

**Max. Marks: 100 (Section A:50M & Section B:50M)**

**Class: F.Y.B.Tech.**

**Name of the Course: Engineering Chemistry**

**Course Code: 1UHC103**

**Duration: 2hr ea**  
**Semester: II**  
**Branch: All**  
**Date:**

Question No.	Section A	Max Marks
Q.1.	<p><b>Attempt any four of the following.</b></p> <p>i) Convert the following total hardness of water samples in °Cl and °Fr.            a) 20.1 ppm            b) 31.8 ppm</p> <p>ii) What is osmosis and reverse osmosis?            Explain purification of hard water by reverse osmosis.</p> <p>iii) What is hardness of water?            Distinguish between temporary hardness and permanent hardness (two points each).</p> <p>iv) With respect to the EDTA method for determination of hardness of water explain the following.            a) Draw EDTA structure.            b) Which Indicator is used?            c) Which buffer is used?            d) Write reaction between metal (M) and EBT            e) Write reaction between M-EBT complex and EDTA.</p> <p>v) Classify the following impurities into temporary, permanent and non-hardness causing impurities.  <math>\text{Ca}(\text{HCO}_3)_2</math>, <math>\text{MgSO}_4</math>, <math>\text{Mg}(\text{HCO}_3)_2</math>, <math>\text{KCl}</math>, <math>\text{CaCl}_2</math>, <math>\text{SiO}_2</math></p>	20
Q.2.	<p><b>Attempt Any Four.</b></p> <p>i) List the names of any five characteristic properties of fuels.</p> <p>ii) Write Dulong's formulae for GCV and HCV.            Calculate GCV of coal sample having following composition.  <math>\text{C}=80\%</math>, <math>\text{H}=6\%</math>, <math>\text{O}=8\%</math>, <math>\text{S}=1\%</math>, <math>\text{N}=2\%</math>, Ash = rest.</p> <p>iii) Explain the determination of Volatile matter content w.r.t following points.            a) Temperature used            b) Time required            c) Crucible used            d) Process            e) Formula</p>	20

	iv) Define the following terms. a) Knocking b) Octane number Explain mining of petroleum with suitable diagram.	2 3
	v) Name the two methods available cracking? Give the further classification of each of the available cracking method.	2 3
Q. 3	<b>Attempt the following.</b> i) The EDTA structure has _____ donar atoms. a) two b) four c) six d) eight	10 1
	ii) Which of the following does not come under proximate analysis? a) %moisture b) %Ash c) %S d) %Volatile matter	1
	iii) The hardness of water is expressed in terms of _____ equivalent. a) $\text{CaCO}_3$ b) $\text{MgCl}_2$ c) $\text{CaCl}_2$ d) KCl	1
	iv) The unit of calorific value is _____. a) Kcal/Kg b) ppm c) gram d) unit less value	1
	v) In determination of % moisture the coal sample is heated at _____. a) $250^\circ\text{C}$ b) $110^\circ\text{C}$ c) $60^\circ\text{C}$ d) no heating required.	1
	vi) In estimation of nitrogen the apparatus used is called as _____. a) Kjeldahls flask b) Volumetric flask c) Viscometer d) pH meter	1
	vii) The colour of M-EBT complex is _____. a) Blue b) Green c) Wine red d) Yellow	1
	viii) Which of the following is not a method for purification of drinking water? a) Boiling b) Chlorination c) Reverse osmosis d) EDTA method	1
	ix) Power alcohol used in petrol engine is _____. a) Ethanol b) Ether c) Gasoline d) Benzene	1
	x) In fractional distillation of crude oil, the sulphur content is removed by passing it through _____. a) hot $\text{AgCl}$ coils b) hot $\text{CuO}$ coils c) highly charged electrodes d) hot water	1

ESE

**Max. Marks: 100 (Section A:50M & Section B:50M)**

**Class: F.Y.B.Tech.**

**Name of the Course: Engineering Chemistry**

**Course Code: 1UHC103**

**Duration: 2hr e  
Semester: II  
Branch: All  
Date:**

<b>Question No.</b>	<b>Section B</b>		<b>Ma</b>
			<b>Ma</b>
<b>Q.4.</b>	<p><b>Attempt any Four.</b></p> <p>i) Distinguish between addition and condensation polymerization.(5 points each)</p> <p>ii) With respect to synthesis of PMMA, explain the following.</p> <ul style="list-style-type: none"> <li>a) the name of monomers used</li> <li>b) the name of type of polymerization</li> <li>c) two properties</li> <li>d) one use</li> </ul> <p>iii) In a polymer there are 100 molecules of molecular weight 100, 200 molecules of molecular weight 1000. Find <math>M_n</math>, <math>M_w</math> and PDI.  <math>(\text{Formula: } M_n = \frac{\sum N_i M_i}{\sum N_i})</math></p> <p>iv) What is compounding of plastics?    Write the names of various ingredients used in plastics.</p>		5
	<p>v) What are nanomaterials?    Give any two properties of Nanomaterials?</p> <p>vi) With respect to the Aldol condensation, write the following points.</p> <ul style="list-style-type: none"> <li>a) Name of two substance used.</li> <li>b) Name of two catalysts used.</li> <li>c) Name of product formed.</li> </ul>	1 4 1 2 2	1 4 1 2 2
<b>Q.5.</b>	<p><b>Attempt any four.</b></p> <p>i) A solution of concentration <math>5 \times 10^{-5}</math> mol /dm<sup>3</sup> when placed in a cuvette of path length of 1cm, shows absorbance of 0.65. Calculate molar absorptivity(<math>\epsilon</math>) of the solution. (formula <math>A = \epsilon \times C \times l</math>)</p> <p>ii) Define pH.    Explain the two point standardization method for determination of pH.    Give two application of pH meter.</p> <p>iii) Explain the instrumentation of single beam spectrophotometer w.r.t. following points</p> <ul style="list-style-type: none"> <li>a) Light source</li> <li>b) Sample holder</li> <li>c) Monochromator</li> <li>d) Sample formation</li> <li>e) Detector</li> </ul>	5	1 2 2
			1 1 1 1 1

	iv) With respect to calomel electrode explain the following. a) Electrode metal used. b) Electrolyte used c) Applications (two) d) Cell representation	1 1 2 1
	v) With respect to the enzyme carboxy anhydrase, explain the following. a) Metal used b) Draw Structure (List four coordinate substances attached) c) Function d) Geometry of structure.	1 2 1 1
	vi) Give one biological function of the following metal ions. a) $\text{Ca}^{2+}$ b) $\text{Mg}^{2+}$ c) $\text{Na}^+$ d) $\text{Zn}^{2+}$ e) $\text{Co}^{2+}$	1 1 1 1 1
Q.6.	<b>Attempt the following</b>	10
	i) The methylmethacrylate is a monomer used in preparation of polymer. a) PMMA b) Teflon c) Rubber d) Polyethene	1
	ii) The polymer used in bulletproof jacket is _____. a) Kevlar b) PMMA c) Phenol formaldehyde d) Teflon	1
	iii) Transfer moulding is used for _____ resins. a) Thermoplastic b) Thermosetting c) both thermoplastic and thermosetting d) Thermotropic	1
	iv) Formation of polypropene from propene is _____ polymerization. a) Addition b) Condensation c) Copolymerization d) not a	1
	v) pH is defined as a) $-\log_{10} \text{H}^+$ b) $-\log_e \text{H}^+$ c) $\log_{10} \text{H}^+$ d) $\log_e \text{H}^+$	1
	vi) The Law used in UV-Visible spectrophotometry is _____. a) Boyle's Law b) Charles law c) Beer Lambert's Law d) Hook's law	1
	vii) Wurtz reaction is used for the synthesis of _____. a) Alkanes b) Alkenes c) Alkynes d) Amides	1
	viii) Polydispersivity Index (PDI) = _____. a) $\text{Mn}/\text{Mw}$ b) $\text{Mz}/\text{Mw}$ c) $\text{Mw}/\text{Mn}$ d) $\text{Mn}/\text{Mz}$	1
	ix) The ketone functional group shows _____ peak in IR spectroscopy. a) C-N b) C=O c) C-H d) C=C	1
	x) Enzyme LADH contains _____ metal ion. a) $\text{Zn}^{2+}$ b) $\text{Cu}^{2+}$ c) $\text{Mg}^{2+}$ d) $\text{Fe}^{2+}$	1

**K. J. Somaiya College of Engineering, Mumbai-77**  
 (Autonomous College Affiliated to University of Mumbai)  
**End Semester Exam**  
**May - June 2019**

Set B

**Max. Marks: 100**

Class: F. Y. B. Tech

Name of the Course: Engineering Drawing

Course Code: 2UHC105

**Duration: 3 Hrs.**

Semester: II

Branch: All

**Instructions:**

- All Questions are Compulsory.
- Figures to the right indicate full marks.
- Illustrate your answers using figures, sketches, diagrams etc.
- Assume suitable dimensions if necessary and state it clearly.
- Avoid using colours and layers in your drawings to avoid problems during printing.
- Line type, line thickness, text size, text font, content of title block, proper dimensions etc. at appropriate place carries weightage during assessment.
- Arrange your drawings properly and on minimum number of pages.
- All the students are requested to save the drawings regularly. In case of any hardware or software problems, no any extra time will be allotted to you for unsaved work.
- Any kind of electronic gadgets capable of memory storage such as pen drive, mobile etc. are not permitted.

Q. No.		Max Marks
1.	<p>a) The end A of a straight line AB is in the second quadrant and is 40 mm and 15 mm from both HP and VP respectively. The end B is in the third quadrant. The line is inclined at <math>40^\circ</math> to both the HP and VP. Draw the projections when end B is in the third quadrant and 45 mm from HP. Find its true length and distance of end B from VP.</p> <p>b) A front view of line AB measures 50 mm and makes an angle <math>45^\circ</math> with XY line. The point A 10 mm above the HP and 20 mm in front of the VP. Draw the projections of line AB if it is inclined with the VP at <math>45^\circ</math>. <u>The line lies in first quadrant.</u></p>	12
	<b>OR</b>	08
	<p>A square lamina ABCD of side 50 mm is resting on the corner A in the HP such that plane is seen as a rhombus in the top view with diagonal contained by corner A measuring 25 mm. Draw the projection and determine the surface inclination of the plane with HP.</p>	08

2. Figure shows pictorial view of an Object. (Use First angle Projection method)

Draw :

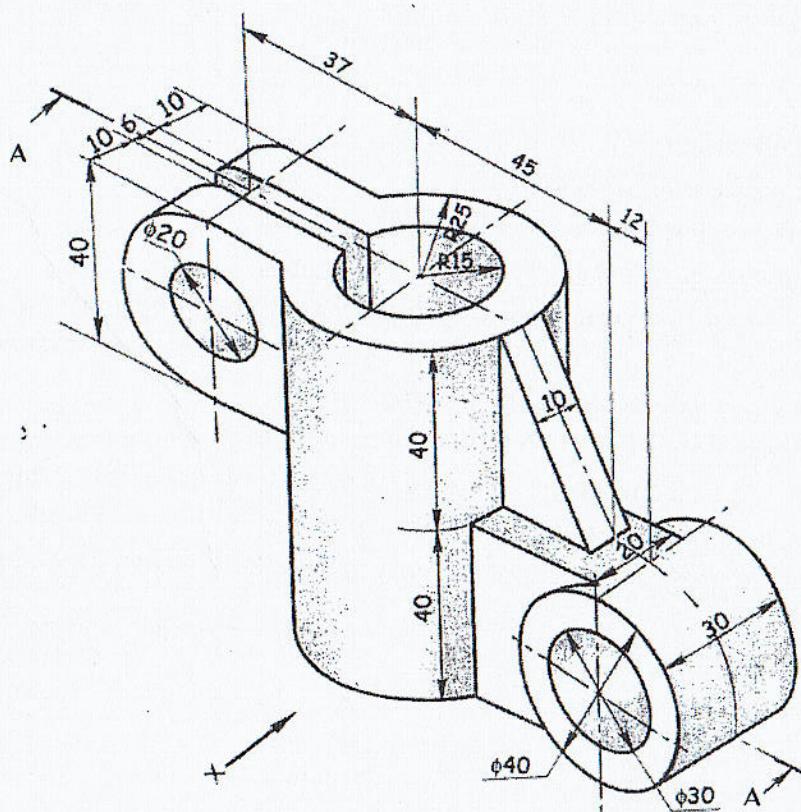
- i) **Sectional Front View along A-A**
- ii) **Top View**
- iii) **Right Hand Side View.**

08

06

06

Note- Show approx. 10 to 12 important dimension in 3 views.



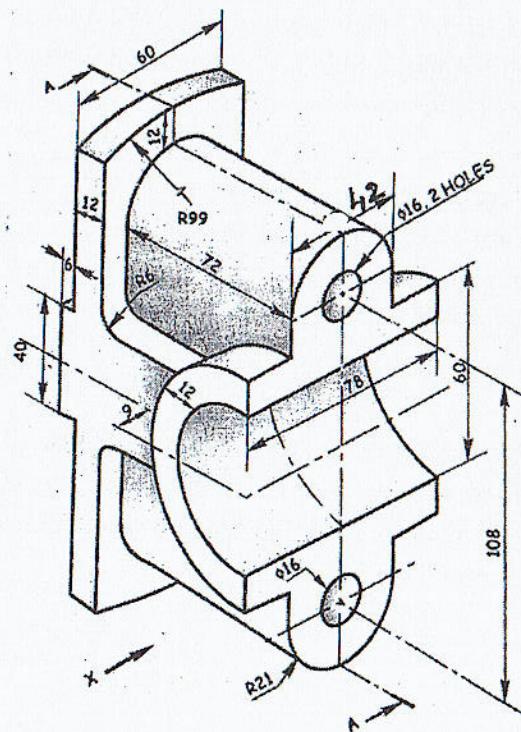
3 (a) Figure shows pictorial view of an Object. (Use First angle Projection method)

10

Draw :

- i) **Front view looking from direction -X**
- ii) **Right Hand Side View;**

Note- Show approx. 6 to 8 important dimension in 2 views.



<p>3 (b)</p>	<p>Figure shows Front View and Top View of an object. Draw the isometric view using natural scale.</p>	<p>10</p>
<p>Q4</p> <p>A hexagonal pyramid, side of a base 30 mm length of axis 60 mm is tilted towards the observer on one of its edges in such a way that the triangular face containing the edge on which pyramid rests, appears in front view as an isosceles triangle of 30 mm base and 45 mm altitude. Draw its projections and find the inclination of the base of the pyramid with the HP.</p>	<p style="text-align: right;">20</p>	<p>20</p>
<p style="text-align: center;"><u>OR</u></p> <p>A square pyramid, side of a base 40 mm length of axis 60 mm has one of its side of base in the HP. The axis of solid is inclined at an angle <math>30^\circ</math> to the HP and <math>45^\circ</math> to the VP. Draw its projections.</p>	<p style="text-align: right;">20</p>	<p>20</p>
<p>Q5</p> <p>A cone of base diameter 70 mm, axis height 90 mm is resting in the HP. It is cut by an section plane which is perpendicular to VP and parallel to and 15 mm away from one of its end generators. Draw <b>Front View</b>, <b>Sectional Top View</b> and <b>True Shape of the section</b>. Also draw <b>development of the lateral surface</b> of the cone removing the apex.</p>	<p style="text-align: right;">20</p>	<p>20</p>
<p style="text-align: center;"><u>OR</u></p> <p>A square pyramid of 30 mm edges of base and 50 mm height is resting on HP and two of its side of base perpendicular to the VP. It is cut by an auxiliary inclined plane which inclined at <math>60^\circ</math> to the HP and perpendicular to VP and passes through the point 15 mm above the base of a pyramid. Draw - <b>Front View</b>, <b>Sectional Top View</b> and <b>True Shape of the section</b>. Also draw <b>development of the lateral surface</b> of solid.</p>	<p style="text-align: right;">20</p>	<p>20</p>

**End Semester Exam**  
 May-June 2019

**Max. Marks:100**

Class: I

Name of the Course: Elements of Electrical and Electronics Engineering

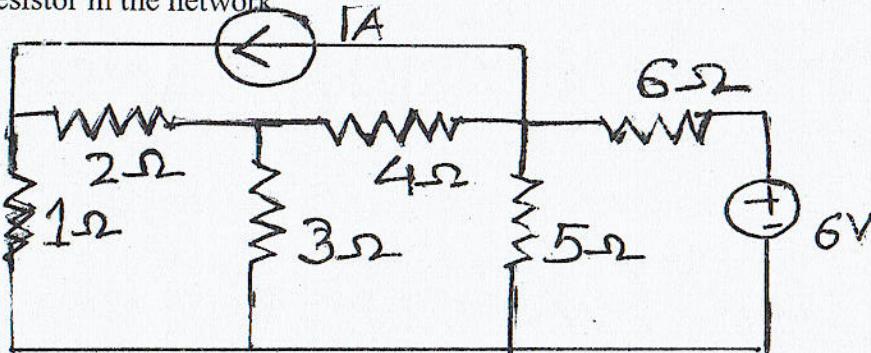
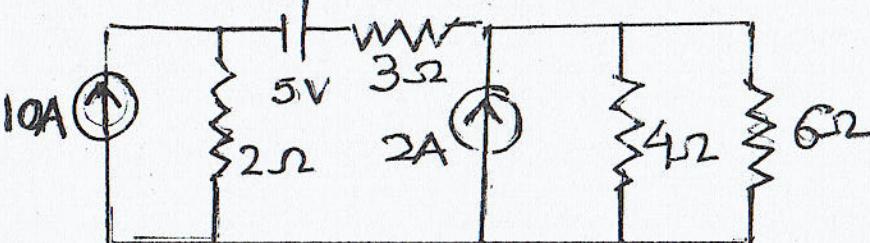
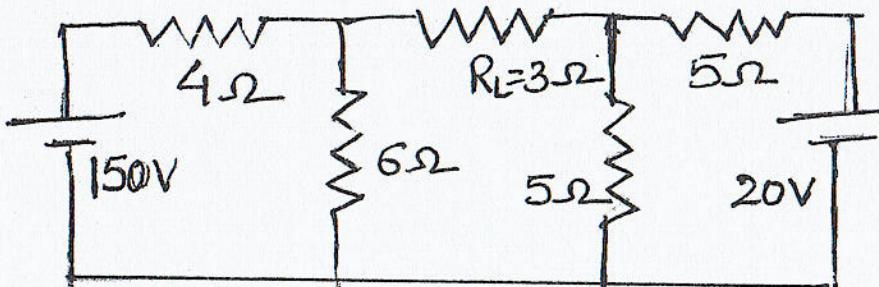
Branch: ETRX/EXTC/MECH

Course Code: 2UHC107

**Duration: 3 Hours**  
 Semester: II

**Instructions:**

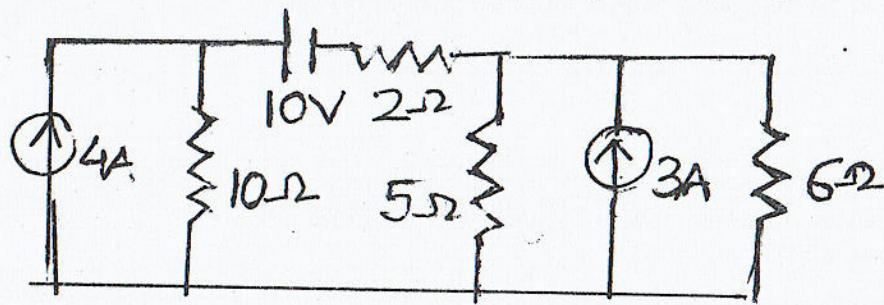
- (1) All Questions are Compulsory
- (2) Draw neat diagrams
- (3) Assume suitable data if necessary

Question No.		Max. Marks
Q 1 (a) ✓	<p>Use node voltage analysis and determine the power consumed by <math>2\Omega</math> and <math>4\Omega</math> resistor in the network</p>  <p>OR</p> <p>Using source conversion reduce the circuit shown in the figure into a single current source in parallel with single resistance.</p> 	10 M
Q 1 (b) ✓	<p>Determine the current through resistance <math>R_L=3\Omega</math> in the circuit by using Thevenin Theorem and hence draw the Thevenin Equivalent.</p> 	10 M

Q2 (a)

Find the current through  $6\Omega$  resistor using Superposition principle.

10 M

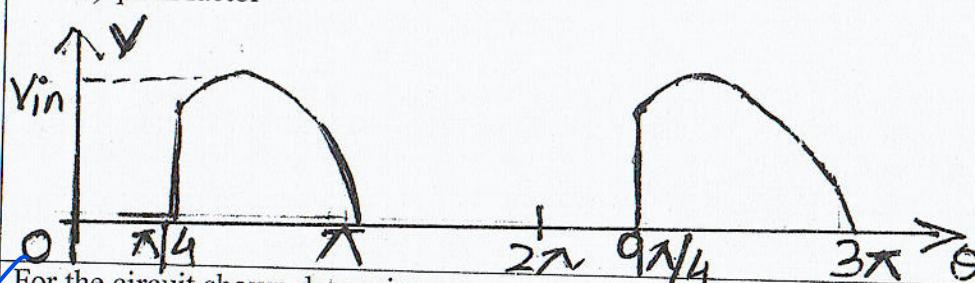


Q2 (b)

Find the following for the waveform given below:

- rms value
- average value
- form factor
- peak factor

10 M

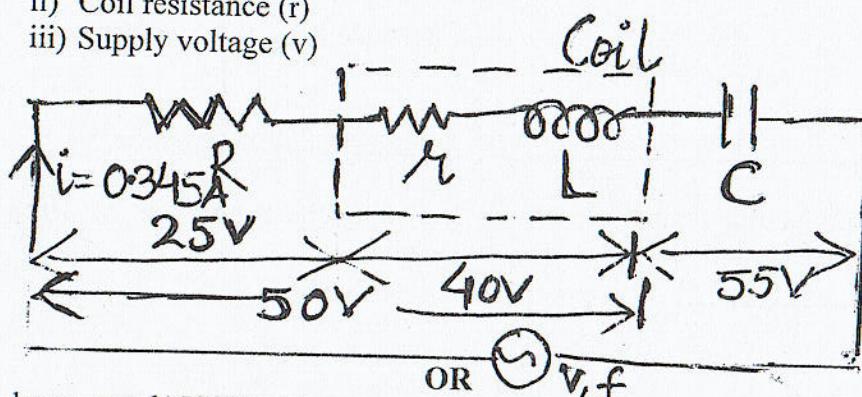


Q3 (a)

For the circuit shown determine

- Supply frequency( $f$ )
- Coil resistance ( $r$ )
- Supply voltage ( $v$ )

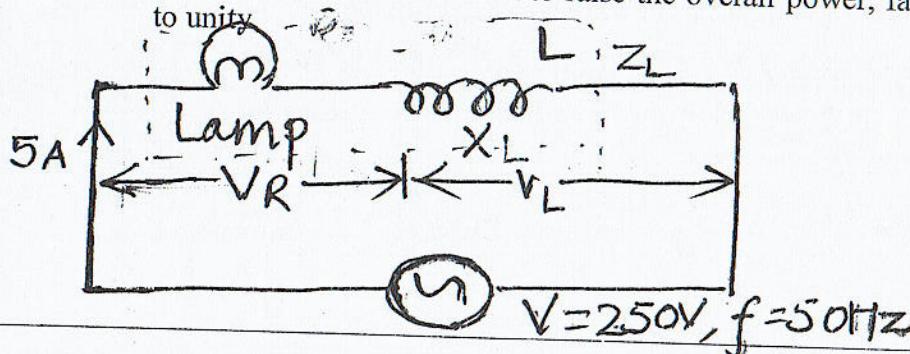
10 M

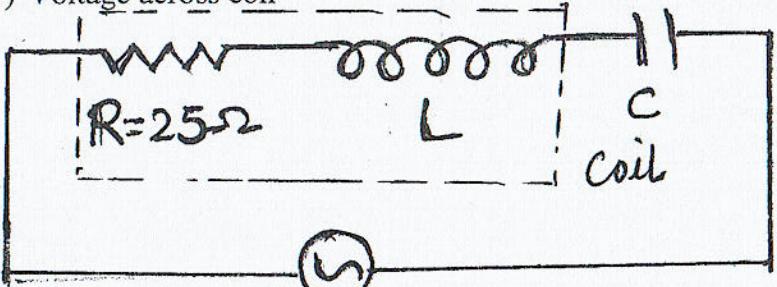
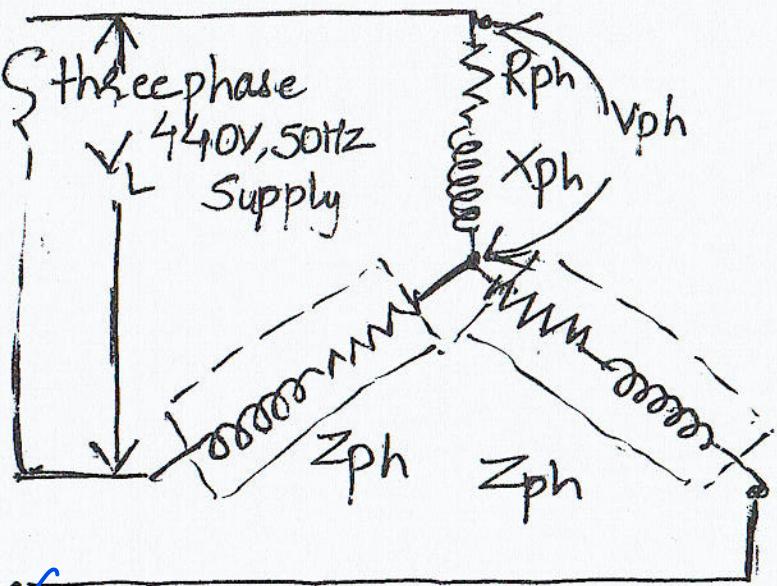


A lamp rated 500W takes a current of 5A when in series with an inductance find

- The value of inductance connected in series to operate the combination from 250V, 50 Hz
- The value of capacitance, which should be connected in parallel with the above combination to raise the overall power factor to unity

10 M



Q3 (b)	<p>An inductor is having a resistance of <math>25\Omega</math> and Quality factor Q of 10 at a resonant frequency of 10 KHz is fed from 100V supply. Calculate</p> <ol style="list-style-type: none"> <li>Inductance of the coil</li> <li>Value of series capacitance required to produce resonance with the coil</li> <li>Voltage across capacitance</li> <li>Voltage across coil</li> </ol>  <p><math>\bar{V} = 100 \angle 0^\circ</math>, <math>f_r = 10 \text{ KHz}</math></p>	10 M
Q4 (a)	<p>The load connected to a 3phase supply contains three similar impedances, which are connected in star(Y). The line current is 50A. The KVA and KW inputs are 50 and 27 respectively. Find the line and phase voltage, KVAR input and the resistance and reactance of each impedance.</p> <p style="text-align: center;"><b>OR</b></p> <p>Three similar coils connected in star, take a total power of 1.5KW in a pf of 0.2 lagging from a three phase 440V, 50 Hz supply. Calculate the resistance and inductance of each coil.</p> 	10 M
Q4 (b)	<p>Draw and Explain the phasor diagram of single-phase transformer on load (Inductive Load) considering winding resistance and magnetic leakage.</p>	10 M

**End Semester Exam**  
 May – June 2019

**Max. Marks: 100**

Class: F. Y. B. Tech.

Name of the Course: Applied Mathematics-II

Course Code: 2UHC111

**Duration: 3 Hrs.**

Semester: II

Branch: ALL

<b>Question No.</b>		<b>Max. Marks</b>
<b>Q.1</b>	A <b>Attempt the following:</b>	
	(a) Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$	03
	(b) Show that $\int_0^{\infty} x^{m-1} \cos ax dx = \frac{\Gamma(m)}{a^m} \cos\left(\frac{m\pi}{2}\right)$	03
	B <b>Attempt any ONE of the following:</b>	
	(a) Prove that $\int_0^3 \frac{x^{3/2}}{\sqrt{3-x}} dx + \int_0^1 \frac{dx}{\sqrt{1-x^{1/4}}} = \frac{432\pi}{35}$	07
	(b) Show that $\int_0^{\pi} \frac{\log(1+acosx)}{\cos x} dx = \pi \sin^{-1} a, 0 \leq a \leq 1$ . Hence evaluate $\int_0^{\pi} \frac{\log(1+\cos x)}{\cos x} dx$ .	
<b>Q.2</b>	<b>Attempt any ONE of the following :</b>	
	(a) Find the length of the loop formed by the curve $9y^2 = (x+7)(x+4)^2$ .	07
	(b) Find the total length of the curve $\frac{x^{2/3}}{a^{2/3}} + \frac{y^{2/3}}{b^{2/3}} = 1$ . Also find the total length if $a = b$ .	
<b>Q.3</b>	A <b>Attempt the following:</b>	
	Evaluate $\int_0^{\infty} \int_y^{\sqrt{y}} \frac{x}{(1-y)\sqrt{y-x^2}} dx dy$	05
	B <b>Attempt any FOUR of the following:</b>	
	(a) Evaluate $\int_0^1 \int_x^{2-x} \frac{x}{y} dx dy$ by changing the order of integration.	
	(b) Evaluate $\int_0^{4a} \int_{y^2/4a}^y \left(\frac{x^2-y^2}{x^2+y^2}\right) dx dy$ by changing to polar coordinates.	
	(c) Find the area inside the circle $r = a \sin \theta$ and outside the cardioid $r = a(1 - \cos \theta)$ .	28
	(d) Find the mass of lamina if the density at any point $r = a(1 + \cos \theta)$ varies with the square of its distance from its axis of symmetry.	
	(e) Evaluate $\iiint xyz(x^2 + y^2 + z^2) dx dy dz$ over the first octant of the sphere $x^2 + y^2 + z^2 = a^2$ .	

	(f) Find the volume bounded by paraboloid $x^2 + y^2 = az$ and the cylinder $x^2 + y^2 = a^2$ .	
Q.4	A Attempt the following:	05
	Solve $xdx + ydy = \frac{a(xdy - ydx)}{x^2 + y^2}$	
	B Attempt any FOUR of the following:	28
	(a) Solve $(x^2 + y^2)dx - (x^2 + xy)dy = 0$	
	(b) Solve $\frac{dy}{dx} + \frac{y}{x} \log y = \frac{y}{x^2} (\log y)^2$	
	(c) Solve $\frac{d^2y}{dx^2} + 2y = x^2 e^{3x} - \cos 2x$ .	
	(d) Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{e^x}$ using method of variation of parameters.	
	(e) Solve $(x+2)^2 \frac{d^2y}{dx^2} - (x+2) \frac{dy}{dx} + y = 3x + 4$	
Q:5	Attempt any TWO of the following:	14
	(a) If $y = \tan^{-1} x$ then prove that $y_n = \frac{(-1)^n(n-1)!}{(x^2+1)^{n/2}} \sin\left(n \tan^{-1}\left(\frac{1}{x}\right)\right)$ .	
	(b) If $y = a \cos(\log x) + b \sin(\log x)$ , then show that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2 + 1)y_n = 0$	
	(c) Prove that $(1+x)^{(1+x)} = 1 + x + x^2 + \frac{x^3}{3} + \dots$ Hence find the value of $(1.01)^{(1.01)}$	

**K. J. Somaiya College of Engineering, Mumbai-77**  
 (Autonomous College Affiliated to University of Mumbai)

**Max. Marks: 100****ESE- May 2019****Duration: 3 Hrs**

Class: F.Y.BTech

Semester: II

Name of the Course: Applied Mathematics-II

Branch: ALL

Course Code: USHC201 (KJSCE2014)

**Instructions:**

- (1) All Questions are Compulsory
- (2) Figures to right indicate full marks. Each sub-question has equal marks.

Question No.		Max. Marks
<b>Q.1</b>	<b>A</b> Evaluate $\int_0^{\infty} \sqrt{x} \cdot e^{-x^2} dx$  <b>B</b> Solve any THREE of the following:  (i) Evaluate $\int_0^{2\pi} \sin^2 \theta (1 + \cos \theta)^4 d\theta$  (ii) Evaluate $\int_0^1 \frac{x^2}{\sqrt{1-x^4}} dx \cdot \int_0^1 \frac{dx}{\sqrt{1-x^4}}$  (iii) Evaluate $\int_5^6 (x-5)^5 (6-x)^6 dx$  (iv) Prove that $\int_0^1 \frac{\cos 2x}{x} (e^{-ax} - e^{-bx}) dx = \frac{1}{2} \log \left( \frac{b^2+4}{a^2+4} \right)$ , $a > 0, b > 0$ using DUIS  (v) Prove that $\int_0^1 \frac{x^\alpha - 1}{\log x} dx = \log(1 + \alpha)$ , $\alpha \geq 0$ using DUIS	04
<b>Q.2</b>	<b>A</b> Solve :- $(2xy \cos x^2 - 2xy + 1)dx + (\sin x^2 - x^2)dy = 0$  <b>B</b> Solve any FOUR of the following:  (i) Solve :- $(1 + x + xy^2)dy + (y + y^3)dx = 0$  (ii) Solve :- $\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$  (iii) Solve :- $(D^4 + 10D^2 + 9)y = 96 \sin 2x \cos x$  (iv) Solve:- $(D^2 - 4D + 4)y = x^2 + e^x + \cos 2x$  (v) Solve :- $\frac{d^2y}{dx^2} + 3 \frac{dy}{dx} + 2y = e^{ex}$ using method of variation of parameters.  (vi) Solve :- $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + y = \frac{(\sin \log x) + 1}{x}$	18
		04
		24

20/5/19(M)

K. J. Somaiya College of Engineering, Mumbai-77  
(Autonomous College Affiliated to University of Mumbai)

End Semester Examinations  
November - December 2018

Max. Marks: 75

Class: FE

Name of the Course : Applied Physics II

Course Code: USHC202

Instructions:

- (1) All Questions are Compulsory
- (2) Draw neat diagrams
- (3) Assume suitable data if necessary

Duration: 2 hr 30 min

Semester: II

Branch: All

KJSCE-2014

Question No.	Marks
Q 1 (a) What is the nature of interference pattern in case of wedge shaped film experiment? Obtain the relation for fringe-width. How to check optical flatness of the surface using wedge shape film?	7
OR	
Obtain relation for diameter of $n^{\text{th}}$ bright ring in Newton's ring experiment.	
Q 1 (b) A glass plate having thickness of $0.3 \times 10^{-4}$ cm is illuminated by a beam of white light normal to the plate ( $\mu$ for glass = 1.5). Calculate the wavelength within the limits of visible spectrum ( $\lambda = 4000 \text{ Å}^0$ to $7000 \text{ Å}^0$ ) which will be intensified in the reflected beam.	5
Q2 (a) Obtain condition for principal maximum in fraunhofer diffraction at N parallel slits (Diffraction Grating).	7
OR	
What is Rayleigh's criterion of just resolution? Obtain relation for resolving power of grating.	
Q2 (b) A diffraction grating used at normal incidence, gives a line $6000 \text{ Å}^0$ in a certain order, which is superimposed on the other line $4500 \text{ Å}^0$ of the next order. If the angle of diffraction is $33^0$ , how many lines/cm are there in the grating?	5
Q3 (a) Explain the terms unpolarised light & plane polarized light. State Brewster's law. Hence obtain a relation between polarizing angle & the refractive index of the Transparent medium.	7

OR

Birefringence  
Define \_\_\_\_\_ and Malus law. Explain application of polarization to photoelasticity.

Pg 1 of 2

**Q3 (b)** Calculate the specific rotation if the plane of polarization is turned through  $26.4^\circ$ , traversing 20 cm length of 20% sugar solution. 5

**Q4 (a)** What is Schrodinger's wave function? Obtain Schrodinger's Time Dependent Wave Equation. 7

OR

Explain degeneracy of energy levels and quantum mechanical Tunneling. Obtain Schrodinger's Time Independent Wave Equation.

**Q4 (b)** An electron is confined to move in a one dimensional potential well of length  $4 \text{ \AA}^0$ . Find the quantized energy values for two lowest energy states. 5

**Q5 (a)** Explain construction and working of He-Ne laser. 7

OR

Explain the term a) Spontaneous emission b) Stimulated emission c) Pumping d) Population inversion e) Metastable state f) Resonant cavity.

**Q5 (b)** Obtain relation for Numerical aperture of an optical fibre. Calculate the numerical aperture of a fibre with core index  $n_1 = 1.59$  and cladding index  $n_2 = 1.51$ . 7

OR

Explain construction and working of an optical fibre. A step index fibre is made with a core of index 1.519 and diameter  $30 \mu\text{m}$  and cladding refractive index 1.5. If it is operated at wavelength  $1.31 \mu\text{m}$ , find V number of fibre and no. of mode it will support.

**Q5 (c)** Write a short note on Holography. 5

**Q6 (a)** State and explain Poisson's and Laplace's equation. 4

OR

Explain the Maxwell's four equations for free space.

**Q6 (a)** Define electric flux, magnetic flux. 4