

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2011

(CCSS)

Complementary Course

Mathematics

MM 4C 04—MATHEMATICS

Time : Three Hours

Maximum : 30 Weightage

I. Answer *all* twelve questions :1 Find the Laplace transform of $f(t) = \cos wt$.2 Find the Laplace transform of $a + bt + ct$ 3 Find $\mathcal{L}^{-1} \left[e^{-3s} \right]$.4 Reduce to the first order and solve $yy'' = 2y'^2$.5 Apply the operator $(D^2 + 3D)$ to $\cosh 3x$.6 Solve $x^2 y'' = 3xy' + 4y = 0$.7 Verify that $y_p = 2x^2 - 6x + 7$ is a solution of $y'' + 3y' + 2y = 4x^2$.8 Find $\mathcal{L}[f(t)]$ where $f(t) = t$.9 Examine whether $f(x) = x|x|$ is odd, even or neither odd nor even.10 Find a solution of the equation $u_{xy} = -u_x$.11 Find $\mathcal{L}(ex)$.12 Examine whether $f(x) = x^4$ ($0 < x < 2\pi$) is odd, even or neither odd nor even.(12 x $\frac{1}{4}$ = 3 weightage)

Turn over

II. Short Answer type questions. Answer *all* nine questions :

13 Solve $y'' + 4y = 8x^2$.

14 Find $L(\sin wt)$.

15 Find $L(2t + 6)$.

16 Find the Laplace transform of $\sin t$.

17 Find $L^{-1} \left| \frac{e^{-3s}}{(s-1)^3} \right|$

18 Reduce to first order and solve $y'' = y'$.

19 Apply the operator $(D^2 + 3D)$ to $e^{-x} e^{2x}$.

20 Verify that $y_p = e^{-3x}$ is a solution of $y'' - y = 8e^{-3x}$.

21 Find a solution of the equation $u_{xx} - u = 0$.

(9 x 1 = 9 weightage)

Answer any *five* questions :

22 Solve the initial value problem $y'' + 4y' + 4y = 0$, $y(0) = 1$, $y'(0) = 1$.

23 Using the method of variation of parameters solve $y'' + 2y' + y = e^{-x} \cos x$.

24 Find the inverse Laplace transform of $\frac{-s-10}{s^2(s-2)}$

25 Using convolution find the inverse $h(t)$ of $H(s) = \frac{1}{s^2(s-1)}$

26 Apply Euler's method to solve $y' = x + y$, $y(0) = 0$, $h = 0.2$.

27 Use the trapezoidal rule with $n = 4$ to estimate $\int_0^3 (2x^2 - 1) dx$.

28 Find the inverse transform of $\ln \left(1 + \frac{w^2}{2} \right)$

(5 x 2 = 10 weightage)

IV. Answer any *two* questions :

29 Using Laplace transform solve $y'' + y' - 6y = 1$, $y(0) = 0$, $y'(0) =$

30 Find the Fourier series of :

$$f(x) = \begin{cases} 1 & \text{if } -\pi < x < 0 \\ -1 & \text{if } 0 < x < \pi \end{cases}$$

31 Apply Euler's method to solve $y' = \sqrt{1 - y^2}$, $y(0) = 0$, $h = 0.1$.

(2 x 4 = 8 weightage)

FINAL YEAR B.Sc. DEGREE EXAMINATION, AUGUST 2009

Chemistry

Paper II—ORGANIC CHEMISTRY—I

(2000 Admissions onwards)

[Common to Paper II of Polymer Chemistry. and Industrial Chemistry—Regular]

Time Three Hours

Maximum : 55 Marks

Section A

Answer any **sixteen** questions.
Each question carries $1\frac{1}{2}$ marks.

1. What is TLC ? How does it differ from GLC ?
2. How would you find out the optical purity of a sample ?
3. Write the Fischer Projection Formula for (2R, 3R)-dibromo butane.
4. What is primary isotope effect ?
5. What happens when diphenylmethane vapour is passed through a red hot tube ?
6. Vinyl halides cannot be used in place of alkyl halides in the Friedel Crafts alkylation reaction. Why ?
7. Carboxyl group is m-orienting, but the carboxylate ion is o, p-orienting in aromatic electrophilic substitution reactions. Explain.
8. Although cycloheptatriene is cyclic and has 6 π electrons, it is not aromatic. Why ?
9. Predict the products formed in the following reactions :—
 - (a) Anthracene $\xrightarrow{\text{Na}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4}$
 - (b) Benzaldehyde $\xrightarrow{\text{KCN}}$
10. Chlorobenzene does not give a white precipitate of AgCl on reaction with an alcoholic solution of AgNO₃. Why ?
11. How would you synthesise *d*-butanol using a suitable Grignard reagent ?
12. The enol tautomer of phenol is more stable than its keto tautomer. Why ?
13. How is phenetole prepared ?
14. Give the IUPAC names of (i) maleic acid ; (ii) benzaldehyde.
15. What is the product formed when cyclohexanone oxime is subjected to Beckmann Rearrangement ?
16. How many important NMR signals would you expect from benzyl alcohol ? Indicate their approximate δ values ?

Turn over

17. How is phenol manufactured from cumene ?
18. Give *two* reactions of ethylene oxide.
19. What is asymmetric synthesis ?
20. Cyclopentadiene is not aromatic, but cyclopentadienyl anion is an aromatic anion. Why ?

(16 x = 24 marks)

Section B

Answer **any four** questions.
Each question carries 4 marks.

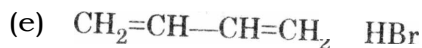
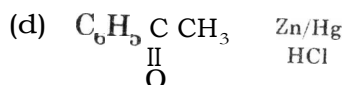
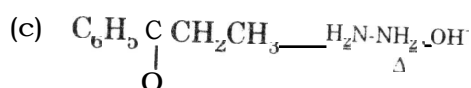
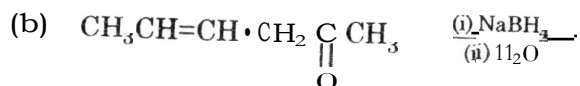
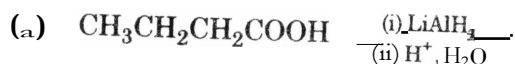
21. Give the mechanism of nitration of nitrobenzene.
22. What are the important conditions necessary for biphenyl compounds to exhibit Optical activity ? Illustrate.
23. Give the Haworth synthesis of phenanthrene from naphthalene.
24. Allyl chloride is converted to allyl iodide by an S_N2 reaction with KI at a rate much faster than *n*-propyl chloride is converted to *n*-propyl iodide under the same conditions. Explain.
25. Illustrate Reformatsky reaction.
26. Write the mechanism of formation of *p*-methoxybenzyl alcohol from the reaction of *p*-anisaldehyde with formaldehyde in presence of NaOH.

(4 x 4 = 16 marks)

Section C

Answer any **two** questions.
Each question carries 7½ marks.

27. Predict the products of the following reactions :—



28. (a) Predict the major product formed when *n*-bromobutane is heated with alcoholic KOH. (5 x 1½ = 7½ marks)

Write the mechanism of the reaction.

- (b) What are carbenes ? Give one example.

(5 marks)

(2½ marks)

29. The presence of an asymmetric carbon atom is not an essential condition for a compound to exhibit optical activity. Substantiate with at least *three* examples. (7% marks)
30. (a) Ethyl magnesium bromide reacts with ethyl acetate to form an unstable compound which gets converted to a carbonyl compound. The carbonyl compound immediately reacts with a second molecule of ethyl magnesium bromide to form a product which on hydrolysis gives an alcohol. Identify the alcohol and write the structures of all intermediate compounds. (5 marks)
- (b) Write a brief note on "energy profile diagrams". (2½ marks)
- [2 x 7½ = 15 marks]