



HG-209

Seat No. _____

B. Sc. (Sem. VI) Examination

March/April - 2015

Organic Chemistry : CCCH-602

Time : 3 Hours]

[Total Marks : 70

સૂચના : પ્રશ્ન-૧ થી ૩ સુધી દરેકના ૨૦ ગુણ તથા પ્રશ્ન-૪ માં ૧૦ ગુણ રહેશે.

૧ (અ) ઓષ્ટેલે યોગ્યતાની જણાવો.

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(૧) આલકાઇલેશન ઓક્સિડેશન સાથેની પ્રક્રિયા દર્શાવો.
(૨) આલકાઇલેશન અને ઓક્સિડેશન સાથેની પ્રક્રિયા સમજાવો.
(૩) આલકાઇલેશન પ્રક્રિયા દર્શાવો.
(૪) આલકાઇલેશન પ્રક્રિયા દર્શાવો.

(૨) આલકાઇલેશન અને ઓક્સિડેશન સાથેની પ્રક્રિયા સમજાવો.
(૩) આલકાઇલેશન પ્રક્રિયા દર્શાવો.
(૪) આલકાઇલેશન પ્રક્રિયા દર્શાવો.

(૫) આલકાઇલેશન પ્રક્રિયા દર્શાવો.

(૬) આલકાઇલેશન પ્રક્રિયા દર્શાવો.

HBr સાથેની પ્રક્રિયા દર્શાવો.

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(3) આરોગ્યકર હવાઘટક સંયોજનો કુદરતી રીતે જોવા મળતા હોય છે, પરંતુ તેઓ NO₂ સહીત પ્રક્રિયા સિદ્ધ કરવાથી આ હાનિ આણે છે, પરંતુ તેઓ કુદરતી રીતે જોવા મળતા હોય છે - સમજાવો.

(2) લેન્થાન એટલે શું ? વિભાજન - યોગ્યતા - યોગ્યતા વિભાજન સમજાવો.

(1) ડિ-આલિફેટિક વિભાજન એટલે શું ? 2-4 ડાયનાઈટ્રોફ્લોરો-લેન્થાનની 170°C તાપમાને NH₃ સાથે 2:4 ડાયનાઈટ્રો લેન્થાન આણે છે. કારણ આપો.

૩ (અ) ઓરોલેન્થાનના સંલક્ષણો આપો : ૧૨

(3) DEM → સાયકલો પ્રોપેન કાર્બોક્સીલિક એસિડ.

(2) FAA → α-પ્રિપાઈલ વૈલેરિક એસિડ

(1) DEM → 2,5 હેક્સેન ડાયોન

૪ (બ) ઓરોલેન્થાનના સંલક્ષણો આપો :

(3) ડિટા-ડીનેલ એલેપ્ટરકા એટલે શું ? FAAનાથી 4-પ્રિપાઈલ 2-હેક્સેનોનો સંલક્ષણો આપો.

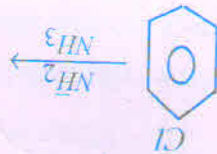
પ્રક્રિયાકરણ - સમજાવો.

(2) સંક્રમણ પ્રણાલિ સંયોજનો એટલે શું ? આ સંયોજનો કાર્બોનિક સ્વાયરમાં ખૂબ જ ઉપયોગી સંલક્ષણો આપો.

(1) સંલક્ષણો એટલે સંલક્ષણો તથા ઉપયોગો આપો.

૨ (અ) ઓરોલેન્થાનના સંલક્ષણો આપો : ૧૨

(99) બેન્ઝોઈન સૂત્ર આપો.
 (102) ઇન્ડોલ ઓનિસાઈલ સૂત્ર આપો.



- (100) પ્રક્રિયા પૂર્ણ કરો :
- (1) પ્રેક અસર એટલે શું ?
 - (2) EAAની બે વર્ણવણી લખો.
 - (3) ઓક્સિડેશન સૂત્ર આપો.
 - (4) ગ્રેન ઇન્ડોલ સંશ્લેષણ સૂત્ર આપો.
 - (5) EAAની ઉત્પાદન શ.લ. પ્રક્રિયા આપો.
 - (6) ઇન્ડોલ સંશ્લેષણ એટલે શું ?
 - (7) 1 : 3 બેન્ઝોઈનની Br₂ સાથેની પ્રક્રિયા આપો.



- (2) પ્રક્રિયા પૂર્ણ કરો :
- (1) આલ્ડેનની હાઈડ્રોજેન પ્રક્રિયા આપો.
 - (2) નીચેની પ્રક્રિયા દેખાડો જણાવો આપો : (1) ને 2 (સ)

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- (1) P-કાર્બો ટીલ્ડેનની આલ્કેલ સાથે ગરમ કરતાં મ-તેમ્પરેચર પર ક્રોમિયમ ઓક્સિડેશન - સમજાવો.

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અથવા

- (1) બેન્ઝોઈનની મલ્ટિપલ સબ્સ્ટિટ્યુશન પ્રક્રિયા આપો.

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- 2 (a) Answer any two :
 (1) Explain the synthesis and uses of Malonicester.
 14

- (b) What is Peroxide effect ? Explain with the mechanism of the reaction of 2-methyl propene with HBr.
 6

OR

- (b) Explain polymerisation of diene by free-radical process.
 6

- (3) Explain Markonikof rule. Give the mechanism of the reaction of 3-Methyl 2-Butene with HCl.
 (2) Explain stereoselective and stereospecific reaction in alkene with illustration.
 (1) What is alkylation ? Explain with the mechanism of the reaction Isobutane with Isobutane in presence of acid.

- 1 (a) Answer any two :
 14

Instruction : Questions from 1 to 3 carry 20 marks each and Q.4 carries 10 marks.

ENGLISH VERSION

- (2) What is active methylene groups? These groups are very useful in organic chemistry as analytical reagent. Explain.
- (3) What is Keto-enol tautomerism? Give the synthesis of 4-methyl 2-hexanone from FAA.
- (b) Give synthesis of : (any two)
- (1) $DEM \rightarrow 2,5$ Hexane Dione.
- (2) $FAA \rightarrow \alpha$ -Methyl Veloric acid
- (3) $DEM \rightarrow$ Cyclopropane Carboxylic acid.
- 3 (a) Answer any two :
- (1) What is bimolecular Substitution reaction? Reaction of 2:4 dinitrochlorobenzene with NH_3 at $170^\circ C$ give 2,4 dinitro aniline. Give the reason.
- (2) What is Benzynes? Explain Elimination-Addition mechanism.
- 14

- (iii) Give the reaction of 1:3 butadiene with Br_2 .
- (iv) What is Dimerization?
- (v) Give the Ketonic hydrolysis of EAA.
- (vi) Give the structural formula of Pentane 2:4 diene.



- 4 Give short answer of the following : (any ten) 10
- (i) Give the hydrogenation reaction of alkene.
- (ii) Complete the reaction :

- (b) Reaction of p-chloro toluene with alkali in hot condition gives m and p-cresol. - Explain. 6

OR

- 6 (b) Give the reaction for benzyne intermediate.

(3) Nucleophilic reaction on aromatic halide is difficult, but if $-NO_2$ group is attached, on ortho para position in aromatic halide, Nucleophilic reaction become easy - Explain it.

- (vii) Give the formula of Glycene.
- (viii) Write two properties of FAA.
- (ix) What is inductive effect ?
- (x) Complete the reaction :
- $$\text{C}_6\text{H}_5\text{Cl} \xrightarrow{\text{NH}_2} \text{C}_6\text{H}_5\text{NH}_2$$
- (xi) Give the formula of benzyne.
- (xii) Give the formula of 2-Bromo 3-Methyl Anisole.



HG-234

Seat No. _____

B. Sc. (Sem. VI) Examination

March/ April - 2015

Polymer Chemistry : Paper - SECH - 605(A)

(Elective)

Time : 2 Hours

[Total Marks : 50

9 (अ) नीचे दी गई प्रश्नों का उत्तर दीजिए।

- (1) आणविक वजन निर्धारण विधियाँ बताइए।
- (2) संघनन पॉलिमराइजेशन प्रक्रिया का उदाहरण दीजिए।
- (3) पॉलिमर में क्रॉस लिंक क्या है ? इसे पॉलिमर में कैसे बनाते हैं।

10 (ब) नीचे दी गई प्रश्नों का उत्तर दीजिए :

- (1) पॉलिमर में समकक्षी बंधों की संख्या बताइए।
- (2) शृंखला वृद्धि (Chain growth) पॉलिमराइजेशन समझाइए।

11 (अ) नीचे दी गई प्रश्नों का उत्तर दीजिए :

- (1) पॉलिमर में आणविक वजन निर्धारण विधियाँ बताइए।

(2) संघनन पॉलिमराइजेशन और अने आणविक वजन निर्धारण विधियाँ बताइए।

(3) पॉलिमर में आणविक वजन निर्धारण विधियाँ बताइए।

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- કેટલાં જવાબ આપો :
- (૧) વિશિષ્ટ સ્નિયતા (Specific Viscosity) આપ્યાં છે ?
 - (૨) તાપમાન 6, 6ની બનાવટમાં કયા માનમાં વધારો છે ?
 - (૩) ડીમના આલેખમાં કયાં મૂલ્ય કુટલું હોય છે ?
 - (૪) માર્ક-હીલ્ક-સમીકરણ આપો.
 - (૫) ટેલોનની વધારણા સૈ આપો.
 - (૬) Syndiotactic મોલોમરની વાસ્તવિક વજન ભારણા આપો.
 - (૭) કાર્બોન અને અકાર્બોનિક મોલોમર વજન ભારણા આપો.
 - (૮) થર્મોગ્રાવિટર અને થર્મોસેટિંગ મોલોમર સેટ હોય છે ? આપ્યાં છે ?
 - (૯) સેલોસિલોસ (C₆H₁₀O₅) માટેની સમીકરણ આપો તે આપ્યાં છે ?
 - (૧૦) મોલોમરના અણુભાર અને વિખેરણ માત્રાની તીવ્રતા વચ્ચે સંબંધ આપો તે આપ્યાં છે ?

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જાણવા માટે $\frac{M_w}{M_n}$ શોધો.

- (૨) 10³ ગ્રામ/મોલ અણુભાર ધરાવતા મોલોમરના 1000 ગ્રામને 10⁴ ગ્રામ/મોલ અણુભાર ધરાવતા મોલોમરના 1000 ગ્રામ સાથે મિશ્ર કરવામાં આવે તે મળતા M_w શોધો.
- (૧) વિવિધ ક્ષાંતિના બનેલા એક મોલોમર અણુમાં એક અણુને ૧૦૩ હોય તેવા 100 અણુ, એક અણુને ૧૦૪ હોય તેવા 200 અણુ, એક અણુને ૧૦૫ હોય તેવા 200 અણુ છે તે M_w શોધો.
- (૧) ૦૫ તે એકની જવાબ આપો :

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ENGLISH VERSION

1 (a) Answer any two of the following : 14

- (1) Discuss mechanism of ionic polymerization.
- (2) Discuss kinetics of condensation polymerization.
- (3) What are polymers ? Give classification in details with examples.

(b) Answer any one of the following : 6

- (1) Write a note on isomers of polymers.
- (2) Explain chain growth polymerization.

2 (a) Answer any two of the following : 14

- (1) Discuss Osmometry method to determine molecular weight of polymers.
- (2) Explain Degree of polymerization and molecular weight.
- (3) Discuss Light Scattering method to determine molecular weight of polymers.

(b) Answer any one of the following : 6

- (1) A polymer sample with various particles contains 100 molecules with 10^3 weight, 200 molecules with 10^4 weight and 200 molecules with 10^5 weight. Calculate \bar{M}_n and \bar{M}_w .

- (2) Find out $\frac{M_w}{M_n}$ when 1000 grams of 10^3 gram/mole molecular weight polymer is mixing with 1000 grams of 10^4 molecular weight polymer sample.

3

Write short answers :

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- (1) Define Specific Viscosity.
- (2) Which monomers are used to prepare Nylon 6, 6 ?
- (3) What is value of slope in Zimm's plot ?
- (4) Give Mark-Honk equation.
- (5) Give structural formula of Terylene.
- (6) Show arrangement of syndiotactic polymer with proper example.
- (7) Define Organic and Inorganic polymers with example.
- (8) What are thermo-plastics and thermo-setting polymers ? Give examples.
- (9) Give equation for Rayleigh ratio (R_θ) and clarify terms involved in it.
- (10) Give Debye equation showing relation between molecular weight of polymers and scattering light and also clarify each term involved in it.



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Seat No. _____

B. Sc. (Sem. VI) Examination

March/ April - 2015

Soaps & Detergents : Paper - SE-CH - 605(D)

Time : 2 Hours]

[Total Marks : 50

9 (अ) नीचे दी गई प्रश्नों के उत्तर दीजिए।

(1) साबुन का निर्माण करने में कौन से घटक शामिल हैं?

(2) साबुन का निर्माण करने में कौन से घटक शामिल हैं?

(3) साबुन का निर्माण करने में कौन से घटक शामिल हैं?

(Consideration) समझाइए।

10 (ब) नीचे दी गई प्रश्नों के उत्तर दीजिए।

(1) साबुन का निर्माण करने में कौन से घटक शामिल हैं?

(2) साबुन का निर्माण करने में कौन से घटक शामिल हैं?

(3) साबुन का निर्माण करने में कौन से घटक शामिल हैं?

(4) साबुन का निर्माण करने में कौन से घटक शामिल हैं?

11 (अ) नीचे दी गई प्रश्नों के उत्तर दीजिए।

(1) साबुन का निर्माण करने में कौन से घटक शामिल हैं?

(2) साबुन का निर्माण करने में कौन से घटक शामिल हैं?

(3) साबुन का निर्माण करने में कौन से घटक शामिल हैं?

- (૧૦) Igepon T નું સૈન આપી.
- (૧૧) ઝીઆલાહાઉટ ઉપચારની પદ્ધતિ ફોલો વ્રકસાવી ?
- (૧૨) ફોલો વ્રકસાવી આજીવન સુધી આપી.
- (૧૩) STPP નું પૂરું નામ લખી.
- (૧૪) ઝીઆલાહાઉટ O.T ની ઉપયોગ જણાવો.
- (૧૫) સેનિટાઇઝર ટાઇપના ૨-૨૨૨૨-૨૨૨૨ ઝીઆલાહાઉટ આપી છે ?
- (૧૬) ટાઇપના ૨-૨૨૨૨-૨૨૨૨ ઝીઆલાહાઉટ ?
- (૧૭) ઝીઆલાહાઉટ આપી ઉપયોગ લખી.
- (૧૮) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી.
- (૧૯) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી.
- (૨૦) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૨૧) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૨૨) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૨૩) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૨૪) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૨૫) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૨૬) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૨૭) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૨૮) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૨૯) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૩૦) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?

૧૦

- (૧) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૨) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૩) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૪) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૫) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૬) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૭) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૮) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૯) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?
- (૧૦) ઝીઆલાહાઉટ આપી ઝીઆલાહાઉટ આપી ?

ENGLISH VERSION

- 1 (a) Answer any two of the following questions : 14
- (1) Explain the continuous process for manufacture of soap.
 - (2) Write a note on toilet soap.
 - (3) Explain the general consideration in soap making.
- (b) Answer any one of the following questions : 6
- (1) Short note :
 - (a) Transparent soap
 - (b) Carboic acid soap.
 - (2) Explain the batch process for manufacture of soap.

- 2 (a) Answer any two of the following questions : 14
- (1) Write a note on cationic detergents.
 - (2) Explain Welsh process.
 - (3) Write a note on : "Detergents containing enzymes".
- (b) Answer any one of the following questions : 6
- (1) Explain manufacture of shampoos.
 - (2) Short notes :
 - (a) Alkyl aryl sulphonates
 - (b) Amide sulphonates.

3 Answer any ten of the following questions :

- (1) What are hard and soft soaps ?
- (2) How can be liquid soap manufactured ?
- (3) Give a component of Neem soap.
- (4) Mention oil to be used for soaps.
- (5) Give uses of metal soap.
- (6) What is detergents ?
- (7) Semipolar detergents are obtained from which ?
- (8) Give uses of Monoxol O.T.
- (9) Write a full name of STPP.
- (10) Give the structure of Igepon T.
- (11) Who developed the process for manufacturing of zeolites ?
- (12) Give the name of any one Antidandruff agent.



HG-217-218

Seat No. _____

B. Sc. (Sem. VI) Examination

March / April - 2015

Mathematics : Paper - 603

CC-MATH-603-A : General Topology

CC-MATH-603-B : Number Theory

Time : 3 Hours]

[Total Marks : 70

Mathematics : Paper - 603

CC-MATH-603-A : General Topology

Instruction : All questions are compulsory, there are five

questions.

I (a)

Define topological space.

If

$T = \{A \subset R \mid A = R \text{ or } A = \phi \text{ or } A = (a, \infty), a \in R\}$; then

prove that (R, T) is a topological space.

(b)

Define the closure of a subset of a topological space.

Prove that : A is closed iff $\bar{A} = A$, where A is a

subset of a topological space.

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1

[Contd...

of all open sets contained in A .

that $\text{Int}(A) = \bigcup_{\alpha \in I} O_\alpha$, where $\{O_\alpha\}_{\alpha \in I}$ is the family

If A be a subset of a topological space; then prove

2 (a) Define interior of a subset of a topological space.

Where A is a subset of a topological space.

\bar{A} is the smallest closed set containing A ;

(c) Prove that : In a topological space;

s.t. F is closed and $A \subset F$. Then prove that $\bar{A} \subset F$.

(b) Let A and F are subsets of a topological space X

all neighbourhoods of e

be a topology on $X = \{a, b, c, d, e\}$; then find out

If $T = \{X, \emptyset, \{a\}, \{a, b\}, \{a, c, d\}, \{a, b, c, d\}, \{a, b, e\}\}$

space.

1 (a) Define neighbourhood of a point in a topological

OR

O is a neighbourhood of each of its points.

iff

A subset O of topological space is open

(c) Prove that :

subset of X
for each open subset O of Y ; $f^{-1}(O)$ is an open

iff

A function $f: (X, T) \rightarrow (Y, T')$ is continuous

(b) Prove that :

topological spaces.

Prove that : R and $(-1, 1)$ are homeomorphic

(a) Define homeomorphic topological space.

OR

for each subset A of X , $f(\overline{A}) \subset \overline{f(A)}$.

iff

$f: (X, T) \rightarrow (Y, T')$ is continuous

(c) Prove that :

(ii) Is f is continuous at d ?

(i) Is f is continuous at c ?

$$f(d) = c$$

Define $f: X \rightarrow X$ by $f(a) = b, f(b) = d, f(c) = b,$

on $X = \{a, b, c, d\}$.

Let $T = \{X, \emptyset, \{a\}, \{b\}, \{a, b\}, \{b, c, d\}\}$ be a topology

at a point $p \in X$.

(b) Define continuity of a function $f: (X, T) \rightarrow (Y, T')$

then $C_{mp}(b) = C_{mp}(a)$.

In a topological space X : let $b \in C_{mp}(a)$

- (a) Define connected subset of a topological space.
 Let A be a connected subset of a topological space X and let $A \subset B \subset \bar{A}$. Then prove that B is also connected.
 (b) Prove that : Connectedness is a topological property.
 (c) Prove that :

OR

- (a) Define topological property :
 $N' = N \cap Y$, where N is a neighbourhood of p in X .
 (b) Show that :
 (i) Length is not a topological property.
 (ii) Boundedness is not a topological property.
 (c) State and prove : Intermediate - Value theorem.

iff
 a subset N' of Y is a relative neighbourhood of p
 Then prove that :
 let $p \in Y$.

- (a) Define subspace of a topological space.
 Let Y be a subspace of a topological space X and

(iii) $O \in T$ iff $f(O) \in T'$

(ii) f is surjective

(i) f is injective

such that

homeomorphic is that there is a function $f : X \rightarrow Y$
 topological spaces (X, T) and (Y, T') be
 A necessary and sufficient condition that two

- (c) Prove that :

- 4 Attempt any two :
- (a) Let A be a subset of a topological space and a point $x \notin A$. Then show that $x \notin F$, for some closed set F containing A .
- (b) Let A be a subset of a topological space. Prove that :
- A is closed iff Bdry $(A) \subset A$.
- (c) Prove that :
In a topological space, component is a closed set.
- 5 Attempt any two :
- (a) Suppose that $X \neq \emptyset; (Y, T')$ be a topological space and $f: X \rightarrow Y$ be a function and $T = \{f^{-1}(G) \mid G \in T'\}$. Show that : T is a topology on X .
- (b) Let a function $f: X \rightarrow Y$ be given. Prove that $f: (X, 2^X) \rightarrow (Y, T')$ is always continuous, as is $f: (X, T) \rightarrow (Y, \{\emptyset, Y\})$; where T' is any topology on Y and T is any topology on X .
- (c) Let A and B be subsets of a topological space X . If A is connected, B is open and closed, and $A \cap B \neq \emptyset$. Prove that $A \subset B$.

$d = ax + by.$

(3) If a and b are integers not both of them are zero and $d = \gcd(a, b)$ then

$56x + 72y = 40.$

(2) Solve the Diophantine equation

either of the form $3k$ or $3k + 1.$

(1) Show that the square of any integer is

12

(b) Attempt any two of the following :

$(a+b)^n = \binom{n}{0}a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{n}b^n$

8

(a) Prove Binomial theorem by induction

OR

t is any integer.

given by $x = x_0 + \left(\frac{d}{b}\right)t, y = y_0 - \left(\frac{d}{a}\right)t,$ where

this equation, then all other solutions are $d = \gcd(a, b).$ Prove if x_0, y_0 is a solution of

has a solution if and only if d/c where

8

(a) The linear Diophantine equation $ax + by = c$

Instructions : (1) All questions are compulsory.
(2) Figures to the right indicate marks of the question.

2 (a) Define linear congruence relation. If a, b, c

are integers, $c > 0$ and $ac \equiv bc \pmod{n}$ then
 $a \equiv b \pmod{n/d}$, where $d = \gcd(c, n)$.

OR

8 (a) Let $n > 0$ be fixed and a, b, c be any integers

(i) If $a \equiv b \pmod{n} \Rightarrow b \equiv a \pmod{n}$

(ii) If $a \equiv b \pmod{n}, b \equiv c \pmod{n} \Rightarrow a \equiv c \pmod{n}$

12 (b) Attempt any two of the following :

(1) Prove that $1^5 + 2^5 + 3^5 + \dots + 100^5$ is

divisible by 4.

(2) Solve the linear congruence equation

$$9x \equiv 21 \pmod{30}$$

(3) If p_n is the n^{th} prime number, then

$$p_n \leq 2^{2^{n-1}}$$
 by mathematical induction.

3 (a) State and prove Euler's theorem.

OR

8 (a) If p is a prime and $p \nmid a$, then

$$a^{p-1} \equiv 1 \pmod{p}.$$

- (b) Attempt any two of the following :
- (1) If p and q are distinct primes such that $a^p \equiv a \pmod{q}$ and $a^q \equiv a \pmod{p}$ then $a^{pq} \equiv a \pmod{pq}$.
- (2) Find the last two digit of 3^{256} by means of Euler's theorem.
- (3) If $n > 2$ then $\phi(n)$ is even.
- 4 Answer the following questions :
- 10
- (1) If a/c and b/c , with $\gcd(a, b) = 1$, then ab/c .
- (2) If $a \equiv b \pmod{n}$ and $c \equiv d \pmod{n}$ then $a+c \equiv b+d \pmod{n}$
- (3) Find the remainder when $1!+2!+3!+\dots+100!$ is divisible by 12.
- (4) Verify $\phi(m \cdot n) = \phi(m) \cdot \phi(n)$ holds when $m = 36$, $n = 10$.
- (5) If n and $n+2$ are pair of twin primes then $\phi(n+2) = \phi(n) + 2$.



HG-225-226-227

Seat No. _____

B. Sc. (Sem. VI) Examination

March / April - 2015

Mathematics

CC-MATH-604-A : Graph Theory

CC-MATH-604-B : Mechanics - II

CC-MATH-604-C : Operations Research - II

(New Course)

Time : 3 Hours]

[Total Marks : 70

Mathematics

CC-MATH-604-A : Graph Theory

Instructions : (1) All questions are compulsory, there are five questions.

(2)

Figures to the right indicate marks of the corresponding question.

1 (a) Define Union of graph with illustration. 6

OR

(a) Define intersection of graph with illustration. 6

(b)

Attempt any two :

(i) Define complete graph with illustration. 12

(ii)

Define incidence and Degree of a vertex with illustration.

(iii)

Define eccentricity of a vertex with illustration.

2

(a)

Define Cut set with illustration. 6

OR

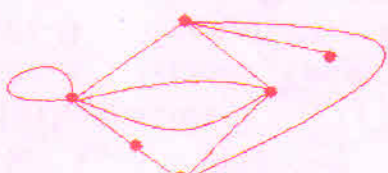
(a)

Define Vertex connectivity of graph with illustration. 6

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1

[Contd...

- (b) Attempt any two : 12
- (i) Define Separable graph with illustration.
- (ii) Check planarity of the given graph below.
- 
- (iii) Define a Cut set matrix and state necessary and sufficient condition for combinatorial dual.
- 3 (a) Explain properties incidence matrix. 6
- OR
- 6 (a) Explain adjacency matrix with illustration. 6
- (b) Attempt any two : 12
- (i) Define covering with illustration.
- (ii) Explain diacyclization with illustration.
- (iii) Define Chromatic partition with illustration.
- 4 Attempt any four : 16
- (1) Defines :
- (i) Circuit sub space
- (ii) Cut set subspace.
- (2) Define branch with illustration.
- (3) Define Chord with illustration.
- (4) Prove that a vertex V of a tree is cut vertex if $d(V) > 1$.
- (5) Define Binary Tree with illustration.

Mathematics
CC-MATH-604-B : Mechanics - II

Attempt any three :

- (a) A particle is moving along the path $r = ae^{\theta}$ in such a way so that the radial component of its acceleration is always zero. Prove that $\frac{d\theta}{dt}$ is constant.

- (b) A particle is projected with velocity V and making an angle θ with horizontal. Find the expression for the horizontal range and the time of flight.

- (c) For a rigid body moving parallel to a fixed plane. In usual notations prove that $T = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$.

- (d) Moving along the x-axis there are two particles

with $x = 10 + 6t$, $x = 3 + t^2$. Then find out velocity at the time of encounter of each other.

2 Attempt any two :

- (a) Define a simple harmonic motion and obtain its equation in the form

$$x = a \left(1 - 2 \sin^2 \left(\frac{1}{2} \sqrt{\mu} t \right) \right)$$

- (b) Define a compound pendulum and in usual notation prove that its periodic time T is obtain by the following equation :

$$T = \frac{2\pi}{\sqrt{g}} \sqrt{\alpha + \frac{K_0^2}{\alpha}}$$

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3

[Contd...

(c) A spherical iron ball 10 cm in radius is coated with a layer of ice of uniform thickness that melts at a rate of 50 cm³/min. When the thickness of ice is 15 cm, then find out the rate at which the thickness of ice decreases.

(b) If polar equation of central orbit is $r = a \cdot n \sqrt{2 \cos^2 \frac{n\theta}{2}} - 1$; then find central force.

(a) A particle is moving under a central force $bu^2 + cu^4$ (where b and c are constants) in a circular orbit of radius a . Find the condition for the circular orbit to be stable.

14

Attempt any two :

(c) State and prove : The theorem of parallel axes for the moment of inertia of rigid body.

(b) Two smooth sphere of mass m_1 and m_2 moving with velocity u and v in the opposite direction, collide in the straight line. If sphere of mass m is brought to rest by the impact; then show that $um_1(1+e) = v(m_2 - em_1)$.

(a) A sphere impinges directly on an equal sphere at rest. If the coefficient of restitution is e ; then prove that their velocities after impact is in the ratio $\frac{1+e}{1-e}$

16

Attempt any two :

(c) A particle describes the central orbit $r^2 = a^2(2 \cos^2 \theta - 1)$; the centre of force being a pole. Show that the law of force varies inversely as r^7 .

Mathematics
CC-MATH-604-C : Operations Research - II
(New Course)

Instructions : (1) All questions are compulsory.
 (2) Figures to the right indicate marks of the question.

- I (a) Prove that transportation problem has a triangular basis. 10
 (b) Solve the following assignment problem : 10

	Job					
	Man	1	2	3	4	
a	3	2	7	4	4	8
b	5	4	3	8	5	5
c	3	7	9	1	2	2
d	4	2	6	5	7	7
e	2	8	4	6	6	6

OR

- I (a) Explain Hungarian method of solving assignment problem. 10
 (b) Solve the following transportation problem for optimal cost : 10

	To				
	D ₁	D ₂	D ₃	a _i	
O ₁	4	8	8	75	
O ₂	16	24	16	80	
O ₃	8	16	24	70	
b _j	40	80	55		

2 (a) Find the sequence that minimizes the total time required in performing the following jobs on three machines in the order ABC. Processing time (in hours) are given in the following table :

Job :	1	2	3	4	5
Machine A :	8	10	6	7	11
Machine B :	5	6	2	3	4
Machine C :	4	9	8	6	5

(b) There are 4 jobs each of which has to go through the machines M_i ($i=1, 2, 3, \dots, 6$) in order M_1, M_2, \dots, M_6 . Processing times are given :

Jobs	A	B	C	D
M_1	20	19	18	22
M_2	10	8	7	6
M_3	9	11	10	5
M_4	4	8	7	6
M_5	12	10	9	10
M_6	27	21	17	14

Determine a sequence of these four jobs which minimizes the elapsed time T .

OR

2 (a) Describe Johnson's Algorithm for n -jobs 2-machine. 10

(b) Following table shows the machine time (in hours) for 5 jobs to be processed on two different machine :

Job :	1	2	3	4	5	6
Machine A :	3	9	4	7	8	6
Machine B :	6	4	8	3	9	5

Passing is not allowed. Find the optimal sequence in which job should be processed.

3 (a) For a real valued function $f(x, y)$, both

$$\max_x \min_y f(x, y) \text{ and } \min_x \max_y f(x, y) \text{ exists.}$$

$$\text{Prove that } \max_x \min_y f(x, y) \leq \min_x \max_y f(x, y).$$

(b) Solve the following game problem by converting it to LPP :

$$A \begin{bmatrix} 4 & 3 \\ 1 & 5 \\ -2 & 4 \end{bmatrix} B$$

OR

- 3 (a) Define :
- (i) Game
 - (ii) Zero sum game
 - (iii) Saddle point
 - (iv) Value of the game
 - (v) Mixed strategy.

10

(b) Solve the graphical solution of

$$A \begin{bmatrix} 2 & -1 \\ 5 & 2 \\ 1 & 3 \\ -2 & 1 \end{bmatrix}$$

B

4 Attempt any two :

(1) Find the saddle point of the game :

Player B

$b_1 \quad b_2 \quad b_3$

$$Player A \begin{bmatrix} a_1 & -3 & -2 & 6 \\ a_2 & 2 & 1 & 2 \\ a_3 & 5 & -2 & -4 \end{bmatrix}$$

(2) There are five jobs, each of which must go through the two machines A and B in the order AB. Processing times are given below :

Job :	1	2	3	4	5
Time for A :	5	1	9	8	10
Time for B :	2	6	7	8	4

Determine a sequence for five jobs that will minimize the elapsed time T.

(3) Find the value of the 2×2 game when saddle point does not exist.

$$A \begin{bmatrix} 5 & 2 \\ 3 & 8 \end{bmatrix}$$

B