xyj$

c: $y = 0$

between points $(0,0)$ to $(a,0)$

g) find $\nabla^2 (r \log r)$

h) Write statement of Stoke's theorem.

Q.7 a) Solve by Gauss Seidel Method

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$$10x + 2y + z = 9$$

$$2x + 20y - 2z = -44$$

2017

$$-2x + 3y + 10z = 22$$

b) Find the directional derivative of

$$f = x^2 - y^2 + 2z^2$$

at the point (1,2,3) in the direction towards the point (2,1,4)

c) Show that vector field

$$\vec{F} = 2x(y^2 + z^3)\mathbf{i} + 2x^2y\mathbf{j} + 3x^2z^2\mathbf{k}$$

is conservative. Find the work done in moving a particle from

(-1,2,1) to (2,3,4)

Q.8 a) Find a root of the equation correct to three decimal places

$$\log x - \cos x = 0$$

b) Show that $f(r)\vec{r}$ is always irrotational

c) Evaluate by Green's theorem

$$\int_c \vec{F} \cdot d\vec{r}, \text{ where } \vec{F} = x^2\mathbf{i} + xy\mathbf{j}$$

And c is a triangle having

Vertices A (0,2), B(2,0) and C (4,2)

Q.9 a) Find $\frac{dy}{dx}$ at $x = 1.9$ for the data

x	1.1	1.3	1.5	1.7	1.9
y	0.21	0.69	1.25	1.89	2.61

b) Using stoke's theorem evaluate

$$\int_c [(x+y)dx + (2x-z)dy + (y+z)dz]$$

c

Where c is the boundary of the triangle with vertices (2,0,0), (0,3,0) and (0,0,6)

c) Show that $\vec{F} = (6xy + z^3)\mathbf{i} + (3x^2 - z)\mathbf{j} + (3xz^2 - y)\mathbf{k}$ is irrotational. Find scalar ϕ such that $F = \nabla\phi$.

Q.10 a) Use Runge Kutta method of order 4

to approximate y when $x=1.1$,

given that $y(1) = 1.2$ and

$$\frac{dy}{dx} = 3x + y^2, \text{ take } h=0.1$$

b) Solve by Euler's modified method

$$\frac{dy}{dx} = -xy^2, y(0) = 2$$

find y (0,2) by taking $h = 0.2$

c) Evaluate

$$\iint_S \vec{F} \cdot \hat{n} ds \text{ where}$$

$\vec{F} = 4xz\mathbf{i} - y^2\mathbf{j} + yz\mathbf{k}$ and S is the surface of the cube bounded by $x=0, x=1, y=0, y=1, z=0, z=1$

SUBJECT CODE NO:- P-47
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(CHEM) Examination May/June 2017
Fluid Mechanics
(Revised)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- i)Q.No.01 and 06 are compulsory.
 - ii)Answer any two questions from remaining of each section.
 - iii)Assume suitable data, if required and draw neat sketches whenever needed.

Section A

- Q.1 Answer the following. 10
- a)Write down MKS, CGS and SI units of shear stress.
 - b)Sketch stress versus strain diagram for Non-Newtonian fluid.
 - c)What do you mean by turbulence?
 - d)Define momentum and average velocity.
 - e)Define density and specific weight.
- Q.2 a)Derive an expression for overall momentum balance from fundamental. 08
b)State and explain the Pascal's law of pressure at a point. 07
- Q.3 a)An oil having viscosity of 1.42 poise and specific gravity 0.9 flows through a pipe 25mm diameter and 300m long at Reynolds number of 1800. Find the flow through the pipe and the power required to maintain the flow. 10
b)Derive an expression for overall mass balance from fundamental. 05
- Q.4 a)The diameter of pipe at the section one and two are 20 and 30 cm resp. find the discharge through pipe if the velocity of water flowing through pipe at the section one is 7m/s. determine also velocity at the section two. 07
b)What do you mean by u tube differential manometer? How they are used for measurement of pressure? 08
- Q.5 Explain the terms 05
- i)Newtonian and non-Newtonian fluid 05
 - ii)Kinetic energy correction factor 05
 - iii)Viscosity of gases and liquid. 05

Section - B

- Q.6 Answer the following. 10
- a) Write the principle of orifice meter.
 - b) What is the head loss of the fluid at the entrance of a straight pipe?
 - c) Explain 'Cavitation' in pumps.
 - d) Define 'Minimum fluidization velocity'.
 - e) Name any three rotary type positive displacement pumps.
- Q.7 a)Derive an equation for one dimensional motion of particle through fluid. 10
b)Write note on hindered settling. 05
- Q.8 a)Derive an expression for minimum fluidization velocity. Also give its physical significance. 08
b)Give an expression for loss of head due to sudden enlargement of the pipe. 07
- Q.9 a)Show that $V_{avg}/u_{max}=0.5$, for laminar flow of Newtonian fluids. 07
b)What is orifice meter? Derive an expression for discharge through a orifice meter. 08

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Q.10 Write short note on
a)Piston pump
b)Gear pump
c)Diaphragm pump

05
05
05

SUBJECT CODE NO:- P-78
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(CHEM) Examination May/June 2017
Engineering Chemistry
(Revised)

[Time: Three Hours]

[Max.Marks:80]

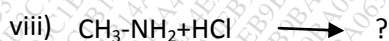
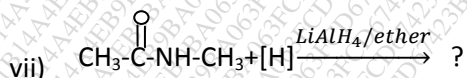
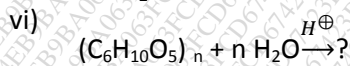
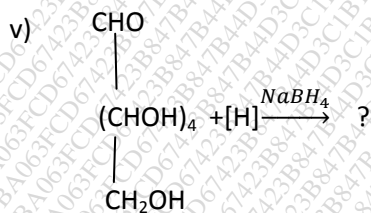
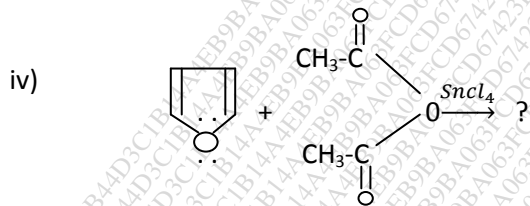
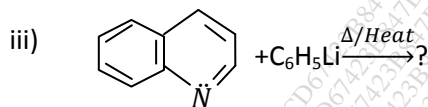
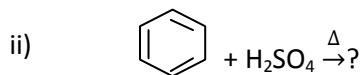
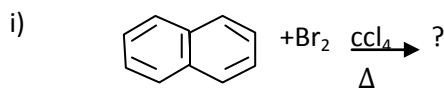
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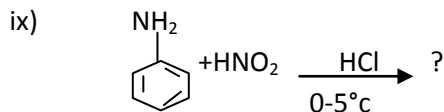
- N.B i) Q.No.1 and Q.No.6 are compulsory.
 ii) Attempt any three questions from each section

Section A

Q.1 Predict the product (Any five)

10

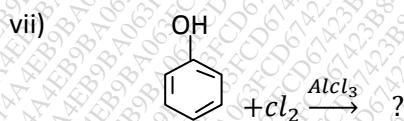
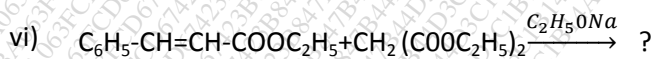
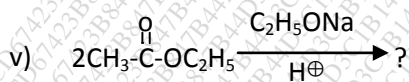
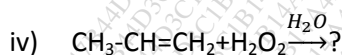
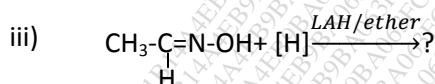
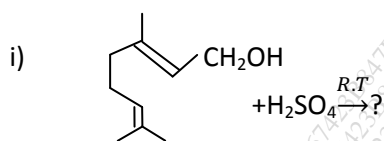


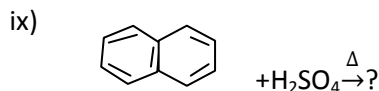
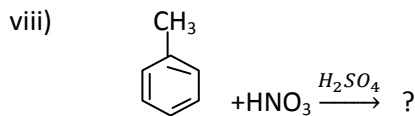


- Q.2 a. Discuss any six chemical reactions of thiophene. 06
 b. Give any two preparation methods of anthracene. 05
 c. Write any four chemical reactions of benzene. 04
- Q.3 A. How indigotin is prepared from isatin and orthonitrocinamic acid? 08
 b. Discuss any one preparation method and four chemical properties of sucrose. 07
- Q.4 a. How diazonium salts are prepared from aniline? Explain any four chemical properties of benzene diazonium chloride. 06
 b. Write any two preparation methods and three chemical properties of aniline. 05
 c. Discuss any four chemical properties of primary amines. 04
- Q.5 Write a short notes on (any three) 15
 i. Haworth synthesis for preparation of naphthalene.
 ii. Electrophilic substitution reactions of pyrrole.
 iii. Cingored.
 iv. Hinsberg method for separation of amines
 v. Structure determination of sucrose.

Section-B

- Q.6 Predict the product (any five) 10





- Q.7 a. Discuss the mechanism of sulphonation of benzene. 06
 b. Explain in brief synthesis of BHC from benzene. 05
 c. What are nitrating agents? Give the four examples? 04
- Q.8 a. How pinacol is converted into pinacolone? Explain with mechanism. 08
 b. What is the Dieckmann reaction? Explain its mechanism with suitable example? 07
- Q.9 a. How α - *pinene* is isolated from turpentine oil? Write any four chemical properties of α - *pinene*. 06
 b. Write any five chemical properties of geraniol. 05
 c. Explain general physical properties and uses of geraniol. 04
- Q.10 Write a short notes on (Any three) 15
 i. Nitration of chlorobenzene
 ii. Uses of hydrogen peroxide.
 iii. Method for isolation of terpenes
 iv. Uses of LAH
 v. Claisen condensation.

SUBJECT CODE NO:- P-111
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Chem) Examination May/June 2017
Physical Chemistry & Thermodynamics
(Revised)

[Time:ThreeHours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- i) Solve any three questions from each section
 - ii) Assume suitable data whenever necessary
 - iii) Question no 1 and Q.6 are compulsory

Section A

- | | | |
|-----|--|----|
| Q.1 | Explain the following terms.(Any Five) | 10 |
| | <ol style="list-style-type: none"> 1. Heat of adsorption 2. Ionic mobility 3. Crystalloids 4. Emulsions 5. Surface tension 6. Quantum efficiency 7. Galvanic cells 8. Viscosity 9. Colloids | |
| Q.2 | a) Explain in detail about the preparation methods of colloidal solutions(any three) | 08 |
| | b) Explain the different types of adsorption isotherms | 07 |
| | <ol style="list-style-type: none"> i) Physical adsorption ii) Chemical adsorption | |
| Q.3 | a) Explain the term surface tension by liquid drop method with the help of well labeled diagram | 08 |
| | b) Explain lamberts Law, Bear's law and Stark Einstein law in detail | 07 |
| Q.4 | a) Explain Debye Huckel theory | 08 |
| | b) Explain B.E.T. equation in detail | 07 |
| Q.5 | Write notes on the following | 15 |
| | <ol style="list-style-type: none"> a) Photosensitized reaction b) Applications of Gels and Foams c) Ionization by radiation in detail | |

Section B

- | | | |
|-----|--|----|
| Q.6 | Answer following terms. (any five) | 10 |
| | <ol style="list-style-type: none"> 1) Path functions in thermodynamics 2) Work done 3) Heat pump 4) Adiabatic process 5) Joule-Thomson coefficient 6) Limitations of first law of thermodynamics | |
| Q.7 | a) Derive a mathematics expression for first law of thermodynamics applied for flow processes | 08 |
| | b) Explain the concept of reversible and irreversible processes with example | 07 |
| Q.8 | a) Heat is transferred to 10kg of air which is initially at 100 kpa & 300 k. until its temperature reaches to | 10 |

600 k. find change in internal energy, enthalpy ,heat and workdone in following processes.

- a) Constant volume process
- b) Constant pressure process

Assume air is an ideal gas. given for air

$$C_v = 20.78 \text{ KJ/kmol.k}$$

$$C_p = 29.09 \text{ KJ/kmol.k}$$

$$R = 8.314 \text{ KJ/kmol.k}$$

Molecular weight of air=29

- b) Explain in detail Carnot cycle from thermodynamics

Q.9 a) Oil at 500 K is to be cooled at a rate of 5000 kg per hr in a heat exchanger using cold water available at 295 k. A temperature approach of 10k is to be maintained at both ends of exchanger. The specific heats of oil and water are $3.2 \frac{\text{kJ}}{\text{kg k}}$ and $4.2 \frac{\text{kJ}}{\text{kg k}}$ respectively. Determine total entropy change in the process

- b) Derive an expression for calculation of work done in adiabatic process which involving ideal gas.

Q.10 Write notes on

- a) Third law of thermodynamics
- b) Gibb's phase rule
- c) Virial equation of state

SUBJECT CODE NO:- P-145
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Chem) Examination May/June 2017
Chemical Process Calculations
(Revised)

[Time:ThreeHours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- i) Q.no.01 and 06 are compulsory
 - ii) Answer any two questions from remaining of each section
 - iii) Assume suitable data if required

Section A

- Q.1 Answer following terms 10
- a) Phase rule
 - b) Latent heat of vaporization
 - c) Dew point temperature
 - d) Excess reactants
 - e) Solubility diagram
- Q.2 08
- a) The dry bulb temperature and dew point of ambient air were found to be 302k and 291k respectively. Barometer reads 100kpa. Given vapor pressure of water at 291 k is 2.0kpa and vapor pressure of water at 302k is 4.0kpa. Calculate humid heat and humid volume.
 - b) How estimation of critical properties are made for pure substance. 07
- Q.3 08
- a) An aqueous solution of acetic acid of 35% concentration by weight has density of 1.04 kg per liter at 25c⁰ find molarity, normality and molality 08
 - b) Add a detail note on van der Waal's equation of state. Also specify how to calculate its constants 07
- Q.4 In decon process for manufacturing of chlorine a dry mixture of Hcl gas & air is passed over heated catalyst. Acid is used 30% excess of that theoretical requirement. Calculate weight of air supplied per kg of acid. Here acid promotes reaction given atomic weight of chlorine=35.5 air contains 23.2% O₂ by weight. 15
- Q.5 Write note on 15
- a) Purging and bypass in batch operation
 - b) Material balance without chemical reaction
 - c) Heal capacity and specific heat

Section B

- Q.6 Answer following terms 10
- a) Heat of combustion
 - b) Application of energy balancing
 - c) Net calorific value of fuel
 - d) Use of enthalpy concentration chart
 - e) Theoretical air requirement
- Q.7 08
- a) Calculate standard heat of formation of n-propanol liquids using following data standard heat of formation of co₂ gas is -393.51KJ/mol. Standard heat of formation of H₂o liquid is -285.83 KJ/mol and standard heat of combustion of n-propanol liquid is -2028.19 KJ/mol 08
 - b) Discuss in detail Hess's law of heat summation 07
- Q.8 Chloro benzene is nitrated using mix. Of HNO₃ and H₂SO₄. During pilot plant run charge consists of mixture of HNO₃, H₂SO₄ chloro benzene as 106.5 kg 65.5% by weight HNO₃, 108.5 kg,93.6% by weight of H₂SO₄ and 100kg of chlorobenze . After two hours of operation. The final mixture was analyzed & found that final product contained 2% unreacted chlorobenze. Also product distribution was found to be 66% p-nitrochloro benzene and 34% of o-nitro chlorobenze .find 15
- a) Analysis of charge

- b) % conversion of chlorobenze and
- c) Composition of product mixture

Q.9 a) Crude oil is analyzed to contain 87% carbon 12.5% H₂ and 0.5% S by weight calculate net calorific value of 10 crude oil at 298K. given $GCV = 45071 \frac{KJ}{Kg}$ oil latent heat of water vapour at 298K is 2442.5 KJ/kg

- b) Explain liquid-liquid extraction mass balancing

Q.10 Write note on

- a) Calorific value of fuels
- b) Enthalpy change in chemical reaction
- c) Mass balancing in distillation column

05

15

SUBJECT CODE NO:- P-220
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (All Branches) Examination May/June 2017
Engineering Mathematics -IV
(Revised)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- i) Q.No.1 from and Q.No.6 are compulsory.
 - ii) Solve any two questions from remaining of each section.
 - iii) Figures to the right indicate full marks.
 - iv) Assume suitable data, if necessary.

Section A

Q.1 Solve any five from the following:

10

- a. Find the analytic function whose imaginary part is $e^x \sin y$.
- b. Show that $u = e^{\theta} \cos(\log r)$ is harmonic.
- c. Find the image of the line $y=2x$, under the transformation $W=Z^2$
- d. Evaluate $\int_0^{1+i} (x^2 - iy) dz$ along the line $y=x$.
- e. Evaluate $\int_c \frac{e^z}{z} dz$, where c is $|z|=1$
- f. Find the poles of the function and the corresponding residues at each pole of $f(z) = \frac{ze^z}{(z+1)^3}$
- g. Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, where $u(x, 0) = 6e^{-3x}$.

OR

Find the Z-transform of $f(k) = k, k \geq 0$.

h. Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x$.

OR

Find the Z-transform of $e^{-ak}, k \geq 0$,

Q.2 a. Show that the function $f(z) = e^{-x}(\cos y + i \sin y)$ is analytic and find its derivative.

05

b. Find the bilinear transformation which maps the point $z = -1, 0, 1$ onto the points $W = 0, i, 3i$.

05

c. Find the Z-transform of $\frac{\cos 2k}{k}, k \geq 0$.

05

OR

Solve $\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$, subject to the conditions

05

$Y(0, t) = 0, Y(l, t) = 0, \frac{\partial y}{\partial t} = 0$ at $t = 0$

And $y(x, 0) = \frac{3a}{2l}x, 0 \leq x \leq \frac{2l}{3}$

$= \frac{3a}{l}(l-x), \frac{2l}{3} \leq x \leq l$.

Q.3 a. Find k such that $f(x, y) = x^3 + 3kxy^2$ may be harmonic and find its conjugate harmonic function.

05

b. Evaluate $\int_c \bar{z}^2 dz$, Where c is $|Z - 1| = 1$.

05

c. Find the inverse Z-transform of $\frac{Z}{(z-2)(z-3)}, |Z| > 3$.

05

OR

Solve $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$ for $0 < x < \pi, t > 0$

$\frac{\partial u}{\partial x} = 0$ at $x=0$, $\frac{\partial u}{\partial x} = 0$ at $x = \pi$ and $u(x, 0) = \sin x$.

Q.4 a. Expand $f(z) = \frac{1}{(z+1)(z+2)}$ for $0 < |z - 1| < 1$.

b. Evaluate $\oint_c \frac{\sin z}{(z-1)^2(z^2-9)} dz$, where c is $|z - 3| = \frac{1}{2}$. By Cauchy's integral formula.

c. Solve the difference equation by Z-transform $u_{k+2} - 2u_{k+1} + u_k = 2^k$, with $Y_0 = 2, Y_1 = 1$.

OR

Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, subject to the conditions

$u(0, y) = u(\pi, y) = 0$ for all $y \geq 0$ and $u(x, 0) = 100 u(x, \infty) = 0$.

Q.5 a. Under the transformation $W = Z + \frac{a^2}{z}$, show that the map of the circle $x^2 + y^2 = a^2$ is a straight line, but the map of the circle $x^2 + y^2 = b^2$ ($b > a$) is an ellipse.

b. Evaluate $\oint_c \frac{z^2}{\sin^3 z \cos z} dz$, where c is $|z + i| = 2$ by Cauchy's Residue theorem.

c. Evaluate $\int_{-\pi}^{\pi} \frac{1}{1 + \sin^2 \theta} d\theta$, by using Residue theorem.

Section-B

Q.6 Solve any five from the following:

a. Find Laplace transform of $te^{-2t} \delta(t - 2)$.

b. Find $L[f(t)]$ and $L[f'(t)]$ of the following function $f(t) = 3, 0 \leq t < 5$
 $= 0, t > 5$.

c. Find the Laplace transform of $f(t) = (t-2)^2, t > 2$
 $= 0, t < 2$

d. Find inverse Laplace transform of $\frac{2s+2}{s^2+2s+10}$

e. Find inverse Laplace transform of $\frac{e^{-\pi s}}{s^2+9}$

f. Find inverse Laplace transform of $s^{-\frac{7}{2}}$

g. Find the Fourier cosine transform of $f(x) = k, 0 < x < a$
 $= 0, x > a$

h. Find the Fourier transform of $f(x) = x, 0 < x < a$
 $= 0, \text{ otherwise}$

Q.7 a. Find the Laplace transform of $\int_0^t \frac{1+e^t}{t} dt$.

b. Find the inverse Laplace transform of $\tan^{-1} \frac{2}{s}$

c. Using Fourier transform, solve the equation $\frac{\partial u}{\partial t} = 2 \frac{\partial^2 u}{\partial x^2}, 0 < x < \infty, t > 0$

Subject to the conditions

$u(0, t) = 0, t > 0, u(x, 0) = e^{-x}, x > 0,$

u and $\frac{\partial u}{\partial x} \rightarrow 0$ as $x \rightarrow \infty$.

Q.8 A. Evaluate $\int_0^\infty e^{-5t} \sinh^3 t dt$

b. Find the inverse Laplace transform by convolution theorem of $\frac{1}{s(s^2+4)}$

c. Find $f(x)$ satisfying the integral equation $\int_0^\infty f(x) \sin \lambda x dx = \frac{\sin \lambda}{\lambda}$

Q.9 Express the following function in terms of Heaviside unit step function and hence find their Laplace transform

$F(x) = \sin t, 0 < t < \pi$

$= t, t > \pi$

b. Solve $y'' - 6y' + 9y = t^2 e^{3t}$, $y(0)=2$, $y'(0)=6$ by Laplace transform.

c. Find the Fourier sine transform of

$$f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$$

Q.10 a. Find the Laplace transform of $f(t) = e^t$, $0 < t < 2\pi$, $f(t) = f(t+2\pi)$.

b. Solve $\frac{dx}{dt} + y = \sin t$, $\frac{dy}{dt} + x = \cos t$, $X(0)=2$, $Y(0)=0$ by Laplace transform.

c. Find the Fourier transform of $f(x) = \frac{1}{2a}$, if $|x| \leq a$
 $= 0$, if $|x| > a$.

05
05
05
05

SUBJECT CODE NO:- P-249
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Chem) Examination May/June 2017
Process Instrumentation& Analytical Tech.
(Revised)

[Time:ThreeHours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- i) Q.No.1 and Q.No.6 are compulsory.
 - ii) solve any two from the remaining in each section A & B
 - iii) Draw neat sketches wherever required

Section A

- Q.1 Define following terms (Any five) 2*5=10
a. Precision b. Drift c. Black body d. Lamberts law e. Absolute scale f. Calibration shift.
- Q.2 a. With suitable examples differentiate between direct and indirect measurement. 08
b. Describe transducers & their classification. 07
- Q.3 Describe construction working & principle of i. Radiation pyrometer ii R.T.D 15
- Q.4 Describe following instrument 15
i. Radiation level detector
ii. Diaphragm pressure gauge
- Q.5 Write short note 3*5=15
a. Sources of static error in pressure spring thermometer.
b. Resonance effect in pressure gauge
c. Root square accuracy

Section-B

- Q.6 Explain following terms (any five)2*5=10 2*5=10
1.Theory of indication
2. thermal conductivity detector
3. Coulometer
4. half wave potential
5. Reference solvent
6. complexometric titrations
- Q.7 With neat sketches explain Karl Fischer titrimetry in detail. 15
- Q.8 a. With neat sketches explain principle working & construction of infrared spectroscopy. 10
b. Application of potentiometric titrations. 05
- Q.9 With different example describe Amperometric titration. 15
- Q.10 Write short note 3*5=15
1. Component of gas chromatography
2. molecular vibrations in infrared spectroscopy
3. Coulometric analysis

SUBJECT CODE NO:- P-280
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Chem) Examination May/June 2017
Strength of Materials
(Revised)

[Time: Three Hours]

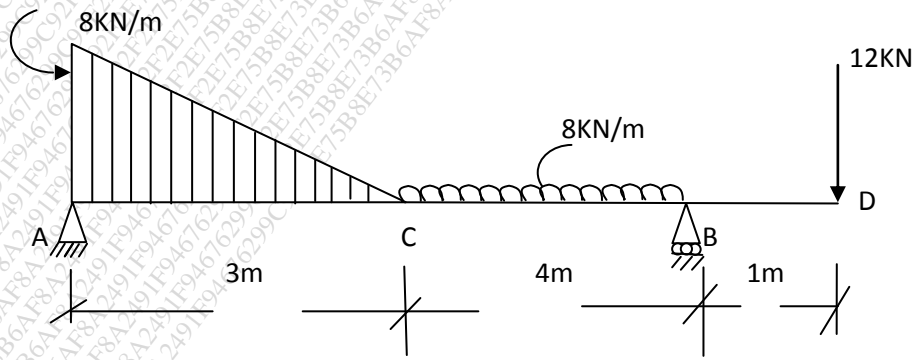
[Max.Marks:80]

“Please check whether you have got the right question paper”.

- N.B
- i) Q.No.1 & Q.No.6 are compulsory. Attempt any two from the remaining for each section
 - ii) Figures to the right indicate full marks.
 - iii) Assume suitable data if necessary.

Section A

- Q.1 Attempt any five 10
- I. Elastic limit
 - II. Section Modulus
 - III. Thermal stresses.
 - IV. Flitched section.
 - V. Modulus of resilience.
 - VI. Principal stresses.
- Q.2 A solid steel bar, 500 mm long and 70mm diameter is placed inside an aluminium tube having 75mm inside diameter & 100mm outside diameter. The aluminium cylinder is 0.15mm longer than the steel rod. An axial load of 700KN is applied to the bar & cylinder through rigid cover plates. Find the stress developed in the steel. Bar & aluminium tube take $E_s=210 \text{ KN/mm}^2$ & $E_A= 70 \text{ KN/mm}^2$ 15
- Q.3 a) Derive an expression between modulus of elasticity, modulus of rigidity and Poisson’s ratio. 04
 b) A simply supported beam of span 4.5m is loaded with concentrated load P acting at center. Determine the magnitude of load P if the max. Bending stress allowed is 160MPa and the section used is I with flanges 300mmx25mm & web 25mmx150mm. Also determine the max. Shear stress in the section. 11
- Q.4 Draw S.F. and B.M. diagram for the beam as shown in fig. Also find the max. B.M. & point of contra flexure if any. 15



- Q.5 At a point in a strained material the principal stresses are 55 MPa tensile and 8 MPa compressive. Determine :- 15
- i) The normal stress, shear stress & resultant stress on a plane inclined at 60° to the major principal plane

- ii) The max shear stress.
- iii) The normal stress on the plane of max shear stress.

Section B

- | | |
|------|---|
| Q.6 | <ul style="list-style-type: none"> a) Explain circumferential stress and longitudinal stress. 05 b) For triangular section show that the shear stress distribution @ N.A is $\tau_{N.A} = \frac{4}{3} \tau_{average}$ and $\tau_{max} = \frac{3}{2} \tau_{average}$. 05 |
| Q.7 | <ul style="list-style-type: none"> a) Derive equation of crippling load for a column having both ends fixed. 05 b) Two shafts of same material are subjected to the same torque if the first shaft is of solid circular section and the second shaft is of hollow section whose internal diameter is 2/3 of the outer diameter, compare the weights of the two shafts. 10 |
| Q.8 | An I section having flanges 150mmx20mm and web 300mmx15mm. find the maximum shearing stress developed in the beam for a S.F of 60 KN 15 |
| Q.9 | <ul style="list-style-type: none"> a) Calculate the increase in volume of spherical shell, 1 m diameter and 12mm thick, when it is subjected to an internal pressure of 1.6 N/mm². Take E = 2.10x10⁵ N/mm² and $\frac{1}{m} = 0.28$. 09 b) Derive bending stress equation 06 |
| Q.10 | <ul style="list-style-type: none"> a) What are the assumptions in the theory of pure bending 05 b) Derive equation of instantaneous stress in a bar due to impact load 05 c) Derive the relationship for change in volume of a thin cylinder subjected to internal fluid pressure. 05 |

SUBJECT CODE NO:- P-312
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chem) Examination May/June 2017
Mechanical Operations
(Revised)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- Question number 1 and 6 are compulsory.
 - Answer any two questions from remaining of each section.

Section A

- Q.1 Answer the following (any five)
- What is actual screen? 02
 - State merits of wet grinding. 02
 - Write down formula for calculating overall effectiveness of screen. 02
 - What is pitch of screw in screw conveyor? 02
 - Fill in the blank 02
Temperature of product during ultrafine grinding----- (increases / decreases)
 - What is silo? 02
 - Explain the term capacity of screen. 02
 - State uses of chain conveyor. 02
 - What are examples of secondary crusher? 02
 - Industry use/uses screening equipment like 02
 - Trommel
 - Grizzly
 - Vibrating screen
 - All of these
 choose correct option
- Q.2
- Derive the formula $n_c = \frac{1}{2\pi} \sqrt{\frac{g}{R-r}}$ for calculating critical speed of ball mill. 10
 - Calculate the power required in horse power to crush $150 \times 10^3 \text{ kg}$ of feed if 80% of feed passes through 2.5 inches screen and 80% of product passes through 1/8 inches screen. ($K_b = 4.784$) 05
- Q.3
- How a gyratory screen works? 05
 - What is cumulative screen analysis? How is it performed? 10
- Q.4
- With a neat labeled diagram, explain construction & working of a screw conveyor. 10
 - How a solid material flows through hopper? 05
- Q.5 Write short notes on
- Tube mill 05
 - Trommel 05
 - Importance of angle of repose. 05

Section B

- Q.6 Answer the following (any five)
- a) State applications of magnetic separation. 02
 - b) Write down formula for power number. 02
 - c) What is the role of frothing agent? 02
 - d) State uses of cyclone separator. 02
 - e) Name industries that can make use of plate & frame filter press. 02
 - f) Fill in the blank
Filter medium resistance is important in ----- early / every stage of filtration. 02
 - g) Unit of specific cake resistance is -----
(gm/cm^2 , cm/gm , cm/gm^2 , gm/cm)
Fill in the blank 02
 - h) Why frothing agent is used in froth flotation? 02
 - i) What is use of jiggling? 02
 - j) Design variable during agitation process are 02
 - i. Agitating equipment variable
 - ii. Fluid properties
 - iii. Impeller rotation speed
 - iv. All of these

Choose the correct alternative.
- Q.7
- a) What is working principle of a mechanical jig? 05
 - b) With the help of a neat diagram, explain construction and working of a froth flotation cell. 10
- Q.8
- a) Draw a diagram for leaf filter. 05
 - b) A rotary filter operating at 0.03 Hz filter $0.0075m^3/s$, operating under same vacuum and neglecting the resistance of filter cloth, at what speed must the filter be operated to give filtration rate of $0.016m^3/s$? 10
- Q.9
- a) How the problem of swirling / vortexing in agitation tank can be solved? 05
 - b) What is importance of mixing in industrial operations? 10
- Q.10 Write short notes on
- a) Magnetic separation 05
 - b) Constant rate filtration 05
 - c) Mixing index. 05

SUBJECT CODE NO:- P-377
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Chem.) Examination May/June 2017

Heat Transfer
(Revised)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

N.B	i) Q.No.1 from section A and Q.No.6 from section B are compulsory. ii) Attempt any two questions from the remaining questions in each section iii) Assume suitable data whenever required	
Section A		
Q.1	Explain the following 1) Fourier's law 2) Economic thickness of insulation 3) Sieder Tate equation 4) Biot number	02 03 03 02
Q.2	a) An exterior wall house may be approximated by a 4cm layer of common brick with $K=0.7\text{w/mk}$ followed by a 1.5cm layer of gypsum plaster with $K=0.4\text{w/mk}$. what thickness of loosely packed Rockwool insulation with $K=0.065\text{w/mk}$ should be added to reduce the heat loss or gain through the wall by 80% b) obtain a relation for calculation of critical radius of insulation for sphere	10 05
Q.3	a) Explain in detail transient heat flow in a semi –infinite solid b) Derive an expression for heat flow at steady state heat conduction through infinitely long cylinder	08 07
Q.4	a) With example explain the importance of dimensionless numbers in heat transfer b) Light oil in a tank is maintained at a temperature of 35°c by means of steam condensing in 3.5 cm diameter tube immersed in the tank. The steam maintains surface temperature of tubes at 95°c Assuming that all tubes are horizontal determine outside surface heat transfer coefficient Properties of oil : $\beta = 7.2 \times 10^{-4} \text{K}^{-1}$, $C_p = 2005 \text{J/kgK}$ $\mu = 8.27 \times 10^{-3} \text{N.s/m}^2$ $\rho = 885 \text{kg/m}^3$ $K = 0.133 \text{w/m.K}$	05 10
Q.5	Write notes on a) Lumped parameter analysis b) Augmentation techniques c) Natural connection	15
Section B		
Q.6	Explain the following a) Monochromatic emissivity b) LMTD c) Wein's law d) Nucleate boiling	03 03 02 02
Q.7	Derive an expression for film coefficient of heat transfer for condensing vapor over vertical plate	15
Q.8	a) Sphere of radius 5cm is concentric with the another sphere. find the radius of the outer sphere so that shape factor of outer sphere w.r.t the inner sphere is 0.6 b) Derive the Stefan's Boltzmann's constant. state the Stefan's Boltzmann's law	08 07

Q.9 Alcohol flowing in inner pipe of a double pipe exchanger is cooled with water flowing in the jacket I.D of inner pipe is 25mm and 2mm thick. The thermal conductivity of steel is 45w/mk. Film coefficient of alcohol is 1200 w/m²k and that of water is 1800 w/m²k, the inside and outside fouling factors are 5000w/m²k and 3000w/m²k respectively. calculate the overall heat transfer coefficient depending on inside as well as outside area of tube 15

Q.10 Write notes on 15

- a) Colburn analogy in convection
- b) Radiation shield
- c) NTU