

# DEPARTMENT OF CHEMISTRY

## COURSE CURRICULUM & MARKING SCHEME

# B.Sc. PART – II & III INDUSTRIAL CHEMISTRY

SESSION : 2022-23



ESTD: 1958

## GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A<sup>+</sup>, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - [www.govtsciencecollegedurg.ac.in](http://www.govtsciencecollegedurg.ac.in), Email – [autonomousdurg2013@gmail.com](mailto:autonomousdurg2013@gmail.com) .



DEPARTMENT OF CHEMISTRY

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG

Approved syllabus for B.Sc. INDUSTRIAL CHEMISTRY by the members of  
Board of Studies for the Session

2022-23

The syllabus with the paper combinations is as under

B. Sc. I:

|   |   |
|---|---|
| Paper I: INDUSTRIAL ASPECTS OF ORGANIC & INORGANIC CHEMISTRY  | Paper II: INDUSTRIAL ASPECTS OF PHYSICAL CHEMISTRY, MATERIAL AND ENERGY BALANCE |
| Paper III: UNIT OPERATION IN CHEMICAL INDUSTRY AND UTILITIES, FLUID FLOW AND HEAT TRANSPORT IN INDUSTRY | Practical : INDUSTRIAL CHEMISTRY  |

B.Sc.II :

|                                      |                                   |
|--------------------------------------|-----------------------------------|
| Paper I: INDUSTRIAL CHEMISTRY-I      | Paper II: INDUSTRIAL CHEMISTRY-II |
| Paper III : INDUSTRIAL CHEMISTRY-III | Practical: INDUSTRIAL CHEMISTRY   |

B.Sc. III:

|  |                                 |
|--|---------------------------------|
| Paper I: CHEMICAL PROCESS AND INDUSTRIAL ECONOMICS | Paper II: PHARMACEUTICALS       |
| Paper III : DRUGS                                  | Practical: INDUSTRIAL CHEMISTRY |

**Note:** Industrial visits/ training is mandatory for all students as part of curriculum.

The syllabus for B.Sc. Ind. Chemistry is hereby approved for the session 2022 - 23

NAME AND SIGNATURE:

|   | Departmental members      |         |
|---|---------------------------|---------|
| Chairperson /H.O.D .....  | 1.....                    | 8.....  |
| Subject Expert .....<br>(University Nominee)                    | 2.....                    | 9.....  |
| Subject Expert.....<br><i>S.2</i><br><i>in Name of</i>          | 3.....                    | 10..... |
| Representative .....<br>(Industry)                              | 4.....                    | 11..... |
| Representative <i>Dr. Bhawana Jain</i><br>(Alumni)              | 5.....<br><i>Divastan</i> | 12..... |
| Representative .....<br>(Professor Science Faculty Other Dept.) | 6.....<br><i>B. Jain</i>  | 13..... |
| Student Representative  | 7.....                    | 14..... |

# DIRECTIVES FOR STUDENTS OF PART-I, II & III

2022-23

## EVALUATION PATTERN

Theory Paper - I : 34 marks; Paper – II & III: 33 marks

Practical: 50 marks

### Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper for UG Classes is to be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (No Multiple choice questions. No 'fill in the blank' type Questions)
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows:

| Question Type         | MM 33<br>(Marks x No. of Questions) | MM 34<br>(Marks x No. of Questions) |
|-----------------------|-------------------------------------|-------------------------------------|
| A (Very short Answer) | 8x1 = 08                            | 1x9 = 09                            |
| B (Short Answer)      | 2x5 = 10                            | 2x5 = 10                            |
| C (Long Answer)       | 3x5 = 15                            | 3x5 = 15                            |

6. The half yearly internal examinations will be held for Part-I, Part-II & Part III. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.

### NAME AND SIGNATURE:

|  |   |
|--|---|
| Chairperson /H.O.D.....   | Departmental members:<br><br><br><br><br><br><br> |
| Subject Expert.....<br>(University Nominee)  |   |
| Subject Expert.....   |   |
| Representative..... <br> | <br>Student Representative   |





## B.Sc. ( with INDUSTRIAL CHEMISTRY)

### Programme Specific Outcome (PSO):

*Upon completion of B.Sc. Degree Programme (with Industrial Chemistry), the students would be able*

PSO1: To have a knowledge of history, development, fundamentals and uses of various aspects in Industrial Chemistry.

PSO2: To explain the concepts and application of chemistry in various industries.

PSO3: To acquaint with the principles/concepts/pre-requisites/management involved in industries.

PSO4: To understand the various processes of industries through theory, project and industrial visits.

PSO5: To get familiarized with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments.

PSO6: To carry out experiments, record the observations and present the inference/results.

### NAME AND SIGNATURE:

|   |  | Departmental members |         |
|---|--|----------------------|---------|
| Chairperson /H.O.D .....                |  |                      |         |
| Subject Expert .....                    |  | 1.....               | 8.....  |
| (University Nominee)                    |  | 2.....               | 9.....  |
| Subject Expert.....                     |  | 3.....               | 10..... |
| Representative .....                    |  | 4.....               | 11..... |
| (Industry)                              |  | 5.....               | 12..... |
| Representative .....                    |  | 6.....               | 13..... |
| (Alumni)                                |  | 7.....               | 14..... |
| Representative .....                    |  |                      |         |
| (Professor Science Faculty Other Dept.) |  |                      |         |
| Student Representative                  |  |                      |         |

**Syllabus and Marking Scheme for Second Year  
2022-23**

| Paper No.    | Marks Allotted in Theory |     |
|--------------|--------------------------|-----|
|              | Max                      | Min |
| I            | 34                       | 33  |
| II           | 33                       |     |
| III          | 33                       |     |
| IV Practical | 50                       | 17  |
| <b>Total</b> | <b>150</b>               |     |

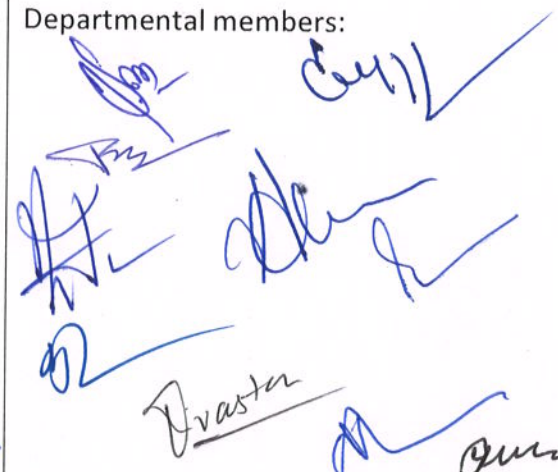
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|-------------------------|---|------------|
| <b>03 Theory papers</b> | - | <b>100</b> |
| <b>01 Practical</b>     | - | <b>50</b>  |
| <b>Total Marks</b>      | - | <b>150</b> |

**Note:**

- The half yearly internal examinations will be held. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.
- Industrial visits/ training is mandatory for all students as part of curriculum.

The syllabus for B.Sc. Ind. Chemistry is hereby approved for the session 2022 - 23

**NAME AND SIGNATURE:**

|  |  |
|--|--|
| Chairperson /H.O.D..... <u>Asli</u><br><br>Subject Expert.....<br>(University Nominee)<br>Subject Expert..... <u>S.2</u> <u>gus</u><br><br>Representative..... <u>Dr. Bhawans Jai</u><br><u>B. Jai</u> | Departmental members:<br><br><br><u>Prastu</u><br>Student Representative |
|--|--|

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# B. Sc. II (INDUSTRIAL CHEMISTRY)

2022-23

## PAPER- I

### Course Outcome (CO):

*After completion of the course, the students would be able:*

- CO1: To have basic idea of material science, nature of materials and manufacturing of quality products.
- CO2: To gain insight into various materials - metals and alloys, cement and ceramics, their properties, applications, manufacturing process and its economic relevance.
- CO3: To understand about polymeric material and composites, physico-chemical properties and correlations between structure and properties in polymeric materials with wide industrial applications and composite structures.
- CO4: To learn about glasses with one or more components, formation, crystallization, physico-chemical properties, production and applications.
- CO5: To acquire basic electrochemical knowledge of corrosion processes, corrosion forms and their repercussions and able to apply corrosion protection measures.
- CO6: To gain knowledge of the different types of pollution from industries, their effects, environmental regulatory legislations and standards and evaluation methods.

### NAME AND SIGNATURE:

|   | Departmental members |         |
|---|----------------------|---------|
| Chairperson /H.O.D .....  |                      |         |
| Subject Expert .....<br>(University Nominee)                    | 1.....               | 8.....  |
| Subject Expert.....   | 2.....               | 9.....  |
| Representative .....<br>(Industry)                              | 3.....               | 10..... |
| Representative .....<br>(Alumni)                                | 4.....               | 11..... |
| Representative .....<br>(Professor Science Faculty Other Dept.) | 5.....               | 12..... |
|   | 6.....               | 13..... |
|   | 7.....               | 14..... |

Student Representative

## B. Sc. II (INDUSTRIAL CHEMISTRY)

2022-23

### PAPER- I

Max. Marks – 34

**UNIT- 1 Material science:**

Mechanical Properties of material and change with respect to temperature.

**Material of constructions used in Industry:**

**Metals and Alloys:**

Important metals alloys, iron, copper, aluminum, lead, nickel, titanium and their alloys- mechanical and chemical properties and their applications.

**Cement:**

Types of cement, composition, manufacturing process, setting of cement.

**Ceramic:**

Introduction, Types, Manufacturing process, Applications, Refractories.

**UNIT- 2 Polymeric materials:**

Industrial polymer and composite materials. their constitution, chemical and physical properties, industrial applications.

**UNIT- 3 Glass:**

Types, composition, manufacture, physical and chemical properties, Applications.

**Corrosion:**

Various types of corrosion relevant to chemical industry-mechanism and preventive method.

**UNIT- 4 Pollution:**

Air, oxygen, nitrogen cycle, water, biosphere, flora and fauna, energy, Soil. Pollutants and their statutory limits, pollution evaluation methods.

**UNIT- 5 Air pollution:**

Various pollutants, water pollution - organic/inorganic pollutants, noise pollution, sewage analysis, pesticide pollution, radiation pollution, green house effect, future.

**REFERENCE BOOKS:**

1. Pollution control in chemical & allied industries, S.P.Mahajan.
2. Pollution Control in Industries, A Series of Books by Jones H.P.
3. Air Pollutions –Vol. 1 to 4, Editor Stern, A.C. Academic Press.
4. Environmental Engineering, G.N. Pandey, Tata Mc Graw, Hill.
5. Hand Book of Air Pollution, A. Parker, Tata Mc Graw, Hill.
6. Science of Ceramic chemical processing, Hench L.L.
7. Science of Ceramics, Stewarts G.H.
8. Chemistry of Cement
9. Properties of Glass, Morcy G.W.
10. Chemistry of Glasses, Paul A.
11. Corrosion-causes and prevention, Spellur F.N.

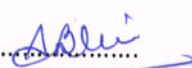




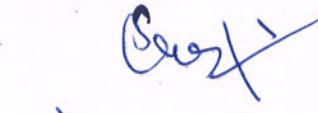

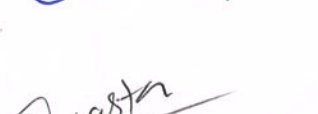
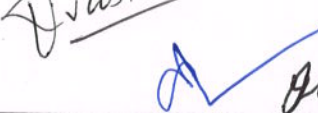

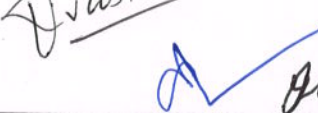
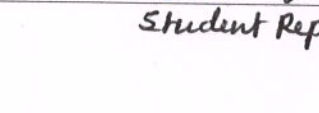
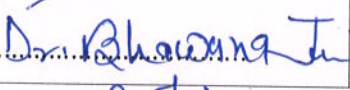
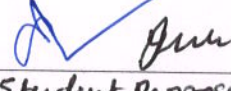


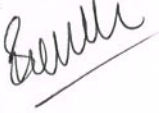
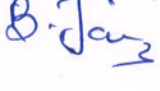
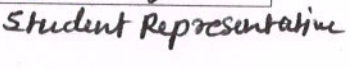
Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper for UG Classes is to be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. **(No Multiple choice questions. No 'fill in the blank' type Questions)**
3. Section B shall contain short answer type questions with the limit of 150 words.
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5. The scheme of marks should be as follows:

| Question Type         | MM 34 (Marks x No. of Questions) |
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| A (Very Short Answer) | 1x9 = 09                         |
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| C (Long Answer)       | 3x5 = 15                         |

**NAME AND SIGNATURE:**

|   |   |
|---|---|
| Chairperson /H.O.D.....  | Departmental members:<br><br><br><br> |
| Subject Expert.....<br>(University Nominee)   | <br><br><br>                      |
| Subject Expert.....      | <br>  |
| Representative.....      |    |



B. Sc. II (INDUSTRIAL CHEMISTRY)

2022-23

PAPER- II

Course Outcome (CO):

*After completion of the course, the students would be able:*

- CO1: To understand about unit processes in organic chemicals manufacture involving nitration, nitrating agents, kinetics and mechanism of nitration processes.
- CO2: To gain knowledge about halogenation, kinetics, reagents for halogenation, commercial manufacture of chloro-compounds.
- CO3: To understand about sulphonation, sulphonating agents, chemical and physical factors, kinetics and mechanism of sulphonation reaction, commercial sulphonation.
- CO4: To acquaint with principles and equipments for effluent treatment and waste management.
- CO5: To know about filters, precipitators, eliminators, scrubbers, absorbers, solid waste management and industrial safety

NAME AND SIGNATURE:

|  | Departmental members  |                        |
|--|-----------------------|------------------------|
| Chairperson /H.O.D ..... <i>AShu</i>   |                       |                        |
| Subject Expert .....<br>(University Nominee)                                   | 1. <i>[Signature]</i> | 8. <i>[Signature]</i>  |
| Subject Expert ..... <i>S2</i>   | 2. <i>[Signature]</i> | 9. <i>[Signature]</i>  |
| Subject Expert ..... <i>n Mishra</i>   | 3. <i>[Signature]</i> | 10. <i>[Signature]</i> |
| Representative .....<br>(Industry)   | 4. <i>[Signature]</i> | 11. <i>[Signature]</i> |
| Representative ..... <i>Dr. Bhawana Jain</i><br>(Alumni)                       | 5. <i>[Signature]</i> | 12. ....               |
| Representative ..... <i>B. Jain</i><br>(Professor Science Faculty Other Dept.) | 6. <i>[Signature]</i> | 13. ....               |
| Student Representative   | 7. <i>[Signature]</i> | 14. ....               |

## B. Sc. II (INDUSTRIAL CHEMISTRY)

2022-23

### PAPER- II

Max. Marks – 33

**UNIT- 1** Unit processes in organic chemicals manufacture-  
**Nitration:** Introduction, Nitrating agents, kinetics and mechanism of nitration processes such as nitration of:

- Paraffinic hydrocarbons
- Benzene to nitrobenzene and m-dinitrobenzene
- Chlorobenzene to o- and p- nitrochloro benzenes
- Acetanilide to p-nitro acetanilide.
- Toluene

Continuous vs. batch nitration.

**UNIT-2** **Halogenation:**  
Introduction – kinetics of halogenation reactions, reagents for halogenations, Halogenation of aromatic-side and nuclear halogenations, commercial manufacture of chlorobenzenes, chloral, monochloroacetic acid and chloromethane, dichlorodifluoro methane.

**UNIT-3** **Sulphonation:**  
Introduction, sulphonating agents, chemical and physical factors in sulphonation. Kinetics and mechanism of sulphonation reaction, Commercial sulphonation of benzene, naphthalene, alkyl benzene, batch vs. continuous sulphonation.

**UNIT- 4** **Effluent treatment and waste management:**  
Principles and equipments for aerobic, anaerobic treatment adsorption, filtration, sedimentation.

**UNIT- 5** Bag filters, electrostatic precipitator, mist eliminators, wet scrubbers, absorbers, solid waste management Industrial safety.

#### REFERENCE BOOKS:

- Unit process in Organic synthesis P.M. Groggins, McGrawHill.
- Effluent Treatment in process Industries - Inst. of Chem.Engg.
- Effluent Treatment and waste Disposal –Inst. of Chem.Engg.
- Effluent Treatments and Disposal –Inst. of Chem.Engg.



**Question Paper Format and Distribution of Marks for Under Graduate Examination**

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3. Section B shall contain short answer type questions with the limit of 150 words.
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5. The scheme of marks should be as follows:

| Question Type         | MM 33 (Marks x No. of Questions) |
|-----------------------|----------------------------------|
| A (Very Short Answer) | 1x8 = 08                         |
| B (Short Answer)      | 2x5 = 10                         |
| C (Long Answer)       | 3x5 = 15                         |

**NAME AND SIGNATURE:**

|  |                                       |
|--|---------------------------------------|
| Chairperson /H.O.D..... <i>Asli</i>              | Departmental members:                 |
| Subject Expert.....                              | <i>[Signature]</i> <i>[Signature]</i> |
| (University Nominee)                             | <i>[Signature]</i> <i>[Signature]</i> |
| Subject Expert..... <i>S2</i> <i>[Signature]</i> | <i>[Signature]</i> <i>[Signature]</i> |
| <i>[Signature]</i>                               | <i>[Signature]</i> <i>[Signature]</i> |
| Representative..... <i>Dr. Sharda Ji</i>         | <i>[Signature]</i> <i>[Signature]</i> |

*[Signature]*

*B. Jais*

Student Representative

**B. Sc. II (INDUSTRIAL CHEMISTRY)**

**2022-23**

**PAPER- III**

**Course Outcome (CO):**

*After completion of the course, the students would be able:*

CO1: To understand about oxidation reaction, oxidising agents, commercial manufacture of important organic compound by oxidation.

CO2: To gain knowledge about hydrogenation reaction, catalysts for hydrogenation, manufacture of organic compounds.

CO3: To understand about esterification and amination reaction and amination by reduction and ammonolysis.

CO4: To understand concept of construction, principle and working of temperature and pressure measuring instruments.

CO5: To know about liquid level measurement, density and viscosity measurement.

**NAME AND SIGNATURE:**

|  | Departmental members  |                        |
|--|-----------------------|------------------------|
| Chairperson /H.O.D ..... <i>A. Beni</i>  |                       |                        |
| Subject Expert .....<br>(University Nominee)                                       | 1. <i>[Signature]</i> | 8. <i>[Signature]</i>  |
| Subject Expert ..... <i>S. L. Beni</i>   | 2. <i>[Signature]</i> | 9. <i>[Signature]</i>  |
| Representative .....<br>(Industry)   | 3. <i>[Signature]</i> | 10. <i>[Signature]</i> |
| Representative ..... <i>Dr. Bhawana Jain</i><br>(Alumni)                           | 4. <i>[Signature]</i> | 11. <i>[Signature]</i> |
| Representative ..... <i>[Signature]</i><br>(Professor Science Faculty Other Dept.) | 5. <i>[Signature]</i> | 12. <i>[Signature]</i> |
| Student Representative   | 6. <i>[Signature]</i> | 13. ....               |
|  | 7. <i>[Signature]</i> | 14. ....               |



## B. Sc. II (INDUSTRIAL CHEMISTRY)

2022-23

### PAPER- III

Max. Marks – 33

#### UNIT-1

##### **Oxidation:**

Introduction, Types of oxidation reactions, oxidizing agents, kinetics and mechanism of oxidation of organic compounds liquid phase oxidation, vapour phase oxidation, commercial manufacture of benzoic acid, maleic anhydride, phthalic anhydride, acrolein, acetaldehyde, acetic acid.

#### UNIT-2

##### **Hydrogenation:**

Introduction, kinetics and thermodynamics of hydrogenation reactions, catalysts for hydrogenation reactions, hydrogenation of vegetable oil. Manufacture of methanol from carbon monoxide and hydrogen, hydrogenation of acid and esters to alcohols, catalytic reforming.

##### **Alkylation:**

Introduction; Types of alkylation, alkylating agents. Thermodynamics and mechanism of alkylation reactions, manufacture of alkyl benzene (for detergent manufacture), ethyl benzene, phenyl ethyl alcohol, N-alkyl anilines (mono and di methylanilines)

#### UNIT-3

##### **Esterification:**

Introduction, hydrodynamics and kinetics of esterification reactions, Esterification by organic acids, by addition of unsaturated compounds, esterification of carboxy acid derivatives, commercial manufacture of ethyl acetate, dioctyl phthalate, vinyl acetate, cellulose acetate.

##### **Amination**

**(A) By reduction:** Introduction , methods of reduction - metal and acid, catalytic, sulfide, electrolytic, metal and alkali sulfites, metal hydrides, sodium metal, concentrated caustic oxidation, reduction, commercial manufacture of aniline, m-nitro aniline, p-aminophenol.

**(B) By aminolysis:** Introduction, aminating agents, factors affecting aminolysis.

**Hydrolysis:** Introduction, hydrolyzing agents, kinetics, thermodynamics and mechanism of hydrolysis.

#### UNIT-4

##### **Process Instrumentation:**

Concept of measurement and accuracy, principle, construction and working of following measuring instruments.

##### **Temperature:**

Glass thermometers, bimetallic thermometer, pressure spring thermometer, vapour filled thermometers, resistance thermometers, radiation pyrometers.

**Pressure:** Manometers, barometers, bourdon pressure gauge, bellow type, diaphragm type pressure gauges, Macleod gauges, pirani gauges, etc.

#### UNIT-5

**Liquid level:** Direct-indirect liquid level measurement, Float type liquid level gauge, ultrasonic level gauges, bubbler system, density measurement, viscosity \ measurement.

**REFERENCE BOOKS:**

1. Unit process in organic synthesis, P.M. Groggins, Mc GrawHill.
2. Industrial Instrumentation, Bekmen, D. P. JohnWileys.
3. Applied Instrumentation in process Industries, Vol. I, II & III Andrew, W. G. GulfPublication.
4. Instrumentation and Control for the process Industries, Borer, S.E levier Applied SciencePublishers.
5. Chemical Engineer's Hand book, Perry, J.H. and Green, D. Mc GrawHill.

**Question Paper Format and Distribution of Marks for Under Graduate Examination**

1. The question paper for UG Classes is to be divided into three Sections - A, B &C.
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**NAME AND SIGNATURE:**

|   |                                       |
|---|---------------------------------------|
| Chairperson /H.O.D..... <i>[Signature]</i>  | Departmental members:                 |
| Subject Expert.....<br>(University Nominee) | <i>[Signature]</i> <i>[Signature]</i> |
| Subject Expert..... <i>[Signature]</i>      | <i>[Signature]</i> <i>[Signature]</i> |
| Representative..... <i>Dr. Bhawana Jain</i> | <i>[Signature]</i> <i>[Signature]</i> |
| <i>[Signature]</i>                          | <i>[Signature]</i>                    |
| <i>B Jain</i>                               | <i>Student Representative</i>         |



# B. Sc. II (INDUSTRIAL CHEMISTRY)

2022-23

## PRACTICAL

Duration of Examination: 04Hrs.

Max. Marks – 50

### UNIT PROCESS:

One to two examples of each of the following.  
Nitration, Sulphonation, Friedel-crafts reaction, Esterification, Hydrolysis, Oxidation,  
Halogenation, Chloro-Sulphonation, Reduction, Polymerisation, Reaction of diazonium salts.

### INSTRUMENTAL METHODS OF ANALYSIS:

Use of colorimeter, pH meter, Potentiometer, Conductometer, Refractometer, Polarimeter.

### MATERIAL TESTING :

Testing of alloys, Identification of plastics/rubber, estimation of yield point, Young's modulus, flaredness; Optical, Thermal, Mechanical and Electrical properties.

### PROCESS INSTRUMENTATION:

Transducers of different types, use of Transducers for measuring flow control. Determination of flash point and ignition points of liquids.

### WATER ANALYSIS:

Solid contents, hardness, COD and other tests as per industrial specifications.

### FLOW MEASURING DEVICES: Floats

Monographs of representative raw materials such as sulphuric acid, toluene, sodium carbonate, sodium hydroxide, carbon tetra chloride, benzoic acid (5-6 compounds).

Limit tests for heavy metals Pb, As, Hg, Fe and ash content.

### QUALITATIVE ANALYSIS:

Analysis of heavy metals in industrial wastes.  
Analysis of Cu, Ni and Al in coin/brass/solder material.  
Analysis of silver jewelry.

### QUATITATIVE ANALYSIS:

Determination of moisture content in cement.  
Determination of volatile content in coal.  
Determination of ash content in coal.

### NAME AND SIGNATURE:

|   |   |
|---|---|
| Chairperson /H.O.D..... <i>Arshi</i>      | Departmental members:<br><i>[Signatures]</i><br><i>Divastar</i> |
| Subject Expert.....                       |   |
| (University Nominee)                      |   |
| Subject Expert..... <i>S2</i>             |   |
| Representative..... <i>Dr. Bhawana Ja</i> |   |

*[Signature]*  
Student Representative - *[Signature]*

## Syllabus and Marking Scheme for Third Year

2022-23

| Paper No. | Title of the Paper                        | Marks Allotted in Theory |     |
|-----------|---|--------------------------|-----|
|           |   | Max                      | Min |
| I         | CHEMICAL PROCESS AND INDUSTRIAL ECONOMICS | 34                       | 11  |
| II        | PHARMACEUTICAL CHEMISTRY                  | 33                       | 11  |
| III       | DRUGS                                     | 33                       | 11  |
| IV        | Practical                                 | 50                       | 17  |
|           | <b>Total</b>                              | <b>150</b>               |     |

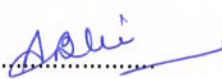
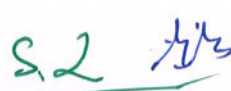
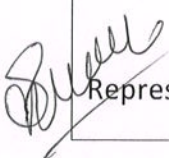
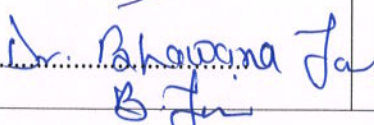
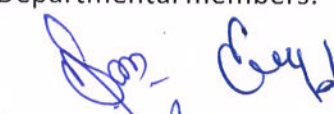


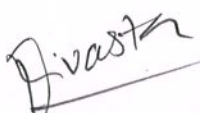
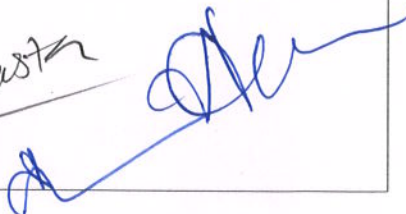
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|--------------------|---|------------|
| 03 Theory papers   | - | 100        |
| 01 Practical       | - | 50         |
| <b>Total Marks</b> | - | <b>150</b> |

**Note:**

- The half yearly internal examinations will be held. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.
- Industrial visits/ training is mandatory for all students as part of curriculum.

The syllabus for B.Sc. Ind. Chemistry is hereby approved for the session 2022- 23

**NAME AND SIGNATURE:**

|  |  |
|--|--|
| Chairperson /H.O.D..... <br><br>Subject Expert.....<br>(University Nominee)<br>Subject Expert..... <br> Representative.....  | Departmental members:<br><br><br><br><br> |
|--|--|

Student Representative - 



**B. Sc. III (INDUSTRIAL CHEMISTRY)**

**2022-23**

**PAPER-I**

**CHEMICAL PROCESS AND INDUSTRIAL ECONOMICS**

**Course Outcome (CO):**

*After completion of the course, the students would be able:*

CO1: To gain knowledge of the process of estimating the costs associated with completing a project within scope and according to its timeline.

CO2: To understand about various resources for fixed assets and land and gain knowledge regarding start-up.

CO3: To determine the real value of assets and fixing right price for products.

CO4: To develop ability to calculate profit.

CO5: To learn about management skills and become efficient managers.

CO6: To deal with controlling and regulating the flow of material in relation to changes in variables like demand, prices, availability, quality, delivery schedules etc.

**NAME AND SIGNATURE:**

|   |  | Departmental members |         |
|---|--|----------------------|---------|
| Chairperson /H.O.D .....  |  |                      |         |
| Subject Expert .....<br>(University Nominee)                    |  | 1.....               | 8.....  |
| Subject Expert.....   |  | 2.....               | 9.....  |
| Representative .....<br>(Industry)                              |  | 3.....               | 10..... |
| Representative .....<br>(Alumni)                                |  | 4.....               | 11..... |
| Representative .....<br>(Professor Science Faculty Other Dept.) |  | 5.....               | 12..... |
|   |  | 6.....               | 13..... |
|   |  | 7.....               | 14..... |

Student Representative

## B. Sc. III (INDUSTRIAL CHEMISTRY)

2022-23

### PAPER- I

## CHEMICAL PROCESS AND INDUSTRIAL ECONOMICS

Max. Marks – 34

- UNIT-1**
1. Factors involved in project cost estimation, methods employed for the estimation of capital investment.
  2. Capital formation, elements of cost accounting.
- UNIT-2**
1. Interest & investment cost, time value of money equivalence.
  2. Depreciation, method of determining depreciation, taxes.
  3. Some aspects of marketing, pricing policy.
- UNIT-3**
1. Profitability criteria, economics of selecting alternatives
  2. Variation of costs with capacity. Break - even point, optimum batch sizes, Production, scheduling etc.
  3. Sampling of Bulk materials, techniques of sampling of solids, liquids and gases.
  4. Collection & processing data.
  5. Particle size determination.
  6. Rheological properties of liquids, plastics and their analysis.
- UNIT-4**
- Industrial Organization**
1. Concept of scientific management in industry.
  2. Functions of management, decision making, planning, organizing, directing & control.
  3. Location of industry.
- UNIT-5**
1. Materials management.
  2. Inventory control.
  3. Management of human resources - Selection, incentives, Welfare & safety.

### REFERENCE BOOKS:

1. Industrial Organization & Management, Bethal ,L.L.
2. Industrial Organization & Management, Tarachand , Vol.I&II.
3. Book on Management , Khandelwal, O.P.
4. Rheology Theory & Application, Vol , 5, Elrich ,R.F.
5. Economics of Chemical Industry, Hempel , E.H.
6. Plant Design & Economics for Chemical Engineers , Peter Time Rhaus, Mc GrawHill.
7. I.C.M.A. Booklets -9&10



**Question Paper Format and Distribution of Marks for Undergraduate Classes**

1. The question paper for UG Classes is to be divided into three Sections.
2. Section A shall contain very short answer type questions (answers in one or two sentences) or objective type questions. **(No Multiple choice questions, No 'blank' type Questions)**
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The student is required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows:

| Question Type         | MM 34 (Marks x No. of Questions) |
|-----------------------|----------------------------------|
| A (Very Short Answer) | 1x9 = 09                         |
| B (Short Answer)      | 2x5 = 10                         |
| C (Long Answer)       | 3x5 = 15                         |

**NAME AND SIGNATURE:**

|   |  |
|---|--|
| Chairperson /H.O.D..... <u>Dr. B. Jais</u><br><br>Subject Expert.....<br>(University Nominee)<br><br>Subject Expert..... <u>Dr. Bhaugna Jais</u><br>Representative..... <u>Dr. Bhaugna Jais</u> | Departmental members:<br> |
|---|--|

Dr. Bhaugna Jais

Dr. Bhaugna Jais

Dr. Bhaugna Jais  
Student Representative - Jais

## B. Sc.- III (INDUSTRIAL CHEMISTRY)

2022-23

### PAPER- II PHARMACEUTICALS

#### Course Outcome (CO):

*After completion of the course, the students would be able:*

- CO1: To correlate and compare historical background/development of Indian and other important pharmacopoeias and understand formulations/routes of administration/aseptic conditions/sterilization and need for sterilization in pharmaceuticals.
- CO2: To describe the manufacture and quality specifications of pharmaceutical excipients/additives and applications of sutures, ligatures in surgical dressing.
- CO3: To acquaint with the packaging/ancillary materials, machinery and important legal aspects of food and drugs industry.
- CO4: To explain and compare the various statistical tools, testing methods employed for pharmaceutical quality control.
- CO5: To understand fundamentals and applications of crystallization, distillation, extraction techniques and various chromatographic techniques like paper HPLC, GLC, TLC, column and ion chromatography for evaluation/identification of crude drugs.
- CO6: To describe the principle and applications of UV-Visible, IR, AAS, NMR spectroscopy, Flame photometry, X-Ray Fluorescence and Ion Selective Electrodes in pharmaceuticals.

#### NAME AND SIGNATURE:

|   | Departmental members            |                                  |
|---|---------------------------------|----------------------------------|
| Chairperson /H.O.D ..... <i>B. Sini</i> ..... |                                 |                                  |
| Subject Expert .....<br>(University Nominee)  | 1..... <i>[Signature]</i> ..... | 8..... <i>[Signature]</i> .....  |
| Subject Expert..... <i>[Signature]</i> .....  | 2..... <i>[Signature]</i> ..... | 9..... <i>[Signature]</i> .....  |
| Representative .....<br>(Industry)            | 3..... <i>[Signature]</i> ..... | 10..... <i>[Signature]</i> ..... |
| Representative ..... <i>B. J. J.</i> .....    | 4..... <i>[Signature]</i> ..... | 11..... <i>[Signature]</i> ..... |
| Representative ..... <i>[Signature]</i> ..... | 5..... .....                    | 12..... .....                    |
| Representative ..... <i>[Signature]</i> ..... | 6..... <i>[Signature]</i> ..... | 13..... .....                    |
| Representative ..... <i>[Signature]</i> ..... | 7..... <i>[Signature]</i> ..... | 14..... .....                    |
| Student Representative - <i>[Signature]</i>   | <i>[Signature]</i>              |                                  |



## B. Sc. III (INDUSTRIAL CHEMISTRY)

2022-23

### PAPER- II PHARMACEUTICALS

Max. Marks – 33

- UNIT- 1**
1. Historical background & development of pharmaceutical industry in India in brief.
  2. Pharmacopoeias - Development of Indian pharmacopoeia & introduction of B.P., U.S.P., E.P., N.F & other important Pharmacopoeias.
  3. Introduction to various types of formulations & routes of administration.
  4. Aseptic conditions, need for sterilization, various methods of sterilization.
- UNIT- 2**
1. Various types of pharmaceutical excipients, their chemistry, process of manufacture & quality specifications. Glidants, lubricants, diluents, preservatives, antioxidants, emulsifying agents, coating agents, binders, coloring agents, flavouring agents, gelatin and other additives, sorbitol, mannitol, viscosity builders etc.
  2. Surgical dressing, sutures, ligatures with respect to the process, equipments used for manufacture, method of sterilization and quality control.
- UNIT- 3**
1. Pharmaceutical packaging introduction, package selection, packaging materials, ancillary materials, packaging machinery, quality control of packaging materials.
  2. F.D.A. Important schedules & some legal aspects of drugs.
  3. Pharmaceutical quality control (other than analytical methods covered under core subject) sterility testing, pyrogenic testing, glass testing, bulk density of powder etc.
- UNIT- 4**
1. Evaluation of crude drugs - Moisture content, extractive value, volatile oil content, foreign organic matter, quantitative microscopic exercises, including starch, leaf content, (palisade ratio stomatal number & index vein, islet number & vein termination number) crude fiber content introduction to chromatographic method for identification of crude drugs.
  2. Chromatography: Paper chromatography, TLC, HPLC, GLC.
  3. Ion chromatography.
- UNIT-5**      INSTRUMENTATION
1. UV-Visible spectroscopy
  2. IR- Spectroscopy non – dispersive IR
  3. NMR Spectroscopy
  4. Atomic absorption & Flame photometry
  5. X-Ray Fluorescence
  6. Ion Selective Electrodes
  7. Neutron Diffraction

#### REFERENCE BOOKS :

1. Instrumental methods of analysis, Willard, Merit, Dean.
2. Introduction to instrumental methods of analysis, Braun, R.D.      Mc GrawHill.
3. Analytical chemistry, J.B. Dick, McGraw Hill.
4. Quantitative Inorganic analysis, A. Vogel.

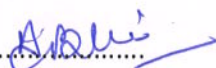
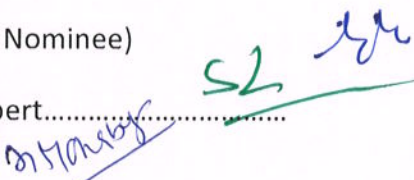
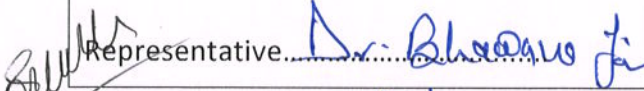
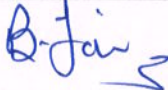







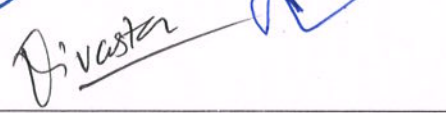
5. Instrumental methods of analysis, Skoog & West.
6. Instrumental methods of analysis, B.K. Sharma.
7. Practical Pharmacognosy, T.B.Wills
8. Practical Pharmacognosy, T.N.Vasudevan
9. Modern Pharmacognosy Remstad, Mc GrawHill
10. Indian Pharmacopoeia, 1985
11. British Pharmacopoeia, 1990
12. Hand Book of Drugs and Cosmetic Act., Mehrotra
13. Pharmaceutical excipients
14. Pharmaceutical Dosage forms.

**Question Paper Format and Distribution of Marks for Under Graduate Examination**

1. The question paper for UG Classes is to be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. **(No Multiple choice questions. No 'fill in the blank' type Questions)**
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows:

| Question Type         | MM 33 (Marks x No. of Questions) |
|-----------------------|----------------------------------|
| A (Very Short Answer) | 1x8 = 08                         |
| B (Short Answer)      | 2x5 = 10                         |
| C (Long Answer)       | 3x5 = 15                         |

**NAME AND SIGNATURE:**

|  |   |
|--|---|
| Chairperson /H.O.D..... <br><br>Subject Expert.....<br>(University Nominee)<br>Subject Expert..... <br>Representative..... <br><br><br>Student Representative.....  | Departmental members;<br><br><br><br><br><br><br>Divaster.....  |
|--|---|



**B. Sc. III (INDUSTRIALCHEMISTRY)**

**2022-23**

**PAPER- III**

**DRUGS**

**Course Outcome (CO):**

*After completion of the course, the students would be able:*

- CO1: To learn classification of crude drugs and manufacture of sulpha drugs.
- CO2: To have knowledge of chemical constitution of plants and isolation procedures for active ingredients for alkaloids.
- CO3: To get an introductory idea of Antimicrobial, Analgesic Barbiturates Blockers and Cardiovascular drugs.
- CO4: To understand the structure, function, deficiency disease caused by steroidal hormones and vitamins.
- CO5: To know about fermentation process and product processing.
- CO6: To gain insight into manufacture of antibiotics.

**NAME AND SIGNATURE:**

|   | Departmental members      |                            |
|---|---------------------------|----------------------------|
| Chairperson /H.O.D ..... <i>Aswini</i>        |                           |                            |
| Subject Expert .....<br>(University Nominee)  | 1..... <i>[Signature]</i> | 8..... <i>Carl</i>         |
| Subject Expert..... <i>5.2 [Signature]</i>    | 2..... <i>[Signature]</i> | 9..... <i>[Signature]</i>  |
| Subject Expert..... <i>[Signature]</i>        | 3..... <i>[Signature]</i> | 10..... <i>[Signature]</i> |
| Representative .....<br>(Industry)            | 4..... <i>[Signature]</i> | 11..... <i>[Signature]</i> |
| Representative ..... <i>Dr. Bhadrans Jain</i> | 5..... <i>[Signature]</i> | 12.....                    |
| (Alumni) <i>B. Jain</i>                       | 6.....                    | 13.....                    |
| Representative ..... <i>[Signature]</i>       | 7..... <i>[Signature]</i> | 14.....                    |
| (Professor Science Faculty Other Dept.)       |                           |                            |

*Student Representative - [Signature]*

## B. Sc. III (INDUSTRIALCHEMISTRY)

2022-23

PAPER- III

DRUGS

Max. Marks – 33

- UNIT- 1**
1. Phytochemicals - Introduction to plant classification & crude drugs, cultivation, collection, preparations for the market & storage of medicinal plants.
  2. Classification of various types of drugs with examples.
  3. Raw materials, process of manufacture, effluent handling, etc of the following bulk drugs: Sulpha drugs - sulphaguanidine, sulphamethoxazole.
- UNIT- 2**
1. Chemical constitution of plants including carbohydrates, amino acids, proteins, fats, waxes, volatile oils, terpenoids, steroids, saponins flavonoids, tannins, glycosides, alkaloids.
  2. Various isolation procedures for active ingredients with examples for alkaloids reserpine, one for steroids - sapogenin, diosgenin, diogron.
- UNIT- 3**
1. Antimicrobial: Chloramphenicol, Furazolidne, Mercurochrome, isoniazid, Na-PAS.
  2. Analgesic - Antinflammatory: Salicylic acid and its derivatives, Ibuprofen, Mefenamic acid.
  3. Steroidal Hormones: Progesterone, Testosterone, Methyltestosterone
- UNIT-4**
1. Vitamins: Vit. A, Vit.-B6 and Vit -C
  2. Barbiturates: Pentobarbital
  3. Blockers – Propranolol, Atenolol
  4. Cardiovascular Agent -Methyldopa
  5. Antihistamins - Chloropheneraminemelate
- UNIT-5**
1. Products based on fermentation processes: Brief idea of micro organisms, their structure, growth & usefulness. Enzyme systems useful for transformation, microbial products.
  2. General principles of fermentation processes & product processing.
  3. Manufacture of antibiotics - Penicillin - G & semi synthetic penicillin, Rifamycin, Vitamin -B12
  4. Bio transformation process for prednisolone, 11-hydroxylationin steroids.
  5. Enzyme catalysed transformation, manufacture of ephidrine.

### REFERENCE BOOKS:

1. Practical Pharmacognosy, T.B.Wills
2. Practical Pharmacognosy, T.N.Vasudevan
3. Modern Pharmacognosy Remstad, Mc GrawHill
4. Indian Pharmacopoea, 1985
5. British Pharmacopoea, 1990
6. Hand Book of Drugs and Cosmetic Act., Mehrotra
7. Pharmaceutical excipients
8. Pharmaceutical Dosage forms.
9. Principles of Medicinal Chemistry, W.O. Foye, Lea & Febigen, Publication Philadelphia.
10. Essentials of Medicinal Chemistry, Korolkovas & Burkhatler, Wiley Interscience.
11. Text book of Organic Medicinal and Pharmaceutical Chemistry, Wilson, Gisvold, Derge, Lippinett-Toppan.



**Question Paper Format and Distribution of Marks for Under Graduate Examination**

1. The question paper for UG Classes is to be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. **(No Multiple choice questions. No 'fill in the blank' type Questions)**
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| Question Type         | MM 33 (Marks x No. of Questions) |
|-----------------------|----------------------------------|
| A (Very Short Answer) | 1x8 = 08                         |
| B (Short Answer)      | 2x5 = 10                         |
| C (Long Answer)       | 3x5 = 15                         |

**NAME AND SIGNATURE:**

|   |   |
|---|---|
| <p>Chairperson /H.O.D..... <u>A. Bhu</u></p> <p>Subject Expert.....</p> <p>(University Nominee)</p> <p>Subject Expert..... <u>S.L. Jais</u></p> <p>Representative..... <u>D. Bhawana Jais</u></p> <p><u>B. Jais</u></p> | <p>Departmental members:</p> <p><u>Dev</u></p> <p><u>...</u></p> <p><u>...</u></p> <p><u>...</u></p> <p><u>Divastar</u></p> |
| <p><u>...</u></p> <p>Student Representative - <u>...</u></p>  |   |

## B. Sc. III (INDUSTRIAL CHEMISTRY)

### PRACTICAL

Duration of Examination: 08 hrs. spread over two days.

Max. Marks –50

#### Two experiments have to be performed

1. Synthesis of common industrial compounds involving two - step reactions.  
4 - bromoaniline, 3-Nitro aniline, Sulphanilamide, 4- Aminobenzoic acid,  
5 -- Nitrobenzoic acid , dihalobenzenes, Nitrohalobenzenes.
2. Industrial analysis of common raw materials as per industrial specification:  
Phenol, Aniline, Formaldehyde, Hydrogen peroxide, Acetone, Epoxide,  
Olefins,oils etc.
3. Demonstration of various pharmaceutical packaging materials, quality  
controltests of some materials, - A1 Strips, Cartons, Glass bottles
4. Limit tests for chlorine, heavy metals, arsenic etc. of two representative  
bulkdrug.
5. Demonstration of various pharmaceutical products.
6. Active ingredient analysis of few types of formulations representing different  
methods of analysis - acidimetry, alkalimetry, non-aqueous.
7. Determination of sulphate ash, loss of drying & other tests of bulk drugs,  
complete I P monograph of three drugs representing variety of testing  
methods.
8. Evaluation of crude drugs - macroscopic examination, determination &  
identification of starch granules, calcium oxalate.
9. Palisade ratio, stomatal index -determination and identification of few  
drugs,TLC method for identification.
10. Microbiological testing determination of mic of some antibacterial drugs by zone  
/cupplate method.
11. Spectrophotometric estimation of drugs – ciprofloxacin, paracetamol, etc.
12. Preparation of pharmaceutical formulations like cream, suspension and emulsions.
13. Determination of saponification value of oil/polymeric materials.
14. Determination of iodine value of oil/polymeric materials.
15. Quantitative analysis of jewelry.
16. Determination of ash content in polymeric substance.

#### DISTRIBUTION OF MARKS

|    |                   |   |           |
|----|-------------------|---|-----------|
| 1  | EXPERIMENT NO . 1 | - | 20        |
| 2  | EXPERIMENT NO. 2  | - | 10        |
| 3. | VIVA              | - | 05        |
| 4. | SESSIONAL         | - | 05        |
| 5  | PROJECT WORK      | - | 10        |
|    | <b>TOTAL</b>      | - | <b>50</b> |



**NAME AND SIGNATURE:**

|   |  | Departmental members  |                        |
|---|--|-----------------------|------------------------|
| Chairperson /H.O.D .....  | <u>A. B. Sui</u>                         |                       |                        |
| Subject Expert .....<br>(University Nominee)                    |  | 1. <u>[Signature]</u> | 8. <u>[Signature]</u>  |
| Subject Expert.....   | <u>[Signature]</u> <u>S. J.</u>          | 2. <u>[Signature]</u> | 9. <u>[Signature]</u>  |
| Representative .....<br>(Industry)                              |  | 3. <u>[Signature]</u> | 10. ....               |
| Representative .....<br>(Alumni)                                | <u>Dr. Bhavanna Jaw</u><br><u>B. Jaw</u> | 4. ....               | 11. <u>[Signature]</u> |
| Representative .....<br>(Professor Science Faculty Other Dept.) | <u>[Signature]</u>                       | 5. <u>[Signature]</u> | 12. <u>[Signature]</u> |
|   |  | 6. ....               | 13. ....               |
|   |  | 7. <u>[Signature]</u> | 14. ....               |

Student Representative - [Signature]