Total No. of Printed Pages:2

SUBJECT CODE NO:- K-12

FACULTY OF ENGINEERING AND TECHNOLOGY

S.E. (All Branches) Examination Oct/Nov 2016

Engineering Mathematics -IV

(Revised)

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B
i. Questions numbers 1 and 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:- 10

a) Find the analytic function $f(x) = u + i\vartheta$, whose imaginary part is $\vartheta = \sin hx \cos y$.

b) Find the harmonic conjugate of $u = 4xy + x + 1$.

c) Evaluate $\int_0^{1+\pi i} e^z dz$.

d) Evaluate $\int_{0,1}^{(2,5)} (3x + y)dx + (2y - x)dy$, along $y = x^2 + 1$.

e) Find the residue of $f(x) = \frac{1}{(z^2-1)^3}$ at each pole.

f) Find the image of the circle |Z| = 1, under the transformation W =$\log z$.

g) Solve $\frac{\partial^2 u}{\partial x^2} = 0$, where $u\ (0, y) = y^2$,and $u(l, y) = 1$.

OR

Find the z- transform of $K^2, K \geq 0$.

h) Solve $\frac{\partial u}{\partial x} = 4\frac{\partial u}{\partial y}$, where $u\ (x, 0) = 4e^{-x}$.

OR

Find the z – transform of $f(K) = 4^K, K < 0$
$= 3^K, K \geq 0$

Q.2 a) If $u = a\ (1 + cos\theta)$, find ϑ so that $u + i\vartheta$ is analytic. 05

b) Evaluate $\int_c \frac{(e^z sin2z-1)}{z^2(z+2)^2} dz$ where c is $|z| = \frac{1}{2}$. 05

c) Solve$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, subject condition $u(0, y) = 0$, $u(\pi, y) = 0$, $u(x, 0) = 100$ and u(x,∞)=0 05

OR

Find the z- transform of $\sin h\frac{K\pi}{2}$. 05

Q.3 a) Show that $u = e^x cosy + x^2 - y^2$ is harmonic. Find harmonic conjugate, also find corresponding analytic function. 05

b) Evaluate $\int \frac{z+2}{z} dz$, where c is left half of the circle |Z| =2. 05

c) Solve $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$, subject to the conditions $y(0, t) = y(l, t) = 0$, $y(x, 0) = 0$ and $\left(\frac{\partial y}{\partial t}\right)_{t=0} = \lambda x(l - x)$. 05

OR

Find the inverse Z – transform of $\frac{z^2}{z^2+9}$ 05

Q.4 a) Find the image of the circle |Z-3| = 5 under the transform W=$\frac{1}{Z}$. 05

b) Evaluate $\oint_c \frac{2Z+1}{Z^2-Z-2} dz$, where C is |Z| =3, by Cauchy residue theorem. 05

c) Solve $\propto^2 \frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$, with the boundary conditions $\frac{\partial u}{\partial x}\ (0, t) = 0, \frac{\partial u}{\partial x}\ (l, t) = 0$ and $u(x, 0) = Kx$. 05

OR

Solve $Y_{K+1} - Y_{K-1} = u(k), y(0) = 0$, by Z- transform. 05

Q.5 a) Find the bilinear transformation which maps the points Z=0, $-i$, $2i$ into the points W= $5i$, ∞ , $\frac{-i}{3}$ respectively. 05

b) Expand $f(z) = \frac{z^2-1}{(z+2)(z+3)}$ in a Laurent's series for 2< |Z| < 3. 05

c) Evaluate $\int_0^{2\pi} \frac{d\theta}{13+12cos\theta}$, by residue theorem. 05

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Section B

Q.6 Solve any five:- 10

a) Find the Laplace transform of $\frac{sin4\,t}{t}$.

b) Find the Laplace transform of $\left[\frac{d}{dt}\,(t^3e^{-3t})\right]$.

c) Find the Laplace transform of $[a\,cos^2\,2bt]$.

d) Find the inverse Laplace transform of $\frac{1}{s}\left(\frac{s-a}{s+a}\right)$

e) Find the inverse Laplace transform of $\left[\frac{s}{(2s+1)^2}\right]$.

f) Find the inverse Laplace transform of $\frac{Se^{-2s}}{S^2+25}$

g) Find f(x) , if its Fourier sine transform is $e^{-a\lambda}$.

h) Find the Fourier transform of

$$f(x) = 0\,, \infty < x < a$$
$$= x\,, a \le x \le b$$
$$= 0\,, x > b$$

Q.7

a) Evaluate $\int_0^\infty \frac{e^{-t}\,sin\sqrt{3t}}{t}\,dt$. 05

b) Find the inverse Laplace transform of $\frac{1}{2s}\log\left(\frac{s^2+36}{s^2+16}\right)$ 05

c) Solve $\frac{\partial u}{\partial t} = K\,\frac{\partial^2 u}{\partial x^2}$, subject to the conditions 05

1) u= 0 , when x =0, t $\geq$ 0
2) $u = e^{-ax}$, when t =0 , x > 0 and
3) $u(x,t)$ Is bounded.

Q.8

a) Find the Laplace transform of $e^{4t}\int_0^t t\cos t\;dt$. 05

b) Find inverse Laplace transform of $\frac{s}{s^4+8s^2+16}$ by convolution theorem. 05

c) Find the Fourier sine transform of $\cos hx - \sin hx$ 05

Q.9

a) Find the Laplace transform of periodic function. $f(t) = \left(\frac{\pi+t}{2}\right)^2, 0 < t < 2\pi\ and\ f(t) = f(t+2\pi)$. 05

b) Solve $\frac{d^2y}{dt^2} - 6\frac{dy}{dt} + 9y = t^2, e^{3t}, y(0) = 2, y'(0) = 6$ by Laplace transform method. 05

c) Solve the integral equation $\int_0^\infty f(x)\sin px\,dx = 1-p\,, 0 \le p \ge 1$ 05

0, P>1

Q.10

a) Express the following function in terms of Heaviside unit step function and hence find their Laplace transform. 05

$f(t) = (t-a)^4, t > a$
$= 0, 0 < t < a$

b) Solve $\frac{dx}{dt} + y = 0\,, \frac{dy}{dt} - x = 0\,, x(0) = 1\,, y(0) = 0$ 05

c) Find the Fourier transform of $f(x)$, where 05

$f(x) = \cos x\ , if\ 0 < x < 1$
$= 0$, Otherwise.

Total No. of Printed Pages:2

SUBJECT CODE NO:- K-39
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Chem) Examination Oct/Nov 2016
Process Instrumentation& Analytical Tech.
(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 B are compulsory.
ii) Two questions from remaining questions from each section to solve.
iii) Wherever necessary draw neat sketches.

Section A

Q.1 Define following term (any five) 10
a) Recording instruments
b) Principles of measurement
c) Liquid expansion thermometer
d) Thermal well
e) Pressure head
f) Resonance effect

Q.2 Describe with help of neat sketches 08
a) Inclined leg manometer 07
b) Bourdon pressure gauge

Q.3 a) Describe construction and work in of Thermocouple 08
b) Radiation pyrometer 07

Q.4 a) With suitable examples differentiate between direct and indirect measurement. 08
b) What is transducer & write down their classification. 07

Q.5 a) Describe various float level gauges. 08
b) Describe orifice flow meter. 07

Section – B

Q.6 Define following terms 10
a) R_F. Value
b) Principles of flame photometer
c) Transmittance
d) Coulometric analysis
e) Carrier gas

Q.7 Describe, construction, working and principles of 08
a) Karl-Fischer titrametry 07
b) Gas chromatography

Q.8 a) Explain different methods of quantitative & qualitative analysis of polarography. 08
b) Write down principles, construction & working of flame photometer. 07

Q.9 a) Describe molecular vibration of Infrared spectroscopy. 08
b) Write down advantages and disadvantages of Amperometric titration. 07

Q.10 Write short note
a) Theory of indicator 08
b) General characteristics of coulometric analysis 07

Total No. of Printed Pages:2

SUBJECT CODE NO:- K-69
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Chem) Examination Oct/Nov 2016
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 from and Q.No.6 are compulsory.
ii) Solve any two questions from each section.
iii) Assume suitable data if required and state it clearly.

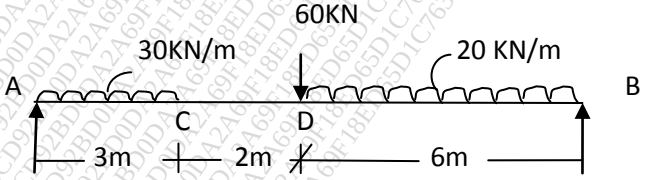
Section A

Q.1 Attempt any three from the following.

a) Derive relation between load, shear force and bending moment. 04
b) Explain pure bending. 03
c) Define stress and strain. 03
d) Define principle planes and principle stresses. 03

Q.2 A steel rod 400 mm^2 c/s area is placed coaxially inside a copper tube of 800 mm^2 c/s area. End of the rod & the tube are rigidly connected together. Find the stresses in the two materials when the temperature rises from 25^0C to 85^0C. Take 15
Es =200 GPa, Ec =90 GPa
$\alpha_s = 12 \times 10^{-6}/°C \; and \; \alpha_c = 19 \times 10^{-6}/°C$

Q.3 a) Derive an expression for volumetric strain for a rectangular bar which is subjected to three mutually perpendicular tensile stresses. 06
b) The beam is supported and loaded as shown in fig. Draw SFD and BMD indicating all important values. 09



Q.4 a) State and explain the assumptions made in pure bending theory. 03
b) A steel beam of hollow square section of 100 mm outer side and 50 mm inner side is simply supported on a span of 4m. Find the maximum concentrated load the beam can carry at the middle of span if the bending stress is not to exceed 120 N/mm^2. 12

Q.5 a) Derive shear stress equation for a beam. 05
b) The principle tensile stresses at a point across two perpendicular planes are 160 N/mm^2 and 120 N/mm^2. Find the normal, tangential & resultant stress on a plane at 45^0 with the major principal plane. 10

Section B

Q.6 Explain the following terms <u>any five</u>. 10

i) Strain energy
ii) Section modulus
iii) Core of section
iv) Crippling load
v) Short column & long column
vi) Assumptions in Euler's theory

Q.7 a) Derive the relationship for change in volume of a thin cylinder subjected to internal fluid pressure. 05

b) A 12 mm diameter mild steel bar of length 1.3m is stressed by a weight of 150N dropping freely through 15mm before commencing to stretch the bar. Find the max instantaneous stress and elongation produced in the bar. Take $E = 2.1 \times 10^5 N/mm^2$ 10

Q.8 a) Derive torsion equation. 05

b) A hollow shaft of external dia. 120 mm transmit 300KW power at 220 r. p. m. Determine the maximum internal dia. If the max stress in the shaft is not to exceed 65N/mm^2. 10

Q.9 a) A C.I column of hollow circular c/s is 5m long. With both ends firmly built in. Its safety carries an axial load of 850KN. Determine the section of the column using factor of safety 3. Assume the internal dia. Of column as 80% of the external diameter. Use Rankin's formula fy =550N/mm^2 & a=1/6500. 12

b) Write assumptions in the theory of torsion. 03

Q.10 a) Explain circumferential stress and longitudinal stress. 03

b) A cylindrical shell 90 cm long and 20 cm internal diameter having thickness of the metal as 8 mm is filled with fluid at atmospheric pressure. If the additional 20 cm^3 of fluid is pumped into the cylinder find 12

i) Pressure exerted by the fluid on the cylinder. And
ii) The hoop stress induced.

Total No. of Printed Pages:2

SUBJECT CODE NO:- K-99
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chem) Examination Oct/Nov 2016
Mechanical Operations
(Revised)

[Time:Three Hours] **[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) Answer any two questions from remaining of each section.
iii) Draw well labelled diagram it necessary.

SECTION A

Q.1 Answer the following (any five) 10

a) State Bond's law.
b) What is the ratio of actual mesh dimension in one screen to that of next smaller screen as per Tyler's standard scale?
c) What is classification?
d) What is the meaning of +5mm/-10mm in screen analysis?
e) What is blinding of a screen?
f) Define sphericity
g) Opening of 400 mesh screen (Tyler screen) is _ _ _ _ _ _ (0.38mm/0.038mm)
h) As particle size is reduced screening becomes_ _ _ _ _ _ (easy/difficult)
i) Trammel employs_ _ _ _ _ _ (punched plate/cloth)
j) Apron conveyer is used for_ _ _ _ _ _ _(heavy load and short run/heavy load and long run)

Q.2
a) What is critical speed of a ball mill? 03
b) What are advantages of wet grinding over dry grinding? 04
c) A material is crushed in a Blake jaw crusher such that the average size of particle is reduced from 50mm to 10mm with a consumption of energy at the rate of 13.0 KW/kg/s. What will be the consumption of energy needed to crush the same material of average size 75mm to an average size of 25mm : 08
i) Assuming Rittinger's law applies?
ii) Assuming kick's law applies?

Q.3
a) What is mesh number? State its significance. 04
b) Compare ideal and actual screens. 06
c) Explain the terms capacity and effectiveness of a screen. 05

Q.4
a) What are bins and silos? 06
b) Fine Barytes having bulk density 2000 kg/m^3 is to be conveyed by a 20^0 two roll ideal seat belt conveyor running at 3 m/s along an incline of 8^0. If the product has an angle of surcharge of 15^0, then determine the minimum belt width required to get mass through put of 50 kg/sec. Slope factor ks = 0.955. 06
c) Explain the term angle of repose. 03

Q.5 Write short notes on (any three) 15

a) Concept of work index
b) Pneumatic Conveying
c) Grizzly
d) Problems associated with handling of solids.

SECTION B

Q.6 Answer the following(any five) 10

a) What is paramagnetic material?
b) Pine oil used in truth flotation acts as_ _ _ _ _ _ _ (frothier/modifier)
c) Filter medium resistance is important during_ _ _ _ _ _ _ (early/final) stage
d) What are desirable properties of filter medium?
e) State the formula for power number.
f) What is reverse osmosis?
g) For beneficiation of iron ore, most commonly used method is_ _ _ _ _ _ _ (jigging and tabling, flocculation)
h) Flow number N_q is _ _ _ _ _ _ _ _ ($\frac{nD^3}{q}$, $\frac{q}{nD^3}$)
i) Jigging is based on difference in (specific gravities/wettability)
j) What are industrial uses of cyclone separator?

Q.7 a) What is forth flotation? Discuss its application. 07
b) Explain construction & working of a hydraulic jig. 08

Q.8 a) What is Principle of working of centrifugal separation? 03
b) What are filter aids? Mention few examples. 04
c) The collection efficiency of a cyclone is 45% over the size range 0-5 μm, 80% over the size range 5-10 μm, 96% for particles exceeding 10 μm. Calculate efficiency of collection for the following dust Mass distribution 50% 0-5 μm, 30% 5-10 μm and 20% above 10 μm. 08

Q.9 a) What is purpose of agitation? 05
b) Derive an expression for calculating power consumption in agitating Newtonian fluid by dimensional analysis. 10

Q.10 Write short notes on (any three) 15

a) Constant rate filtration
b) Muller mixer
c) Magnetic drum separator
d) Mixing index.

Total No. of Printed Pages:2

SUBJECT CODE NO:- K-166
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Chem) Examination Oct/Nov 2016
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 & 6 are compulsory.
ii) Solve two questions from each section A & section B from remaining.
iii) Assume additional data if required.

Section A

Q.1 Define the following. 10
a) Fourier's law.
b) Insulation.
c) Heat transfer coefficient.
d) Natural convection.
e) Reynolds number.

Q.2 Estimate the rate of evaporation of liquid oxygen from a thin spherical container 1.8m inside diameter covered with 30 cm layer of asbestos insulation. The temperatures at the inner and outer surfaces of asbestos are -183^0C and 0^0C respectively. Boiling point of oxygen is -183^0C and latent heat of vaporization is 212.5KJ/kg. The conductivity of insulation is 0.157w/mk and 0.125w/m.k at 0^0C and 183^0C respectively. 15

Q.3 A cylindrical rod of 2cm diameter and 25cm long projects from a well-insulated steam vessel (Ts=100^0C) into air at 30^0C. The free end of rod is insulated. Determine the temperature at free end of rod is made of : 15
i) Cu with K=330 w/mk
ii) Steel with K=49 w/mk
Also calculate heat transfer in each case.

Q.4 a) Derive the Dittus –Boltzer equation. 07
b) Derive the equation for laminar heat transfer on a flat plate. 08

Q.5 Write notes on. 15
a) Dimensionless number.
b) Augmentation techniques.
c) Colburn equation

Section B

Q.6 Explain the following terms. 10
a) Emissivity.
b) Wien's law.
c) Opaque body.
d) NTU.

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e) Filmwise condensation.

Q.7 Ammonia vapours at 34^0C are condensed on a square array 25×25 horizontal tubes. Outside diameter of tube is 30 mm and length of each tube is 1.6m surface temperature of the tubes is maintained at 22^0C. Calculate the rate of condensation of ammonia vapours, properties of ammonia at average temperature. 15
Density of ammonia vapour =0.68 94 kg/m^3.
Density of liquid ammonia =600 kg/m^3.
Viscosity =0.21×10^{-3} N.S/m^2. Thermal conductivity =0.51 w/mk.

Q.8 What do you mean by radiation shield? Show that due to one radiation shield, the rate of heat transfer reduces to half of initial value. 15

Q.9 What do you mean by fouling of plate heat exchanger? Explain in detail. 15

Q.10 Write notes on. 15
a) Analogy between heat transfer & momentum transfer.
b) Stefan Boltzmann law.
c) LMTD.

Total No. of Printed Pages:3

SUBJECT CODE NO:- K-185
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(ALL-BRANCHES) Examination Oct/Nov 2016
Engineering Mathematics - III
(Revised)

[Time: Three Hours] **[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 out of Q. 2, 3, 4 & 5.
iii. Solve any two out of Q. 7, 8, 9& 10.
iv. Use of Non-programmable calculator is allowed.
v. Figures to the right indicate full marks.
vi. Assume suitable data, if necessary.

Section A

Q.1 Solve any five 10

a) Find C.F. of $\frac{d^2x}{dt^2} + 3a\frac{dx}{dt} - 4a^2x = 0$
b) Solve $(D^3 - 3D^2 + 3D - 1)y = 0$
c) Find P.I of $(D+2)(D-1)^2y = e^{-2x}$
d) Find P.I of $(D^2 - 4)y = x^2$
e) If the probability of a defective mobile phone is 0.2, find the
   I. Mean
   II. The standard deviation for the distribution of mobile phones in a total of 200.
f) Suppose 3% of bolts made by machine are defective the defects occurring at random during production if bolts are packaged 50 per box find Poisson approximation to it that a given box will contain 5 defectives.
g) There is no skewness in the distribution if ----------.
h) Draw the electrical circuit that gives damped free oscillations.

Q.2 a) Solve $(D^2 + 13D + 36)y = e^{-4x} + cos2x$ 05

b) Find the Karl Pearson's coefficient of skewness for the following 05

Years under	10	20	30	40	50	60
No. of persons	15	32	51	78	97	109

c) An alternating $emfE \sin \omega t$ is applied to an inductance L and capacitance C in series. Show that ,the current in the circuit is $\frac{EW}{(n^2-w^2)L}(coswt - cosnt)$ where $\eta^2 = \frac{1}{LC}$ 05

Q.3 a) Solve by method of variation of parameters. $(D^2 + 2D + 1)y = 4e^{-x}\log x$ 05

b) Apply the method of the least squares to fit a parabola $y = a + bx + cx^2$ for the data. 05

X	-1	0	0	1
Y	2	0	1	2

c) Solve $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \sin(logx^2)$ 05

Q.4 a) An underground mine has 5 pumps installed for pumping out storm water. The probability of any one of the pumps failing during the storm is $\frac{1}{8}$. what is the probability that 05

I. At least 2 pumps will be working

II. All pumps will be working during a particular storm.

b) A body executes damped forced vibrations given by the equation $\frac{d^2x}{dt^2} + 2K\frac{dx}{dt} + b^2x = e^{-kt}\sin wt$. solve the equation for both the cases, when $w^2 \neq b^2 - k^2$ and $w^2 = b^2 - k^2$. 05

c) Solve $(2x+1)\frac{d^2y}{dx^2} - \frac{dy}{dx} + \frac{y}{2x+1} = \frac{3x+4}{2x+1}$ 05

Q.5 a) The first four moments of a distribution about the value 4 of the variable are −1.5, 17,-30 and 108. Calculate the first four moments about the mean and find β_1 and β_2. 05

b) Solve the equation $EI\ \frac{d^2y}{dx^2} + Py = \frac{-wl^2}{8}\sin\left(\frac{\pi x}{l}\right)$ for a strut of length 'l' freely hinged at each end. Prove that the deflection y at the centre is $\frac{wl^2}{8(Q-P)}$ where $Q = \frac{EI\pi^2}{l^2}$ 05

c) Solve by general method $(D^2 + 3D + 2)y = e^{e^x}$ 05

Section – B

Q.6 Solve any five 10

a) Find the first approximate value of the root $(ie.\ x_1)$ by Newton – Raphson method for $\log_e x - x + 3 = 0$.

b) Find the values of x, y, z in the first iteration by Gauss Seidel Method for

$8x + 3y + 2z = 13$

$x + 5y + z = 7$

$2x + y + 6z = 9$

c) Find f(1) for data

X	0	2	3
F(x)	-4	2	14

d) Find grad ∅ at (1,1,-1) if $\emptyset = e^{2x-y+z}$.

e) Prove that $\bar{F} = (y^2 cosx + z^3)i + (2y\ sinx - 4)j + (3xz^2 + 2)K$ is conservation field.

f) If $\bar{A}(t) = ti - t^2j + (t-1)K$

$\bar{B}(t) = 2t^2i + 6tk$

Evaluate $\int_0^2 \bar{A}.\bar{B}\ dt$.

g) If $\bar{r} = xi + yj + zk$ then find $\nabla.\bar{r}$.

h) Write formula of Runge Kutta IVth order method to solve $\frac{dy}{dx} = f(x,y), y(x_0) = y_0$

Q.7 a) Find the root of the equation $e^{-x} - x = 0$ by Newton –Raphson method (correct to three decimal places). 05

b) Find the directional derivation of $\emptyset = xy^2 + yz^3$ at the point (2,-1, 1) in the direction of the normal to the surface $xlogz - y^2 = -4$ at (-1,2,1). 05

c) If $\bar{F} = (5xy - 6x^2)i + (2y - 4x)j$, evaluate $\int_c \bar{F}.d\bar{r}$ along the curve C in $x - y$ plane, $y = x^3$ from the point (1, 1) to (2, 8). 05

Q.8 a) Solve by Gauss Seidel method 05

$28x + 4y - z = 32$

$x + 3y + 10z = 24$

$2x + 17y + 4z = 35$

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b) Verify Green's theorem for $\bar{F} = x^2 i + xyj$ and C is a triangle having vertices A (0, 2), B (2, 0) and C (4, 2). 05

c) Find $\nabla^4(e^r)$. 05

Q.9

a) Given that $\frac{dy}{dx} = 2 + \sqrt{xy}$ and y(1)=1 find approximate value of y at $x = 1.2$ using Euler's modified method (take $h = 0.2$) 05

b) Use Lagrange's interpolation to find the value of y when x=10 for the data given below. 05

X:	5	6	9	11
Y:	12	13	14	16

c) Using stoke's theorem evaluate $\int_c [(x + y) + (2x - z)dy + (y + z)dz]$ where C is the boundary of the triangle with vertices (2,0,0) (0,3,0) and (0,0,6). 05

Q.10

a) Evaluate $\int_c \bar{F}.d\bar{s}$ where 05
$\bar{F} = yi + xj + z^2 k$ over the cylindrical region bounded $by\ x^2 + y^2 = 9, z = 0$ and $z = 2$.

b) From the following table find the value of $\frac{dy}{dx}$ at $x = 2.03$. 05

X:	1.96	1.98	2.00	2.02	2.04
Y:	0.7825	0.7739	0.7651	0.7563	0.7473

c) Use fourth order Runge Kutta method to find y at $x = 0.1$ given that $\frac{dy}{dx} = 3e^x + 2y, y(0) = 0\ and\ \ h = 0.1$. 05

Total No. of Printed Pages:2

SUBJECT CODE NO:- K-314
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Chem) Examination Oct/Nov 2016
Chemical Process Calculations
(Revised)

[Time:Three Hours] **[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) Answer any two questions from remaining of each section.
iii) Assume suitable data, if required.

Section A

Q.1 Answer following terms. 10
i) Dry bulb temperature respect to humidification operation.
ii) Selectivity.
iii) Osmotic pressure.
iv) Normality.
v) Partial pressure.

Q.2 a) A gas mixture has the following composition by mole: 10
CO=22.8%, CO_2=15%, N_2=9.5%, O_2=4.5%, CH_4=28.2%. calculate
i) Average molecular weight of the mixture.
ii) Composition of gas on weight basis.
b) Add a note on bypass and recycle operations. 05

Q.3 Air at a temperature of 20°C and 750 mm Hg has a relative humidity of 80%. Calculate 15
i) The molal humidity of the air
ii) The molal humidity of this air if its temperature is reduced to 10°C and pressure increased to 2000 mm Hg condensing out some of the water, and
iii) Weight of water condensed from 1000 litres of the original wet air in cooling and compressing to the conditions of part (ii).
Vapour pressure of water at 20°C=17.5mm Hg
Vapour pressure of water at 10°C=9.2mm Hg.

Q.4 In the Deacon process for manufacturing chlorine, hydrochloric acid gas is oxidized with air. The reaction taking place is $4HCl+O_2 \rightarrow 2Cl_2+2H_2O$. If the air is used in excess of 30% of that theoretically required and if the oxidation is 80% complete, calculate the composition by volume of dry gases leaving the reaction chamber. 15

Q.5 a) In a causticization process, NaOH is produced by adding a solution containing 10% by weight of sodium carbonate in the stoichiometric proportions to an inlet slurry containing 25% by weight of calcium hydroxide. If the inlet slurry is charged at the rate of 100 kg/hr, what would be the composition of the final slurry if the reaction goes to 99% completion? What is the amount of sodium hydroxide produced? 10
b) What do you mean by unsteady state material balancing? 05

Section B

Q.6 Answer following terms 10

i) Heat of combustion
ii) Percentage excess of air
iii) Classification of fuels
iv) Relative volatility
v) Humid heat

Q.7 Chlorobenzene is nitrated using mixed acid. A charge consisted of 100 kg of chlorobenzene, 106.5kg of 65.5% nitric acid, and 93.6% sulphuric acid. After 2 hours of operation it was found that 2% of the feed chlorobenzene remained unreacted and the product distribution was 66% p-nitrochlorobenzene and 34% o-nitrochlorobenzene. Calculate 15

i) The analysis of charge
ii) Percentage conversion of chlorobenzene
iii) The composition of the products.

Q.8 An evaporator is fed with 10000 kg/hr of a solution containing 1% solute by weight. It is to be concentrated to 1.5% solute by weight. The feed is at a temperature of 37°C. The water is evaporated by heating with steam available at a pressure of 1.34 atm absolute, corresponding to a temperature of 108.3°C. the operating pressure in the vapour space is 1atm absolute. Boiling point elevation and other effects can be neglected. The condensate leaves at the condensing temperature. All the physical properties of the solution may be taken to be same as that of water. What is the quantity of steam required per hour? 15

Data:
Enthalpy of feed=38.1 kcal/kg
Enthalpy of solution inside evaporator (at 100°C)=644 kcal/kg
Enthalpy of vapour at 100°C=644 kcal/kg
Latent heat of vaporization of steam=540 kcal/kg

Q.9 A multiple contact counter-current extractor is employed to extract oil from halibut livers with the help of ethyl ether. The fresh livers are charged to the extractor at the rate of 1000kg/h and contain 25.7% oil. Pure ether enters the bottom of the extractor. The overflow from the extractor contains 70% oil. The underflow rate is 0.23 kg solution/kg of oil-free solids and is known to contain 12.8% oil. Based on these operating conditions, make the complete material balance and find the flow rate of ether to the extractor. Also compute the percentage recovery of oil. All percentage are by mass. 15

Q.10 Write note on following 15

i) Hess's law of heat summation
ii) Effect of T and P on heat of reaction
iii) Material balancing around stage extractor

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Total No. of Printed Pages:2

SUBJECT CODE NO:- K-216
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(CHEM) Examination Oct/Nov 2016
Fluid Mechanics
(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) 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 Define and explain a) surface tension b) viscosity c) the shear stress field d) momentum flux e) eddy viscosity. 10

Q.2 a) What is the Euler's equation of motion? How will you obtain Bernoulli's equation from it? 08

b) Write short note on moody chart. 07

Q.3 a) Derive barometric equation and give its application. 08

b) Derive an expression for hydrostatic equilibrium in vertical column of fluid. 07

Q.4 The water is flowing through a pipe having diameters 20cm and 10cm at section 1 and2 respectively. Rate of flow through a pipe is 35 liters/s. section 1 is 6 m above datum and section 2 is 4m above datum. If intensity pressure at section 1 is 39.24kN/cm^2, find intensity pressure at section 2. 15

Q.5 Explain the terms
a) Intensity and scale of turbulence 05
b) Eddy diffusivity of momentum 05
c) Viscosity of gases and liquid 05

Section –B

Q.6 Answer the following 10
a) Write the continuity equation for one-dimensional steady flow of incompressible fluid.
b) Write the expression for head loss due to sudden expansion.
c) Define the term "relative roughness" in flow through rough pipes.
d) What is "hydraulic smooth pipe"?
e) What is the optimum included angle of the divergent section of a venturimeter?

Q.7 a) Derive an expression for minimum fluidization velocity. Also give its physical significance. 08

b) What is venturimeter? Derive an expression for discharge through a venturimeter. 07

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Q.8 a) With neat sketch explain construction and working of centrifugal pump. 07

b) What do you understand by term major and minor energy losses in pipe? 08

Q.9 a) Write short note on fluidization and minimum fluidization velocity. 07

b) What is terminal velocity? How is it determined? 08

Q.10 Write short note on

a) Boundary layer 05
b) Boundary layer separation and wake formation 05
c) Airlift pump 05

Total No. of Printed Pages:3

SUBJECT CODE NO:- K-247
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(CHEM) Examination Oct/Nov 2016
Engineering Chemistry
(Revised)

[Time: Three Hours] **[Max. Marks:80]**

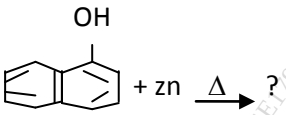
Please check whether you have got the right question paper.

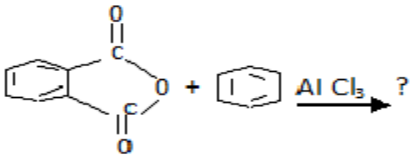
N.B i) Q.No.1 and Q.No.6 are compulsory.
ii) Solve any two questions from remaining each section.

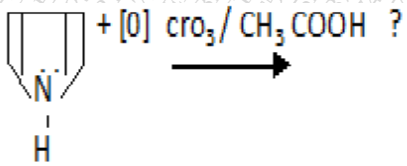
Section A

Q.1 Predict the product (any five). 10

i) $3\ CH{\equiv}CH \xrightarrow[\Delta/500^0C]{\text{Red hot tube}} ?$

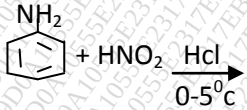
ii) 

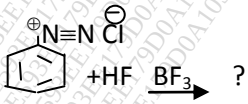
iii) 

iv) 

v) $(CHOH)_4(CHO)(CH_2OH) + NH_2\text{-}OH \longrightarrow ?$

vi) $C_{12}H_{22}O_{11} + H_2O \longrightarrow ?$

vii) 

viii) 

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ix)  + CH_3NH_2 ⟶ ?

Q.2
a) Explain any three methods for the preparation of furan. 06
b) Discuss any five chemical reactions of pyrrole. 05
c) Give physical properties and industrial uses of Benzene. 04

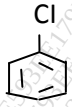
Q.3
a) How is glucose obtained from starch? Discuss the chemical properties of glucose. 06
b) How structure of sucrose is determined? Explain the steps involved in it. 05
c) How is methyl orange used as a dye? 04

Q.4
a) Give any two preparation methods and four chemical properties of secondary amines. 06
b) How is aniline obtained from nitrobenzene and chlorobenzene? Discuss the physical properties of aniline. 05
c) Write a short note on separation of amines using fractional distillation method. 04

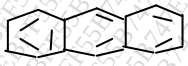
Q.5 Write a short note on. (<u>any three</u>) 15
a) Preparation methods of Benzene
b) Separation of amines using Hinsberg method
c) Indigotin
d) Synthesis and chemical properties of Naphthalene
e) Structure of glucose

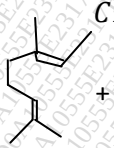
Section B

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

i)  + HNO_3 $\xrightarrow[\Delta]{H_2SO_4}$?

ii) $CH_3\text{-}O\text{-}CH_3 + H_2SO_4$ ⟶ ?

iii)  + Cl_2 $\xrightarrow{FeCl_3}$?

iv)  + [0] $\xrightarrow[EtoH.\ AcOH]{CrO_3}$?

v)  + I_2 $\xrightarrow{PCl_3}$?

vi)  + CO+HCl $\xrightarrow[AlCl_3]{CuCl_2}$?

vii) $\begin{matrix} CH_3 \\ \diagdown \\ \quad C = N\text{-}OH \\ \diagup \\ CH_3 \end{matrix}$ $\xrightarrow{H\oplus}$?

viii) $CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}OC_2H_5 + [H]$ $\xrightarrow[ether]{LiAlH_4}$?

ix) $C_2H_5COOH + H_2O_2$ $\xrightarrow{H_2SO_4}$?

Q.7	a)	How can you prepare nitroacetanilide from acetanilide? Explain with mechanism.	06
	b)	Explain the sulphonation of naphthalene with mechanism.	05
	c)	Write a short note on DDT.	04
Q.8	a)	What is pinacol-pinacolone rearrangement? Explain with mechanism.	08
	b)	Explain in brief claisen condensation with mechanism.	07
Q.9	a)	How geraniol is obtained from palmarosa oil? Explain any four chemical properties of geraniol.	06
	b)	What are terpenes? Explain in brief classification of terpenes.	05
	c)	Give general physical properties of terpenes.	04

Q.10 Write a short note on. (<u>any three</u>) 15

a) Chemical properties of ∝-pinene
b) Uses of peracids
c) Dieckmann reaction
d) Sulphonation of lauryl alcohol and dimethyl ether
e) Synthesis of MCPBA and per-acetic acid

Total No. of Printed Pages:2

SUBJECT CODE NO:- K-280
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Chem) Examination Oct/Nov 2016
Physical Chemistry & Thermodynamics
(Revised)

[Time: Three Hours] **[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 wherever necessary.
III. Figures to the right indicate full Marks.
IV. Question 1 & 6 are compulsory.

Section A

Q.1 Explain the following (any five) 10
i) Hydrophobic systems.
ii) Colloidal systems.
iii) Viscosity.
iv) Covalent bond.
v) Electrode potential.
vi) Adsorption isotherm.
vii) Refractivity.
viii) Photochemical Reactions.
ix) Surface tension.
x) Ionic Mobility.

Q.2 a) Explain BET equation in detail. 08
b) Discuss in detail the application of electrochemical series to predict the reaction as spontaneous & the determination of EMF of cells. 07

Q.3 a) Discuss in detail the determination of surface tension by any one of the method. 08
b) Explain in detail Adsorption & factors influencing adsorption. 07

Q.4 a) Discuss how molecular structure affects the following property i.e. refractivity. 08
b) What are gels & foams? Explain their applications in various fields with examples. 07

Q.5 Write notes on the following. 15
i) Photochemical reaction for decomposition of hydrogen iodide.
ii) Electrode potential and standard electrode potential.
iii) Ionization reaction by radiation.

Section-B

Q.6 Answer following terms. (any five) 10
i) Standard heat of reaction.
ii) Joule Thomson coefficient.
iii) Steady state condition.
iv) Closed & isolated systems.
v) Limitations of first law of thermodynamic.
vi) Definition of entropy.

Q.7 a) Discuss in detail thermodynamic variation of pressure vs. Motor volume for pure fluids. 08

b) What do you mean by equation of state? Explain virial equation of state. 07

Q.8 Calculate the total change in entropy for following processes. 15

1) one gm. mole of an ideal gas (C_p= 7 Cal/gmol.k) cooled at 10 atmospheres absolute pressure from 500 k to 300 k. & then expanded isothermally to 1 atmosphere absolute pressure & 300 k.
2) 100 grams of lead ($c_p = 0.03 \frac{cal}{gmol\,^\circ C}$) originally at 300℃ is mixed with 100 grams of water at 30°C.

Q.9 a) What do you mean by reversible and irreversible processes? Explain with proper example. 07

b) A reservoir at 500 k receives heat of 5×10^6 kJ at constant temperature. The heat source is at 600 k find change in entropy of system surrounding and universe. 05

c) Explain Hess's law of heat summation. 03

Q.10 Write note on, 15

a) Phase rule.
b) Second law of thermodynamics.
c) Van-der wools equation.