

CIRCULAR:-

A reference is invited to the scheme of papers at the B.Sc. degree course under the revised pattern vide this office Circular No.UG/334 of 2004, dated 11th August, 2004 and the Principals of the affiliated colleges in Science are hereby informed that the recommendation made by the Board of Studies in Chemistry at its meeting held on 3rd June, 2005 has been accepted by the Academic Council at its meeting held on 14th June, 2005 vide item No.4.37 and that in accordance therewith the revised guidelines for the pattern of question papers in the subject of Chemistry (3 Units and 6 Units) and Applied Components subjects (Theory and Practical examinations) at the T.Y.B.Sc. examination is as under :-

A) Revised pattern for Theory and Practical question papers:

1. The guidelines given by the Board of Studies regarding the theory question paper format were discussed in detail and reviewed. As per the guidelines there shall be in all five questions in a theory paper of 6-unit Chemistry examination. The first question shall be compulsory and shall carry 20 marks. There shall be other four questions, which will be compulsory and each shall carry 20 marks. They will be framed according to units. Internal options may be given within the units decided and some mixing of units may be necessary. On this background it was resolved as under.

2. Pattern of Question paper for 6 Units Chemistry

- (a) There shall be in all five questions in any question paper of the core subjects.
- (b) The first question shall be compulsory and carry 20 marks. It shall consist of sixteen short-answer type sub-questions, each carrying 2-3 marks. Total setting marks may be 40. These sub-questions shall be so framed as to cover all the eight units; at least two sub-question on each unit. Sub Questions shall be framed such that the student will have to answer one question from each of the eight units.
- (c) There shall be four other questions, of 20 marks each, and all these questions shall be compulsory. Out of these, two questions shall have internal options (i.e. sub-questions may be given with options eg. Q X (a) or (b) and (c) or (d) etc), while the remaining two questions shall have external option, viz, entire question will be given an optional alternative question (i.e. Q.X (a)(b)(c) OR Q.X(d)(e)(f)). The sub-questions from each question shall be framed in such a way that they cover the corresponding topics almost entirely. While doing this, as far as possible, the weightages of different topics given in the syllabus, in the form of number of lectures, be reflected in the **weightages of the** questions framed.

- (d) The total number of marks assigned for the entire question paper shall be 200. Out of these the compulsory component shall be of 100 marks - 20 marks for the first question and 80 marks for Q.2 to Q.5. Thus, Q.2 to Q.5 shall be set for a total of 160 marks.
- (e) The distribution of the units in the syllabus for the questions shall be as under:

Question No.	Analytical	Inorganic	Organic	Physical
2	I, V	I, III	I, III	I, II
3	II, VI	II, IV	II, VI	III, IV
4	III, VII	V, VII	IV, V	V, VI
5	IV, VIII	VI, VIII	VII, VIII	VII, VIII

- (f) Each question from Qs.2-5 shall contain sub-questions, each carrying 4-8 marks.

3. Pattern of Question Paper for 3 Units Chemistry

- (a) Each question paper shall have two sections of 50 marks each; as given in the syllabus.
- (b) There shall be in all three questions in each section.
- (c) The first question shall be from all four units, mixed and shall carry 10 marks. It shall consist of total 10 short-answer type sub-questions, each carrying 1-3 marks (Total 20 marks). These sub-questions shall be so framed as to cover all the four units prescribed for the three-unit course. The sub-questions should be set such that students shall have to answer at least one sub-question on each unit. Student shall answer five sub questions.
- (d) There shall be two other questions, of 20 marks each and both the questions shall be compulsory. Out of these, one question shall have internal option, while the other question shall have external option. (for explanation see 2(b) above). The sub-questions from each question shall be framed in such a way that they cover the corresponding topics almost entirely. While doing this, as far as possible, the weightages of different topics given in the syllabus, in the form of number of lectures, be reflected in the weightages of the questions framed.
- (e) The total number of marks assigned for the entire question paper shall be 200, each section being 100 marks. Out of these the compulsory component shall be of 50 marks per section- 10 marks for the first question (compulsory) and 40 marks for Q.2 and Q.3 together. Thus, Q.2 and Q.3 shall be set for a total of 80 marks.

- (f) The distribution of units for the questions shall be as under:

Question No.	Analytical	Inorganic	Organic	Physical
2	I, II	I, II	I, II	I, II
3	III, IV	III, IV	III, IV	III, IV

- (g) Each question from Q.2-3, shall contain sub-questions, each carrying 4-8 marks.

- 4 The conveners of the subcommittees of the '*Applied components*' should prepare and submit the patterns of the examinations of the respective 'Applied component' subjects on similar lines.

5. **Practical Examination in Analytical, Inorganic, and Physical Chemistry**

The members discussed the experiments in the syllabus pertaining to analytical, inorganic and physical chemistry and recorded that there is no specific difficulty pertaining to the performance of these experiments and also with respect to the conduct of the examination.

6. **Practical Examination in Organic Chemistry**

The members discussed the practical tasks in Organic Chemistry and also gave the feedback received from the other teachers. It was felt necessary to give specific guidelines to the teachers in all the colleges regarding the conduct of the practical examination, as there were many new aspects involved in the Organic Chemistry experiments. After due deliberations the following guidelines were recommended.

6.1. General Requirements:

1. In a laboratory, 1-2 electronic balances with $\pm 10\text{mg}$ accuracy should be provided.
2. There should be 1-2 vacuum pumps with minimum of 10 outlets in the laboratory.
3. The question paper should be provided with spaces for the answers, so as to make the answers very precise.
4. It is expected that the students have done a minimum of 12 binary mixtures.
5. For drying of the organic compounds, it is expected that the laboratory has an electric oven or IR lamp.

6.2. Organic Separation:

6.2.1. General guidelines:

- (1) For a solid + Solid mixture 1.5 - 2.5 g of each solid be given.
- (2) For a mixture containing a liquid, 4-6 ml of a non-volatile liquid and 6-8 ml of a volatile liquid should be given.

... 4/-



- (3) To find the type of the mixture, 500mg of a solid mixture, while 1 ml of a (liquid+liquid) or (liquid +solid) mixture should be given separately at the beginning. After completing this part, the main mixture may be given.
- (4) Identification of a compound means characterization through preliminary observations, solubility profile, elemental analysis, detecting the functional groups, determination of m.p./b.p., only. The students must do the characterization by micro-scale techniques, in line with those studied in the previous year.
- (5) For the crystallization of a solid, the following solvents are recommended: water, ethanol (rectified spirit), 50% aqueous ethanol (by volume), methanol, isopropyl alcohol.
- (6) The students are expected to study different combinations of binary mixtures during their practical sessions. However, for the examination the following scheme is suggested.
- (7) At the time of examination, in a batch of 10 students 3-4 mixtures may be given, and the results may be compared internally.
- (8) For an organic compound, it is necessary to find out its melting behaviour before taking it for drying.
- (9) A high melting compound may be dried using water bath, electric oven, or IR lamp.
- (10) A low melting compound may be dried by passing air through it, on the suction bed, followed by air drying.

6.2.2. Types of Mixtures

[A] Water soluble solid + Water insoluble solid:

- (1) Water soluble solid need not be crystallized. It will be dried and weighed.
- (2) The water soluble compound should be given for characterization.
- (3) Water insoluble compound is to be purified by crystallization, and for this the appropriate solvent of crystallization shall be told. This compound is not given for characterization. Its yield and m.p. should be recorded.

[B] Water insoluble solid + Water insoluble solid:

- (1) One of the two compounds should be crystallized. This compound is not given for characterization. For this compound a suitable solvent of crystallization shall be told. The yield and m.p. of the crystallized compound be recorded.
- (2) The other compound should be dried and weighed; without crystallization. This compound is to be characterized.
- (3) The examiner shall select the compounds to be given for characterization and crystallization.

C] Volatile liquid + Solid

- (1) Volatile liquid not to be redistilled and the yield of the liquid be reported as volume (up to 0.1ml accuracy). This liquid may be dried, if required.
- (2) The solid should be a water insoluble solid.
- (3) The solid should be given for crystallization; the solvent of crystallization be told. The yield and m.p. of the crystallized compound should be given credits.
- (4) Characterization of the volatile liquid should be done.

D] Volatile liquid + Nonvolatile liquid:

- (1) Volatile liquid not to be redistilled and the yield of the liquid be reported as volume (up to 0.1ml accuracy). This liquid be dried, if required.
- (2) Characterization of the volatile liquid should be done.
- (3) Nonvolatile liquid is to be redistilled and the yield and b.p. of the redistilled liquid be reported. This liquid may be dried, if required.

6.2.3. Marking Scheme for Organic Separation:

- (1) Type of the mixture: 3 marks (deduction of 1 marks for each error committed)
- (2) Yield: (a) 2 marks for a compound which is not purified.
(b) 4 marks for the compound which is purified (crystallization/redistillation)
- (3) Quality: (a) 2 marks for a compound which is not purified.
(b) 4 marks for the compound which is purified (crystallization/redistillation)
- (4) Characterization of one compound:
Preliminary tests including solubility - 1 mark
Elements - 2 marks
Functional groups - 3 marks
- (5) Marks for m.p./b.p. of the crystallized/purified compound: 2 marks.
(m.p. + 2°C - 2 marks; -3°C - 1 mark).
- (6) Marks for m.p./b.p. of crude compound: *solid*: +2 to - 3°C - 2 marks; - 4°C - 1 mark.
Liquid: $\pm 3^{\circ}\text{C}$ range - 2 marks; $\pm 4^{\circ}\text{C}$ range - 1 mark (depending also on the b.p. range)

6.2.4.

Notes:

- (a) For assigning the marks for the yield the experts' results may be taken into account.
- (b) The yield should be reported using an electronic balance with $\pm 0.01\text{g}$ accuracy.
- (c) The marks should be given in the increments of 0.5, with an approximate sliding scale, e.g. quantity isolated (crude or crystallized)/quantity expected X 2 or 4.

7. Organic preparations:

- (1) 2g of the starting compound should be given.
- (2) If the starting compound is a liquid, 2g of the liquid be given or if the liquid is given in volume, the density of the liquid should be supplied.
- (3) The product should be crystallized entirely; the solvent of crystallization being given in the procedure itself. Obviously the crude product need not be weighed.
- (4) Marks shall be given on the basis of quality and the quantity of the product as given below:

m.p.	-	3 marks
Quality	-	4 marks
Yield	-	8 marks
- (5) While assigning marks, the yield and quality of the product obtained by the experts should be taken into account.
- (6) **Yield:** The +/- 5% of the highest *possible* yield (under the prevailing conditions), but <100%, be given full credit, and from this as far as possible a downward linear sliding scale be developed with a gradient of 0.5 marks; e.g. Yield obtained/The highest yield obtainable x 8 = Marks to be given (rounded off to the nearest 0.5)
- (7) **Quality:** The samples of all the students be internally compared and also compared with the sample of the expert, while assigning marks for the product. Marks should be given in integers only.

8. Schedule for Organic Chemistry Practical Examination:

- (a) In the morning session, the Organic Separation exercise may be given. The candidates are expected to at least complete the main separation and characterization of one compound in this session.
- (b) In the afternoon session, the separation exercise shall continue, particularly with respect to drying of the other component, etc. Along with this, the Organic preparation exercise shall be given.

2. FORMATS OF THE QUESTION PAPERS

2.1. Organic Separation:

Part A: About 500 mg/1ml of a binary mixture is given to you in a container bearing your table number. Within first 30 min find the type of the mixture and write it in the space provided below. Get it approved by the examiner. If you go wrong you will be permitted to repeat the analysis, with penalty points.

Part B: A weighed quantity of the same mixture will be given to you. Separate the two components. As per the examiner's instructions (see the table below) you have to purify one of the compounds, while the other one is not to be purified. Each m.p./b.p. as well as mass of the compounds must be signed by the examiner. Submit both the compounds to the examiner. Proceed as follows:

- Purify the compound as indicated below. Dry and take the mass. Take the m.p./b.p. Enter these in the table below and submit the compound to the examiner.
- The other compound is to be dried and weighed/volume measured. Report the mass/volume and proceed for the characterization, through preliminary tests, solubility, elemental analysis, functional group identification and physical constant determination (m.p./b.p.).

RESULTS

[A] Type:

Component	A	B
First Attempt		
Second Attempt		
Third Attempt		

To be filled by the Examiner:

Compound to be purified	Purification by: Crystallization/Distillation Solvent of Crystallization:
Compound to be characterized	

[B] Yield:

Yield of crude compound <u>A/B</u>	g/ml
Yield of purified compound <u>A/B</u>	g/ml

[C] Characterization of compound A/B

1. Preliminary Tests:

Test	Observation	Conclusion

2. Solubility: Soluble in : _____

Insoluble in: _____

3. Elements Present: _____

4. Positive Functional group tests:

Test	Observation	Conclusion

Functional

groups

present:

5. Physical Constants (m.p./b.p.)

Crude compound	°C
Purified compound	°C

9.2. Organic Preparation:

Preparation of 1,3-dinitrobenzene from nitrobenzene

1. Procedure:

In a dry round bottom flask take conc. HNO_3 (70% w/v) (ml). Add carefully conc. H_2SO_4 (ml) to it slowly. Mix the acids thoroughly and cool the mixture in an ice-water bath. To this nitrating mixture, add nitrobenzene (given quantity) with shaking the flask thoroughly to ensure the complete mixing. Attach a reflux condenser and heat the flask on a low flame for 30 min with intermittent shaking. Cool and pour the contents of the flask with stirring into ice-cold water. Filter the crude product and wash it thoroughly with water. Crystallize the product from ethanol.

Density of nitrobenzene: g/cm^3

2. Results:

Mass of nitrobenzene taken	g
Mass of the crystallized 1,3-dinitrobenzene obtained	g
Theoretical yield	g
Percent yield obtained	%
M.p. of 1,3-dinitrobenzene	°C
Any conspicuous observation noted	

Pattern of T.Y.B.Sc. Theory and Practical Examinations in Applied Component as per The Revised Syllabus

For major applied component of Dyes and Drugs, the details are given below; For other applied components, similar scheme is to be followed.

Pattern of Theory Papers :

Paper – I : DRUGS (60 Marks) -

- As per the guidelines given by the Board of Studies regarding the theory question paper format, there shall be in all five questions of 12 marks each in the question paper. All the questions shall be compulsory.
- The first question shall consist of ten short-answer type sub-questions, six of which carrying two marks each and four carrying three marks each. Student will answer five question (12 marks). These sub-questions shall be so framed as to cover both the units with equal weightage and student will have to answer for each unit equally.
- There shall be four other questions, two of which shall have internal options (i.e. sub-questions may be given with options), while the remaining two questions shall have external options, viz, entire question will be given an optional alternative question. The sub-questions from each question shall be framed in such a way that they cover the corresponding topics almost entirely. While doing this, as far as possible, the weightages of different topics given in the syllabus, in the form of number of lectures, be reflected in the weightages of the marks given.
- The total number of marks assigned for the entire question paper shall be 120 out of which the compulsory component shall be of 60 marks - 12 marks for the first question and 48 marks for Q.2 to Q.5. Thus, Q.2 to Q.5 shall be set for a total of 6 marks.

The distribution of the units in the syllabus for the questions shall be as under:

Question No.	Units
1	I & II
2	I
3	II
4	I & II
5	I & II

Each question from Qs.2-5 shall contain sub-questions, each carrying 3-6 marks.

Section: PYQS (60 Marks) -

In accordance with the guidelines given by the Board of Studies regarding the theory question paper format, there shall be in all five questions of 12 marks each in the question paper. All the questions shall be compulsory.

The first question shall consist of ten short-answer type sub-questions, six of which carrying two marks each and four carrying three marks each. These sub-questions shall be so framed as to cover both the units with equal weightage.

There shall be four other questions, two of which shall have internal options (i.e. sub-questions may be given with options), while the remaining two questions shall have external options, viz. entire question will be given an optional alternative question. The sub-questions from each question shall be framed in such a way that they cover the corresponding topics almost entirely. While doing this, as far as possible, the weightages of different topics given in the syllabus, in the form of number of lectures, be reflected in the weightages of the marks given.

The total number of marks assigned for the entire question paper shall be 120 out of which the compulsory component shall be of 60 marks - 12 marks for the first question and 48 marks for Q.2 to Q.5. Thus, Q.2 to Q.5 shall be set for a total of 96 marks.

The distribution of the units in the syllabus for the questions shall be as under:

Question No.	Units
1	I & II
2	I
3	II
4	I & II
5	I & II

- (l) Each question from Qs.2-5 shall contain sub-questions, each carrying 3-6 marks.

Pattern of Practical Examination :

1. (a) Preparation: (30 Marks) -

- (1) 2-3 g of the starting compound should be given.
- (2) If the starting compound is a liquid and if it is given in volume, the density of the liquid should be supplied.
- (3) The entire product should be crystallized. The solvent of crystallization should be given in the procedure.
- (4) Marks shall be given on the basis of quality and the quantity of the product as given below:

m.p.	-	4 marks
Quality	-	8 marks
Yield	-	18 marks

- (5) While assigning marks, the yield and quality of the product obtained by the experts should be taken into account.
- (6) **Yield:** The +/- 5% of the highest *possible* yield (under the prevailing conditions), but <100%, be given full credit, and from this as far as possible a downward linear sliding scale be developed with a gradient of 0.5 g
- (7) **Quality:** The samples of all the students be internally compared and also compared with the sample of the expert, while assigning marks for the product. Marks should be given in integers only.

(b) Journal (Drugs & Dyes Preparations) ; 05 Marks

2. (a) Estimation : (25 Marks)

- (1) Students shall prepare standard solutions in 100 mL standard flasks.
- (2) Estimation volumes shall be in the range of 12 to 20 mL to be given in 100 mL standard flasks.
- (3) Marks shall be allotted as follows :

- i) For only on reading type estimations ;

Estimation Reading	: 22 marks
Calculations	: 03 marks
- ii) For standardization and estimation type exercises :

Standardization	: 05 marks
Estimation Reading	: 17 marks
Calculations	: 03 marks

(m) Journal (Drugs & Dyes Estimations) ; 05 Marks

3. Viva-voce Examination : 15 marks –

Viva-voce examination shall be conducted only on the practical syllabus of Drugs & Dyes.

Schedule for Practical Examination :

- Preparation shall be given in the morning session and the candidate should submit the preparation paper in the evening one hour prior to the completion of the examination time.
- Estimation shall be given in the evening session. However, if the estimation experiment involves reflux, it shall be given in the morning session one hour prior to the lunch break. Also, candidates shall be asked to prepare standard solution in the morning session one hour prior to the lunch break.

The above revised guidelines have been brought into force with effect from the academic year 2005-2006.

MUMBAI-400 032

3rd August, 2005

The Principals, of the affiliated colleges in Science

AC/4.37/14.06.05

No.UG/ 307- A of 2005, MUMBAI-400 032

for REGISTRAR

3rd August, 2005

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- 1) The Dean, Faculty of Science
- 2) The Chairman, Board of Studies in Chemistry

for REGISTRAR

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