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Spermatophyta and Paleobotany

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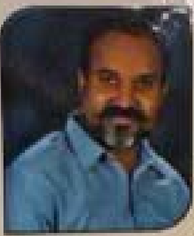

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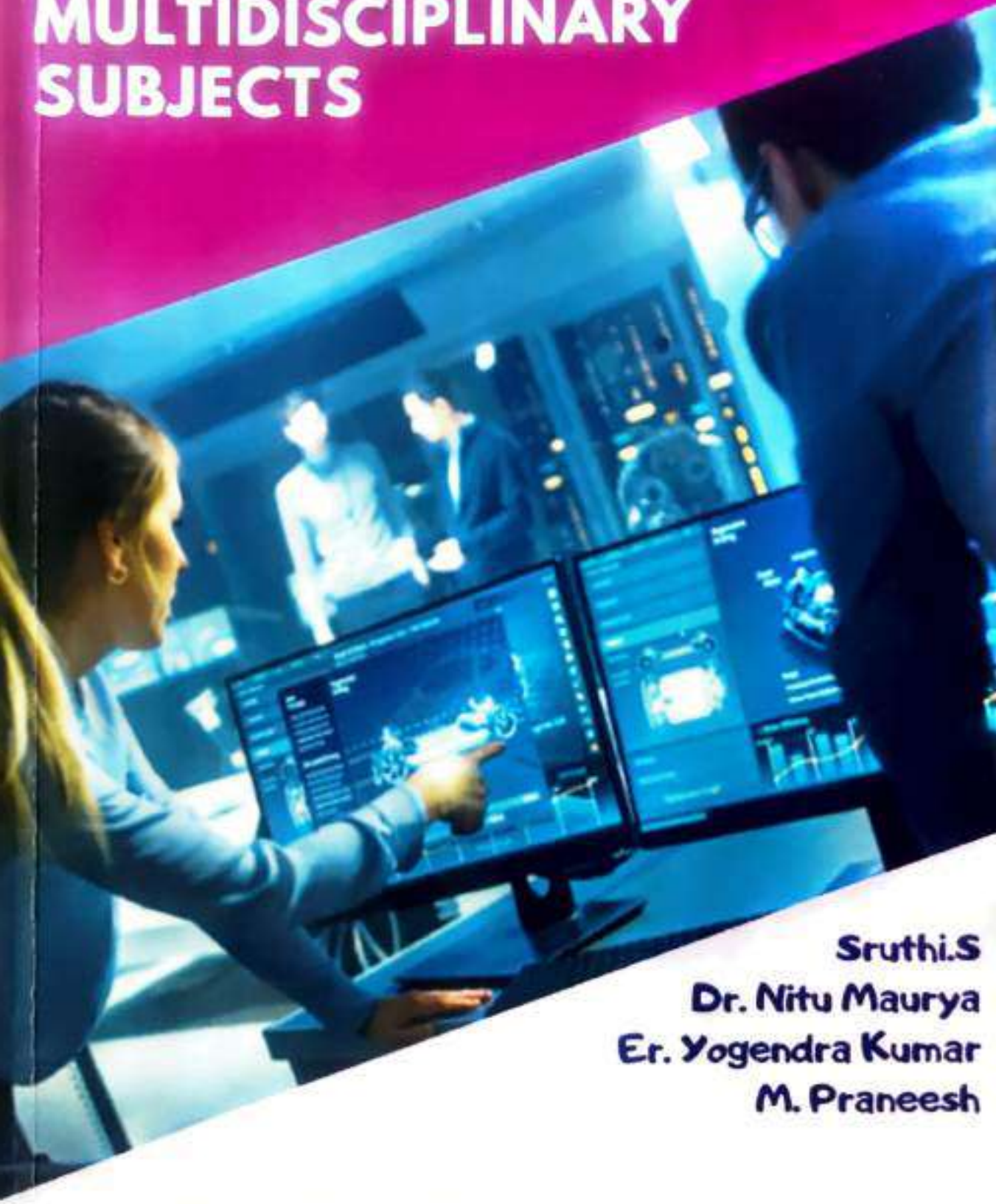

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SCIENTIFIC WRITING: TECHNICAL WRITING TO COMMUNICATE SCIENCE

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ABSTRACT

It is well acknowledged that widely sharing scientific information is crucial. This type of dissemination ensures that crucial scientific knowledge reaches other researchers, policymakers, and the general public. Scientific writing is one approach to communicate with others. It is the technical writing that scientists do to share their research through proper communication of data, figures, research methodologies, and results with others. It is the goal of a research article to provide a novel finding, explain its relevance, and situate it in a cohesive manner within the current body of knowledge. For non-scientists, the scientific style is defined by its stance on problems such as truth and presentation; scene; cast; and thought and language. The result is a technical report or scientific paper that examines current information, presenting it logically and orderly, with evidence supporting statements and citations. Peer review is also common in the scientific community. Scientific research requires references. Citation guidelines for scientific publications help authors increase their manuscript's reputation, minimise plagiarism difficulties, and appropriately link readers to sources. The most crucial aspect of scientific writing is adhering to ethical research and writing guidelines.

Key Words: Scientific Writing, Research Publication, Citation guidelines, References

INTRODUCTION

Although writing is essential to the scientific process, it is usually taught as an afterthought to concepts and is only rarely taught prior to the scientific process. No doubt you can think of other students who devoted weeks to lab or class assignments, then put together the written report the day before it was due. Many consider this a typical result because, even though we place a high value on the scientific process, we ignore the writing process in favour of it. Many students find scientific writing tough and tedious. It deviates from the structure and manner in which we've been trained to write in various academic disciplines. When you're confronted with new, sophisticated knowledge, it might make the scientific writing process feel overwhelming.(Day, R. A., & Gastel, 1995) On the other hand, excellent writing is capable of prompting one to provide a logical and consistent narrative that is grounded in prior research and fresh findings. Clear scientific writing often includes sections for introduction, hypotheses to be tested, methodology, and results, as well as a conclusion piece to tie everything together.(Boice & Jones, 1984) This is a standard structure that occurs in most scientific writing, making knowledge easier to pass from author to reader if some basic rules are followed.(Booth, 1984). Writing science is more than telling people about research results: it is telling stories about how science works. The scientific style produces a distinctive method of writing that is mainly unfamiliar to the students. Well-documented scientific and engineering reports synthesise peer-reviewed work.

It is necessary to follow a concise step-by-step approach that outlines tactics for excellent scientific writing, with the goal of increasing the focus on writing in scientific way. In addition to the fact that there are no hard and fast rules when it comes to scientific writing, following principles will help researchers to overcome the early hurdles involved with writing scientific articles. (Schimel, 2012)

References must be accurate and thorough. Citation guidelines for scientif publications help authors increase their manuscript's reputation, minimise plagiaris difficulties, and appropriately link readers to sources.(Riordan, 2012)

The utmost important point in scientific writing is adhering to ethical principl for research and scientific writing.(Roig, 2006). Research has the greatest benefit wh its findings are published in scientific journals so that others can study and bui upon them. Adhering to ethical principles is essential for fostering scientific growt (Carver et al., 2011) Scientific misconduct is regarded a violation of ethical rul related to plagiarism and authorship (Lorés-Sanz, 2011).

It's fairly typical for unethical mistakes in writing and publishing to occur. The are numerous existing policies that institutions might change to meet their uniq needs. Both students and professors should have access to policies linked plagiarism, and there should be recommendations that help students and teache avoid and identify plagiarism. It is possible to define roles on projects, which can al help establish authorship order on manuscripts before the writing process has ev begun Teams of scientists can support ethical publishing by encouraging cooperati and clearly defining authorship and publishing guidelines.

CONCLUSION

Impending technical report or scientific article analyses current knowledge, preser it logically and orderly, with evidence supporting statements and references. We ho to have offered a wide overview of contemporary advancements and understandin of science writing from the standpoint of students and researchers.

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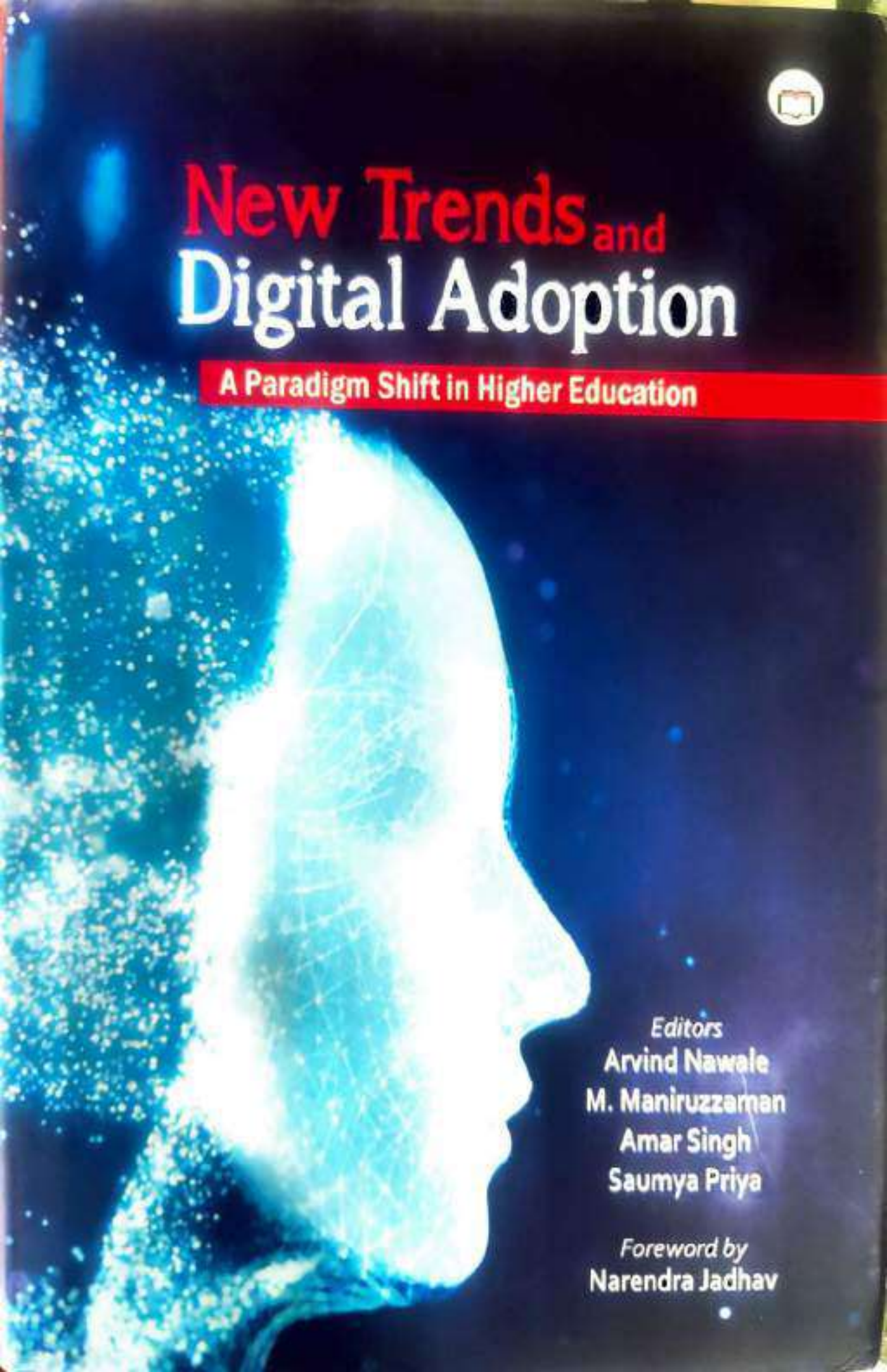
New Trends and Digital Adoption

A Paradigm Shift in Higher Education



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Foreword by

Narendra Jadhav

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CHAPTER 9

India: Educating the Population via Online Tools

Meenakshi V. Rathi

Abstract

Online education and skills are becoming popular among millions of students and teachers in India in the previous fifteen to eighteen months. Lectures that are being delivered via online technologies are being given to students who are situated outside of the classroom. With the widespread use of online education and skills in India, we're in a pivotal time. Learn more about the collection of online learning portals on this page: here. Online learning and teaching is a significant paradigm shift for the Indian education system. Despite these steps, the country is still some way off from implementing it. One step such institutions can take is to allow their degrees to be offered wholly online under the automatic route, and these schools are permitted to do so according to the University Grants Commission's recent decision.

Keywords: Online education, skill based learning, educational tools, learning platforms

Introduction

We're in the midst of a transition in which the domain of skills and education is shifting from face-to-face to online learning and digital tools. (Locket 20) with the added benefit of eliminating the need for breaks in learning. Some vocational training schools have moved to give online sessions with practical hands on training at the core of their curriculum (McQuirter 47) There have been initiatives undertaken by the federal government, colleges, and even corporations like IBM and TCS to deliver instructional content through online learning portals. There are over 10 digital learning portals, ranging from secondary and post-secondary institutions to research and development organisations (Taylerson 170).

eBooks, factual, bibliographies, citations, etc. for higher education. ("E-ShodhSindhu: Consortium for Higher Education Electronics"). All academic institutions like central and state universities and colleges can avail of the services.

Conclusion

All above online courses give learners access to resources, meet and communicate with others on the go, and join in on online discussions. Ensure that excellent educational outcomes are being encouraged by all-encompassing methods that are both creative and secure.

These classes provide both video lectures, class materials, quizzes, examinations, and other supplemental materials for an exciting learning experience. The majority of these portals provide a mix of free and paid courses. Certification information is available on the individual course pages and varies depending on the course. Furthermore, the majority of the portals are mobile-friendly, which means they include an app that students and teachers can use on their phones.

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भूगोल विभाग, चांगु काना ठाकूर महाविद्यालय, नवीन पनवेल, येथे सहा. प्राध्यापक म्हणून कार्यरत. एकुण अध्यापन 25 वर्षे, संशोधन मार्गदर्शक व मा. सदस्य, भूगोल अभ्यास मंडळ, मुंबई विद्यापीठ, पाच भूगोल संस्थांचे आजीव सभासद, राष्ट्रीय व आंतरराष्ट्रीय स्तरावरील जर्नल्स मध्ये 26 संशोधन लेख प्रकाशित, एकुण 16 पाठ्यपुस्तक व संदर्भ ग्रंथ प्रकाशित, विविध कार्यशाळा व चर्चासत्रांमध्ये ३३ ठिकाणी सादरीकरण, 42 ठिकाणी सहभाग व 25 ठिकाणी साधन व्यक्ती म्हणून कार्य. राष्ट्रीय स्तरावरील तीन व राज्य स्तरावरील तीन पुरस्कार प्राप्त.

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प्रा. डॉ. नितीन नथुराम मुंढे (एम.ए., एम.एस्सी., पीएच.डी., पी.डी.एफ. नेट)

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भूगोल विभाग, चांगु काना ठाकूर महाविद्यालय, नवीन पनवेल, येथे सहा. प्राध्यापक म्हणून कार्यरत. एकुण अध्यापन 25 वर्षे, संशोधन मार्गदर्शक व मा. सदस्य, भूगोल अभ्यास मंडळ, मुंबई विद्यापीठ, पाच भूगोल संस्थांचे आजीव सभासद, राष्ट्रीय व आंतरराष्ट्रीय स्तरावरील जर्नल्स मध्ये 26 संशोधन लेख प्रकाशित, एकुण 16 पाठ्यपुस्तक व संदर्भ ग्रंथ प्रकाशित, विविध कार्यशाळा व चर्चासत्रांमध्ये ३३ ठिकाणी सादरीकरण, 42 ठिकाणी सहभाग व 25 ठिकाणी साधन व्यक्ती म्हणून कार्य. राष्ट्रीय स्तरावरील तीन व राज्य स्तरावरील तीन पुरस्कार प्राप्त.

प्रा. डॉ. सुधाकर जगन्नाथ बोरसे (एम.ए., पीएच.डी., नेट)

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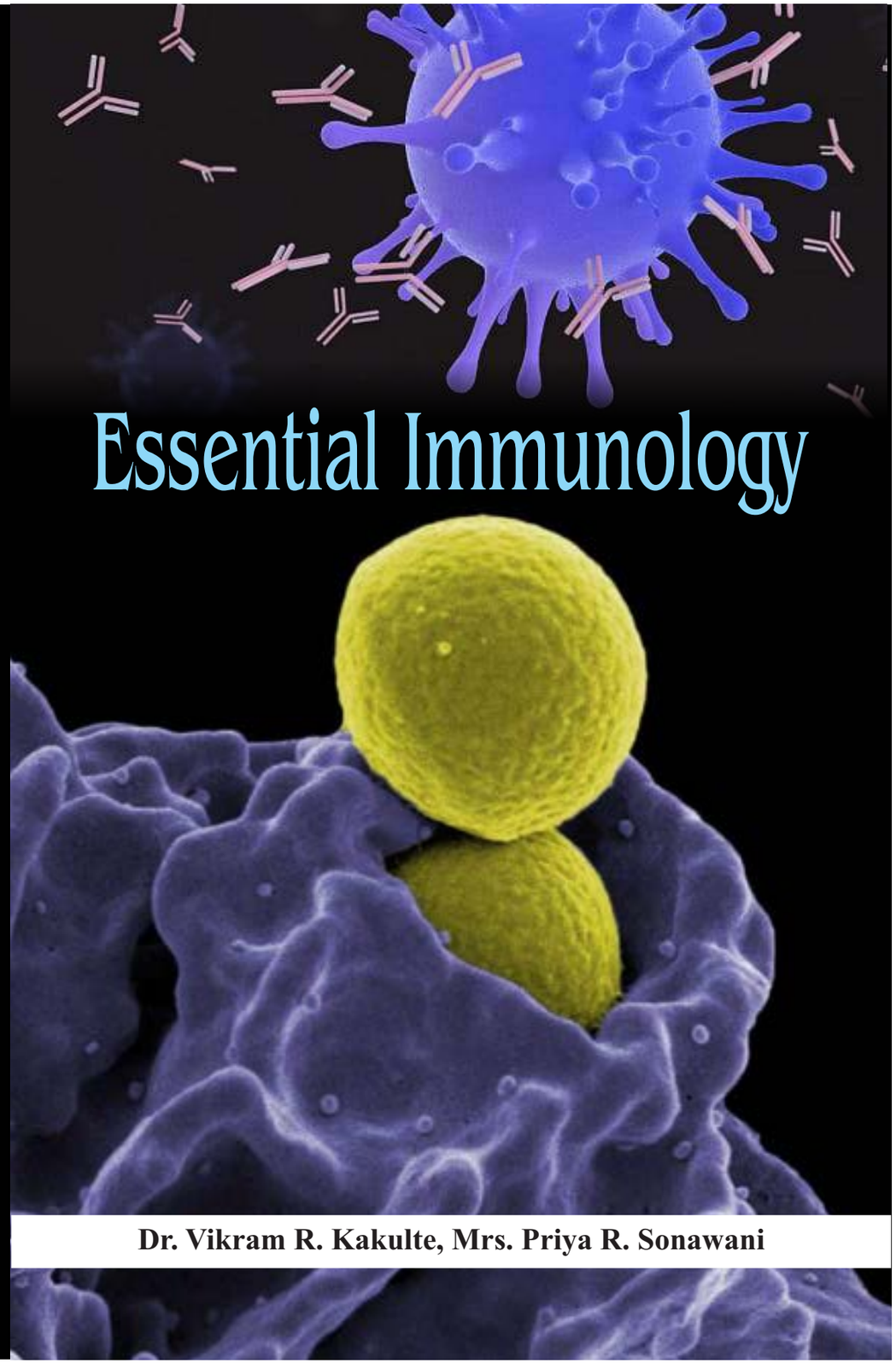

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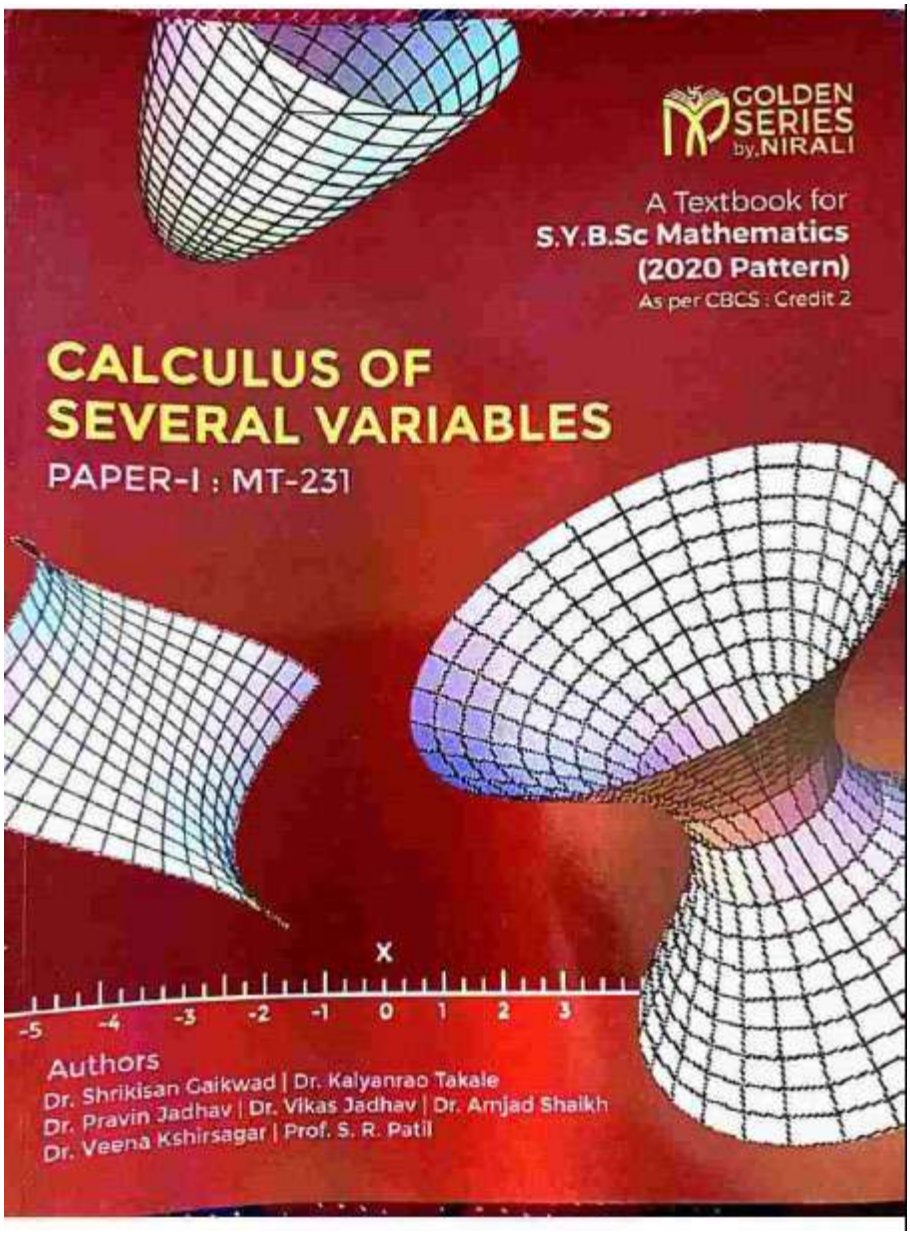
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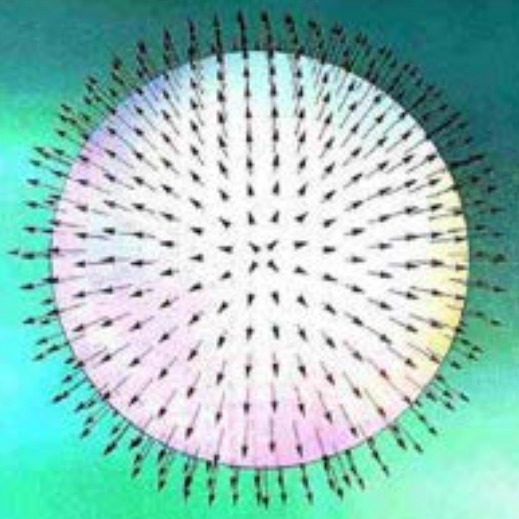

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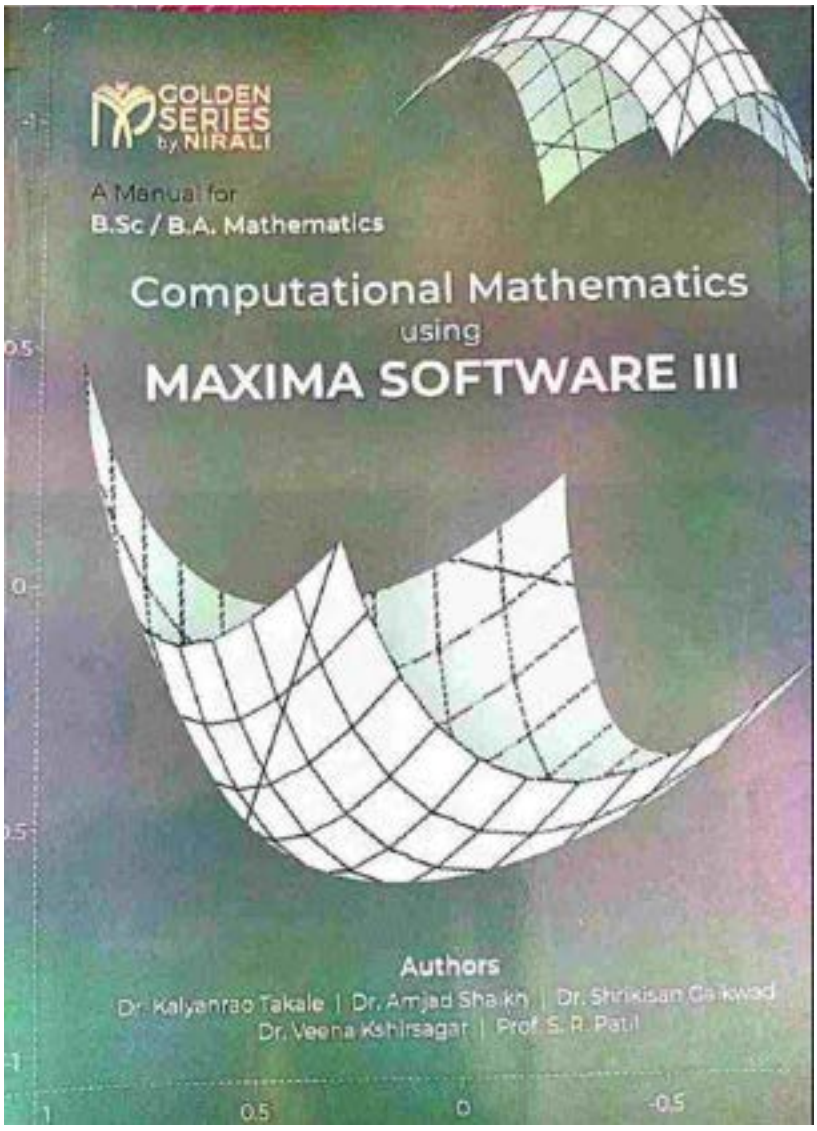
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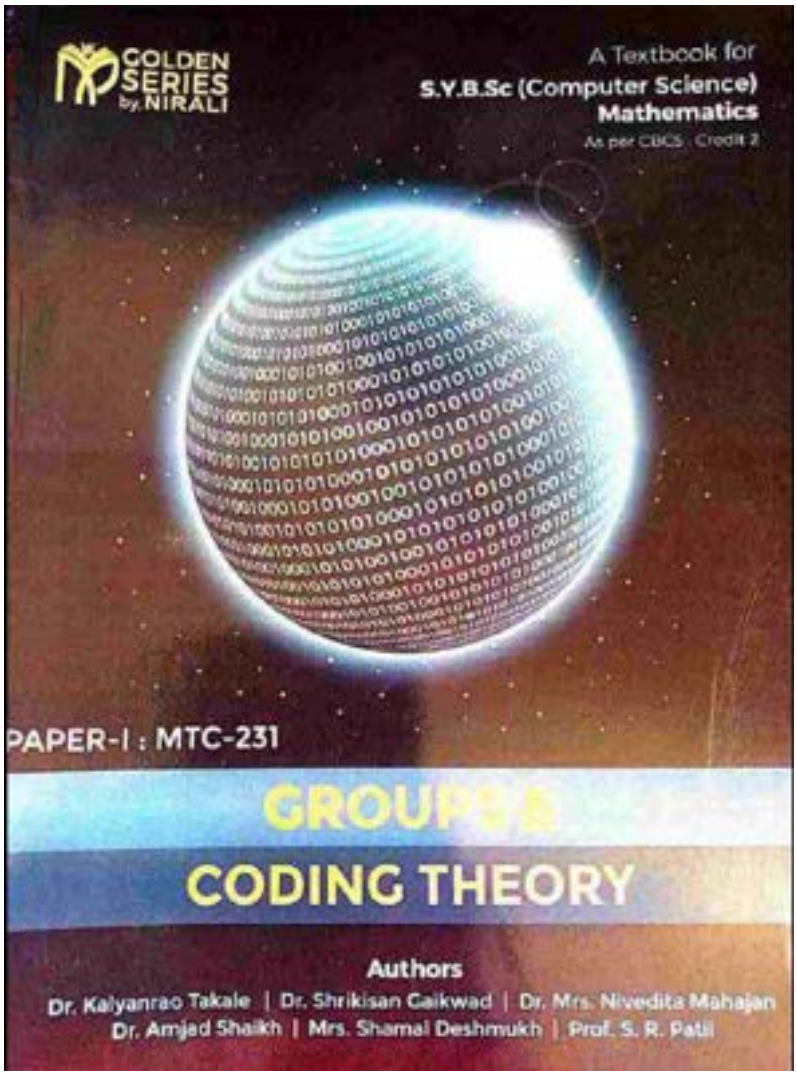
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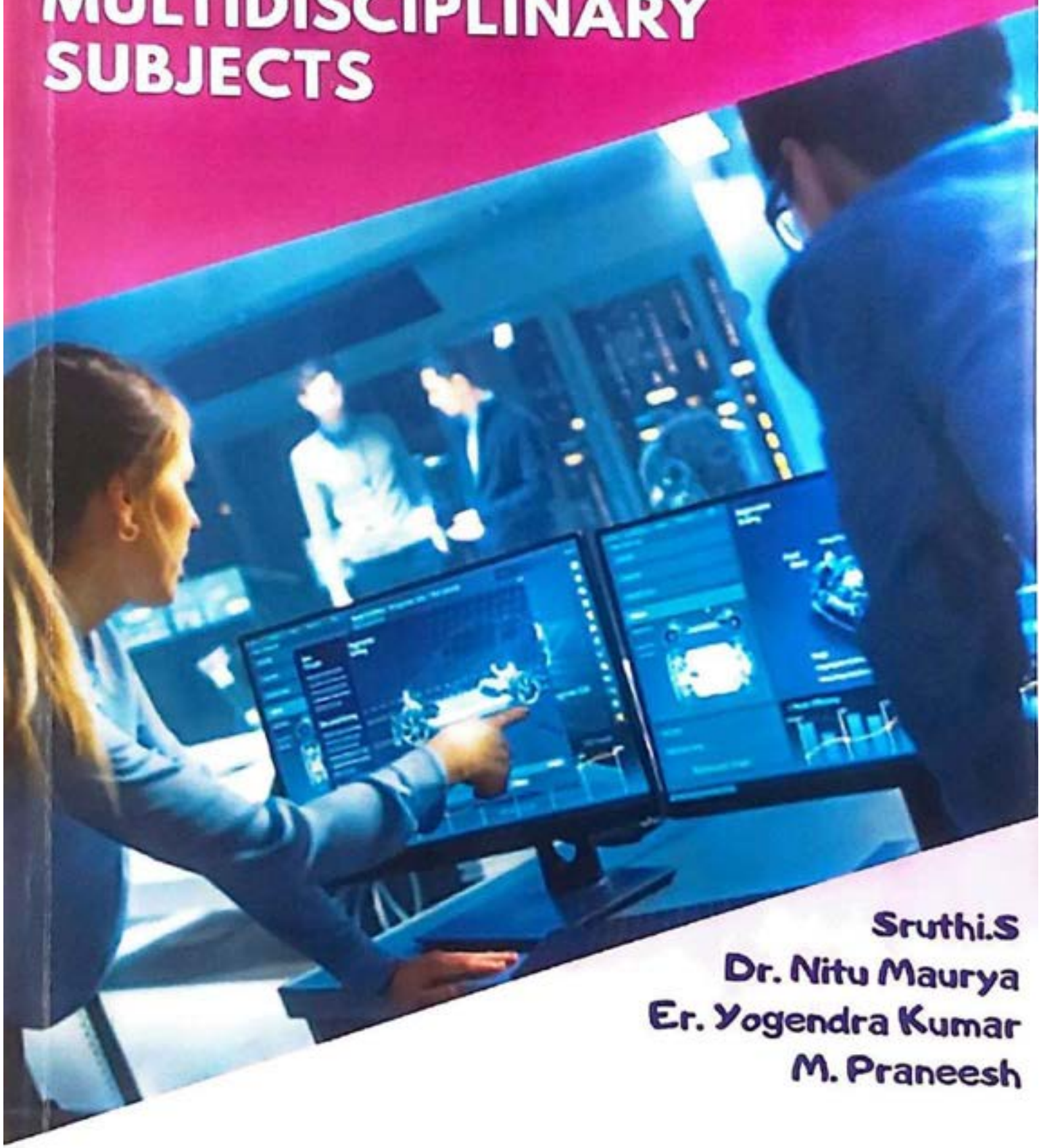

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ANCHORING OF FURAN RESIN: GREENER ROUTE

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ABSTRACT

Furan resins are the polymers prepared from various monomers of furan compounds such as furan, furfuryl alcohol, furfural, various furfural containing compounds such as 5-hydroxymethylfurfural (HMF), 5-methylfurfural, 2-furfurylacrylate and 2,5-furandicarboxylic acid via chain polymerization or polymerization condensation using green approach. Furan resins are derived from vegetable cellulose. The sources of vegetable cellulose include are corn cobs, sugarcane bagasse, oat hulls, paper mill by-products, biomass refinery eluents, cottonseed hulls, rice hulls, and foodstuffs such as saccharides and starch. The furan resins could be obtained in various forms such as Furan resin (FA), urea-formaldehyde-furan resin (UF-FA), phenol-formaldehyde-furan resin (PF-FA), urea-formaldehyde-phenol-furan resin (UF-PF-FA), resorcinol-furan resin (R-FA). These furan resins could be broadly classified as Polyesters, Polyamides, Polyurethanes Hydrogels, Furan-urea resins. Due to special properties of furan resins like corrosion resistance, high carbon yield and stability at elevated temperature, low fire hazard, and excellent physical strength, they found suitable for number of industrial applications.

Keywords: Furan resins, chain polymerization, polymerization condensation, Diels Alder route, furan polyester, greener route

INTRODUCTION

Furan resins are the well-known polymers that could be produced from furfuryl alcohol and furfural as the common starting materials [1]. The furan rings are not conjugated both in the furan resins and cured polyfurfurol. The free-flowing furan resins could be obtained from furan monomers with mild acid catalyst [2]. The ability of furfural to form resins was discovered by Stenhous [3] in 1840. The first furan-based resin was prepared in 1923. Early patents on furan resins reported by Claessen [4] in 1921 and by Stokes [5] in 1925 for synthetic resins (actually mixed phenol furan resins) suitable for use in molding gramophone records. The main advantages of furan resins are that they could be produced from natural sources-vegetable cellulose. Sources of vegetable cellulose includes corn cobs, sugarcane bagasse, oat hulls, paper mill by-products, biomass refinery eluents, cottonseed hulls, rice hulls, foodstuffs materials like saccharides and starch.

Various furan monomers viz. furan, furfural, furfuryl alcohol, 5-hydroxymethylfurfural (HMF), 5-methylfurfural, 2-furfurylmethacrylate, 2, 5-furandicarboxylic acid (2, 5-FDCA), bis-2, 5-hydroxymethylfuran are commonly employed for the production of furan resins [6, 7, 8].

conjugated furan chromophores of 5-[2-(5-methyl furylene vinylene)] furan carboxyaldehyde. The graft polymer can be photo crosslinked.

x) Other applications:

Furan resins are mainly used as chemical-resistant and high turbidity materials.

1. Chemical-resistant materials of furan resin available to prepare the corrosion resistant Putty used as lining or other corrosion-resistant material of chemical equipment.

2. Heat resistance of reinforced composites for furan glass fiber is higher than general phenol aldehyde glass fiber reinforced composites. Usually it can be the long-term use at about 150 ℃.

3. Blending modification with epoxy or phenolic resin to make the furan resin mixed rest use with epoxy or phenolic resin. This improves furan glass fiber-reinforced composite material mechanical properties and process performance of preparation. This type of composite material has been widely used for the preparation of chemical reactor mixing devices, storage tanks, pipelines and other equipments.

4. Furan resins are widely used in the metallurgy and casting industries. It also applied to production of auto parts, plumbing, and tyre mould. The application of furan resin process modeling can access to good economic results.

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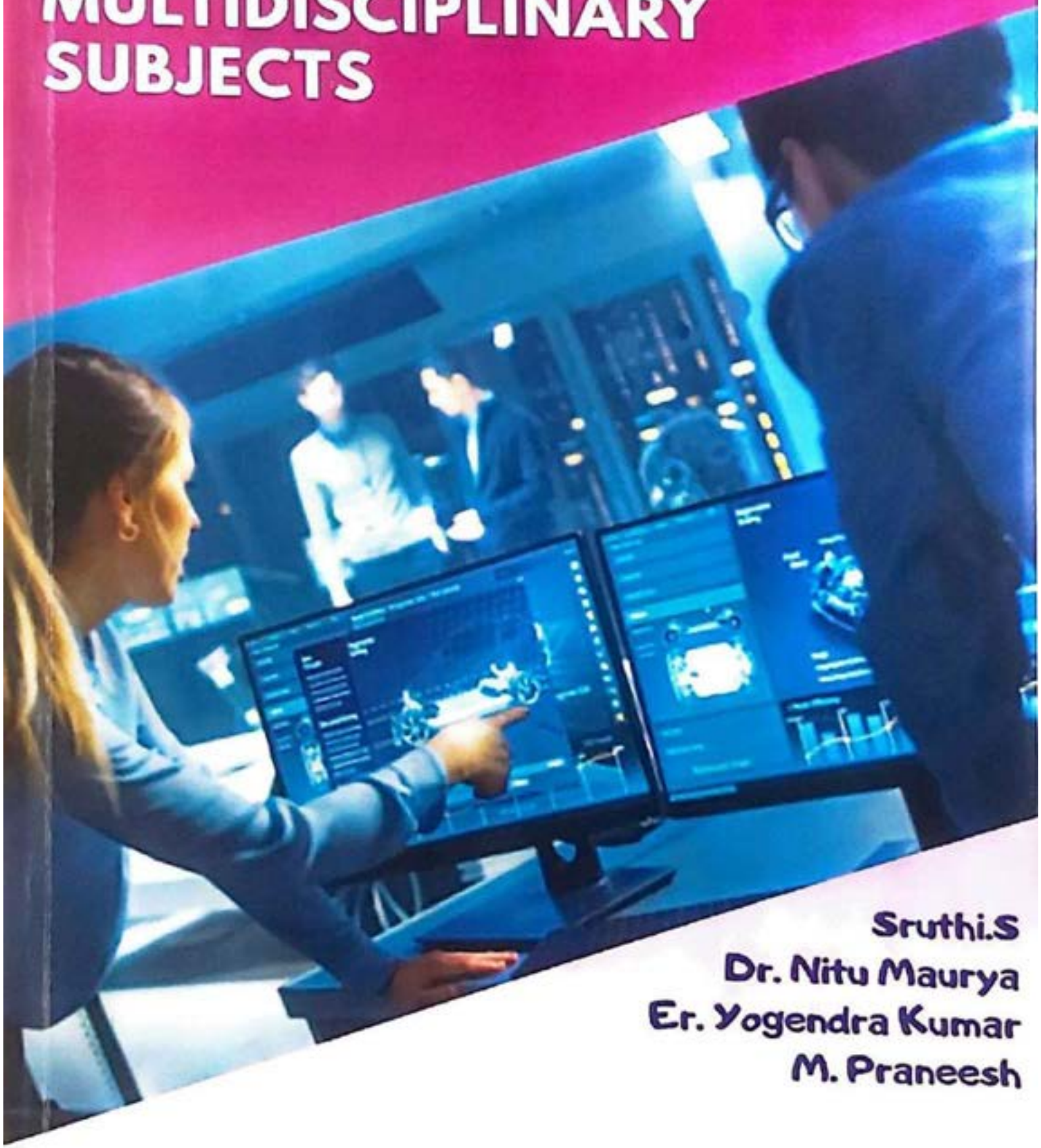

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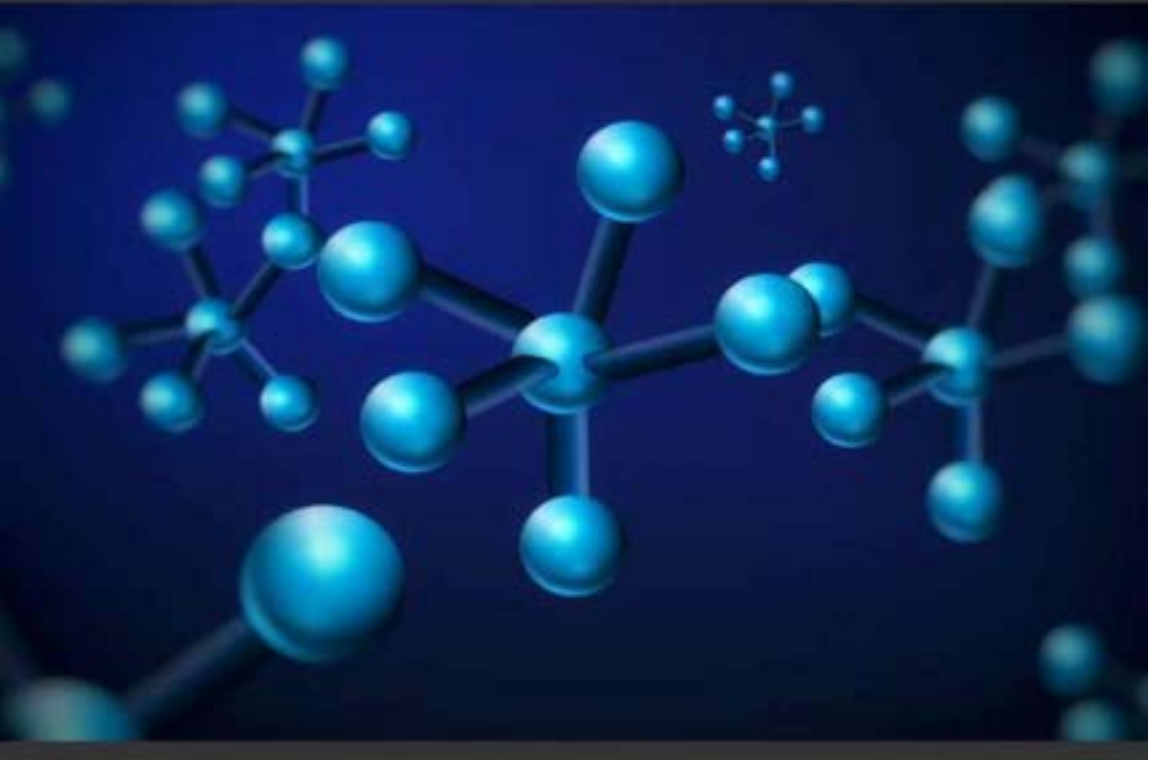

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Dr. Satish M. Chavan
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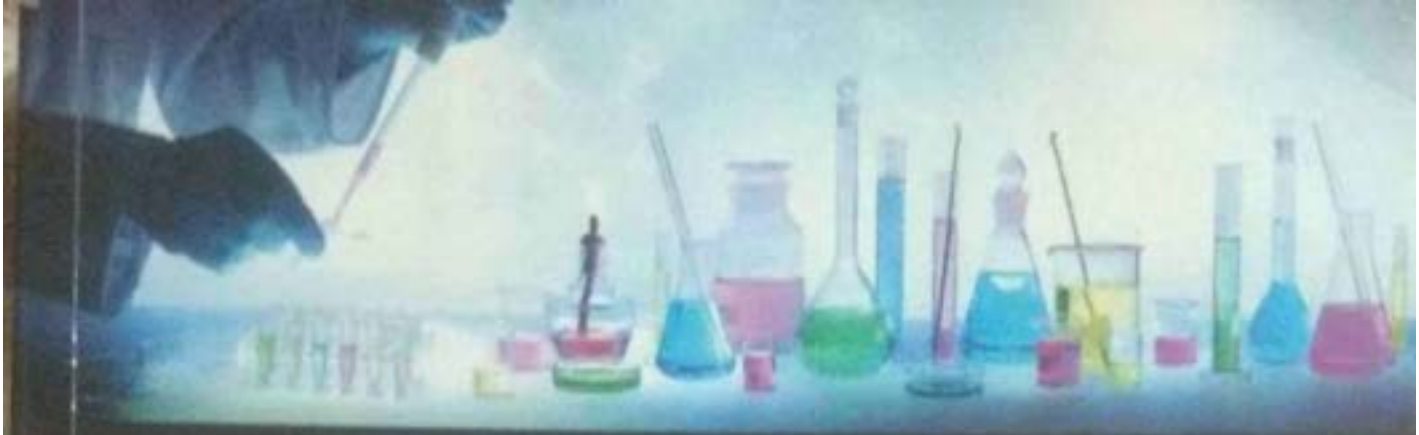

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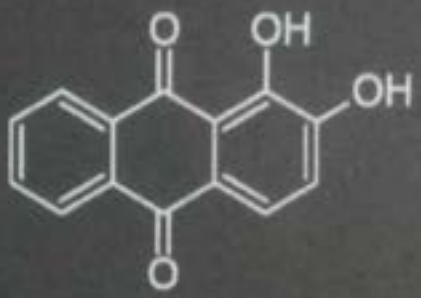

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Green Synthesis of 4-amino-2-oxo/thioxo-6-(substituted phenyl)-1,2-dihydropyrimidine-5-carbonitriles by using Triethylamine Hydrogen Sulfate [Et_3NH] [HSO_4] As an Efficient Ionic Liquid Catalyst

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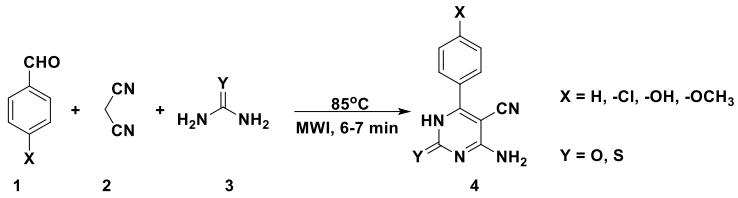
Abstract

The efficacy of Ionic Liquids (ILs) for the environmentally benign synthesis of heterocyclic compounds found important for due to their unique chemical and physical properties viz. low vapor pressure, recyclability, controlled miscibility, high thermal and chemical stability. The synthesis of 4-amino-2-oxo/thioxo-6-(substituted phenyl)-1, 2-dihydropyrimidine-5-carbonitriles were successfully synthesized from aromatic aldehydes, malononitrile and urea or thiourea by using triethylamine hydrogen sulphate [Et_3NH] [HSO_4] as ionic liquid catalyst under solvent free and microwave irradiation method. It was observed that the reaction was best finished when 20 mol% of [Et_3NH] [HSO_4] ionic liquid catalyst, solvent free and MWI conditions are utilized. Our method represents highly efficient, cheap reusable catalyst and environmentally benign greener protocol for the 4-amino-2-oxo/thioxo-6-(2-substituted phenyl) -1, 2- dihydropyrimidine-5-carbonitriles under solvent-free conditions.

Keywords: [Et_3NH] [HSO_4], environmentally benign, Solvent Free, oxo-pyrimidine thioxo-pyrimidine Microwave irradiation

Graphical Abstract:

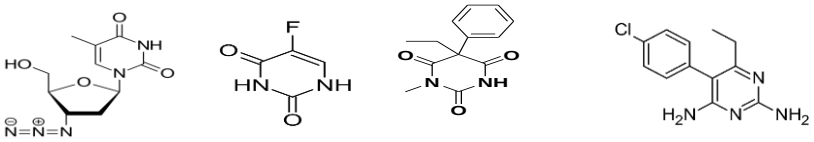


Scheme 1: Synthesis of 4-amino-2-oxo/thioxo-6-(substituted phenyl)-1,2-dihydropyrimidine-5-carbonitriles

Introduction

Ionic liquids (ILs) have taken the attention of the chemical community all over the globe as a green substitute option to traditional eco-friendly media for synthesis, catalysis, separation, and other several chemical tasks [1–7]. ILs include abundant exclusive properties, such as, nonvolatility, low toxicity, extensive liquid range, non-combustible, high thermal stability, excellent solubility, and recyclability [8]. ILs act as "neoteric solvents" for a wide range of industrial and chemical processes. In recent times, ILs have been formulating to be appreciated as environment friendly media for infinite organic revolutions [9, 10]. Moreover, multicomponent reactions (MCRs) are one of the more leading and practical challenges in organic synthesis for the formation of pharmacologically applicable frameworks from the point of view of green chemistry. MCRs give benefits of high yields, target specificity, atom economy, flexibility and specifically one-pot operation [11–13].

Pyrimidine derivatives have a great importance due to their different biological properties such as anticancer [14, 15] antitumor [16] analgesic [17] anti-inflammatory [18, 19] etc. The method commonly used for the synthesis of pyrimidines is the Biginelli reaction, which is a direct condensation of an aldehyde, keto ester, and thiourea/urea. This condensation is usually done by using heat in different solvents and in the presence of a catalyst [20–25]. Thus, the introduction of inexpensive, mild, dynamic and environmental friendly catalyst for significant MCRs superior to analogues of pharmaceutical and biological importance is in demand. In this paper, we have established $[Et_3NH]$ $[HSO_4]$ as ionic liquid catalysed the efficient Synthesis of 4-amino-2-oxo/thioxo-6-(substituted phenyl)-1,2-dihydropyrimidine-5-carbonitriles derivatives via one-pot multicomponent reactions under eco-friendly reaction conditions **(Schemes 1)**



Zidovudine (ZDV) Azidothymidine (AZT) HIV/AIDS treatment	5 Fluorouracil (5-FU) (Adrucil) Anti-cancer	Methylphenobarbital (Mebaral, Mephyltaleten, Phemiton, Prominal) Anti-malarial	Pyrimethamine (Daraprim) Anti-malarial

Fig 1: Chemical structure of active pharmaceutical ingredients having pyrimidine pharmacophore

A vast number of titled heterocycles with significant pharmaceutical potential have been derived from usual sources. Few of them are currently used in clinical trials or as effective drugs. **(Fig.1) & (Fig2)**

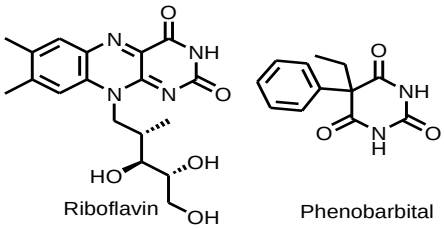


Fig 2: Chemical structure of active pharmaceutical ingredients having pyrimidine pharmacophore

Results and Discussion

To achieve optimized conditions protocol based on the reaction of aromatic aldehydes, (1) (1 mmol) malononitrile (2) (1 mmol) and urea or thiourea (3) (1 mmol) as model substrates, we checked different catalysts, solvents and, temperatures, and the results of this study are summarized in Table 1.

Table 1: Optimization of solvent[a]

Entry	Solvent	Time	Yield (%) [b]
1	Acetonitrile	40 min	50
2	DMF	40 min	62
3	Water	25 min	74
4	Ethanol	20 min	81
5	Solvent free	7 min	90

[a]**Reaction conditions:** Aldehyde (1mmol), malononitrile (1mmol), Urea/Thiourea (1mmol), and 20 mol% [Et_3NH][HSO_4] in MW at 85^0C. [b]Isolated yield.

Table 2: Optimization of catalyst amount

Entry	Solvent	Time	Yield (%) [b]
1	Acetonitrile	40 min	50
2	DMF	40 min	62
3	Water	25 min	74
4	Ethanol	20 min	81
5	Solvent free	7 min	90

Reaction conditions: Aldehyde (1mmol), Malononitrile (1mmol), Urea/Thiourea (1mmol), and 20 mol% [Et_3NH][HSO_4] in MW at 85^0C.

The model reaction was performed in various solvents to optimize the solvent model reaction. It was observed the excellent yield of products formed under solvent-free condition (Table 2).

Preliminary investigations showed that reaction best finished when 20 mol% [Et_3NH] [HSO_4] catalyst was used under MWI. The model reaction was tried with 5, 10, 15, 20 and 25 mol% of catalyst and it was found that 20 mol% of catalyst sufficient to afford product in good yield (Table 2).

Moreover, we also studied the temperature effect on model reactions conferring to these study better results of the desired product when reaction carried at 85 °C (Table 3, entry 4). Detailed reaction conditions are shown in Table 3.

Table 3: Effect of temperature on the synthesis of **4** under solvent-free condition[a]

Entry	Solvent	Time	Yield (%) [b]
1	70	15	62
2	75	12	70
3	80	8	87
4	85	7	90
[a]Reaction conditions Aldehyde(1mmol), Malononitrile(1mmol), Urea/Thiourea(1mmol), and 20 mol% [Et3NH][HSO4] in MW at 85^0C. [b]Reaction progress monitored by TLC. [c]Isolated yield.			

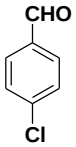
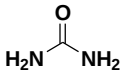
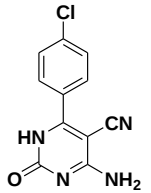
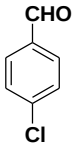
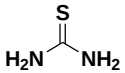
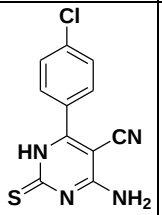
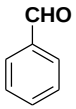
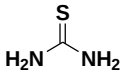
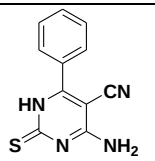
A really excellent method to economic and greener preparation is recovery and recyclability of an ionic liquid. Therefore, we have to check the efficiency of catalyst after recover from the reaction media during the work-up procedure. When reaction is completed, then reaction mass was poured on ice cold water to obtained fine crystal of final 4-amino-2-oxo/thioxo-6-

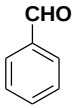
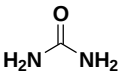
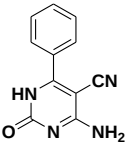
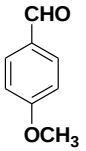
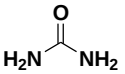
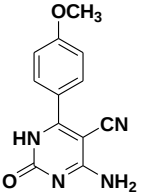
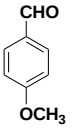
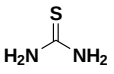
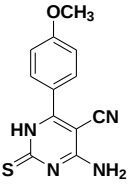
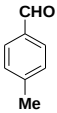
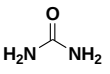
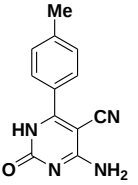
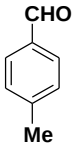
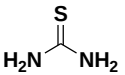
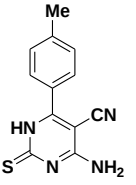
(substituted phenyl)-1,2-dihydropyrimidine-5-carbonitriles derivatives. In the last step removal of H_2O from filtrate using reduced pressure to give viscous liquid, which is on cooling to give pure ionic liquid. Recovered catalysts were recycled for next four frequent cycles without significant loss in catalytic efficiency (**Table 4**).

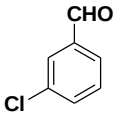
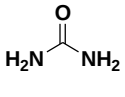
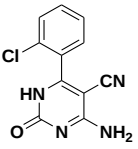
Table 4. Reusability of [Et3NH][HSO4] ionic liquid for model reaction

Entry	Run	Time[a] (min)	Yield[b]
1	fresh	7	90
2	2	7	90
3	3	7	87
4	4	7	85
5	5	7	82
[a]Reaction progress monitored by TLC. [b]Isolated yield.			

Table 5: Synthesis of 4-amino-2-oxo/thioxo-6-(substituted phenyl)-1,2-dihydropyrimidine-5-carbonitriles

Compound	Aldehyde	Urea/Thiourea	Product	Yield %	M.P.(^{0}C)
4a				89	220-222 [21]
4b				90	218-220
4c				93	190-192

4d				90	212-214
4e				91	228-230
4f				87	206-208
4g				88	208-210
4h				87	220-222

4i				82	190-192

[a]Reaction conditions: Aldehyde(1mmol), Malononitrile(1mmol), Urea/Thiourea(1mmol), and 20 mol% $[Et_3NH][HSO_4]$ in MW at 85^0C. [b]Reaction progress monitored by TLC , [c]melting points.

Experimental Section

Materials and Methods. All of the reagents used were of laboratory grade. Melting points of all of the synthesized analogues were taken in an open capillary tube and are uncorrected. The progress of the reaction was monitored by thin-layer chromatography on Merck's silica plates, and imagining was accomplished by iodine/ultraviolet light. ^{1}H NMR spectra were recorded with a Bruker AvIII HD-400 MHz spectrometer operating at 400 MHz using DMSO solvent and tetramethyl silane (TMS) as the internal standard and chemical shift in δ ppm. Chemical shifts (δ) are reported in parts per million using TMS as an internal standard. The splitting pattern abbreviations are designed as singlet (s); doublet (d); double doublet (dd); bs (broad singlet), triplet (t); quartet (q); and multiplets (m).

General Procedure for Preparation of Triethylammonium Hydrogen Sulfate $[Et_3NH][HSO_4]$

Sulfuric acid (98%) (9.8 g, 0.1 mmol) was added dropwise into the triethylamine (10.1 g, 0.1 mmol) at 60 °C in 1 h. After the addition, the reaction mixture was stirred for an additional period of 1 h at 70 °C to ensure that the reaction had proceeded to completion. Then, the traces of water were removed by heating at 80 °C in a high vacuum until the weight of the residue remained constant. The yield of $[Et_3NH]$ $[HSO_4]$ was 99% (19.8 g).^{1}H NMR (DMSO): δ (ppm) 1.17 (t, 3H), 3.11 (m, 2H), 8.90 (s, 1H).

General Procedure for Synthesis 4-amino-2-oxo/thioxo-6-(substituted phenyl)-1,2-dihydropyrimidine-5-carbonitriles

A mixture of Aldehyde (1mmol), Malononitrile (1mmol), Urea/Thiourea (1mmol), and 20 mol% $[Et_3NH]$ $[HSO_4]$ in MW at 85ºC. under microwave irradiations; the progress of reaction was supervised by thin-layer chromatography [ethyl acetate/*n*-hexane (3:7)] as a solvent after a stirring reaction mixture was cooled for 15 min and a poured on crushed ice. **(Table**

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Chapter - 8

Ayurvedic Perspective of Drug Action: A Review

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Abstract:

Natural products have played an important role in the development of the current level of knowledge about drugs used in medicine with the help of chemical sciences. Ayurveda is an ancient science of medicine which mainly uses natural products as medicine. Like medicinal chemistry, Ayurveda also believes that action of drug is completely dependent on its constitutional structure. Without any advanced technology, Ayurveda is able to treat a variety of conditions with the method of drug selection with only limited knowledge resources. Ayurveda also uses methods to change the action of drug positively to enhance the action and to minimise the adverse effects. Though a lot of work has been done regarding the action of natural products, some areas remain untouched. Hence it is an effort to review drug action as per Ayurveda.

Keywords: Ayurveda, Chemistry, Drug Action, Guna

Introduction

Chemistry has made major contributions to the modern health care system as the activity of any compound is reflected in their molecular structure. We can see that similar molecules have similar activities. Medicinal chemistry has passed the long journey from the retrospective study of natural products to development of completely new target specific molecules. Throughout our evolution, the importance of natural products for medicine & health has been enormous. Ayurveda, the ancient Indian system of medicine, is well known for its use of natural products. Ayurvedic texts describe hundreds of drugs of different origins like plants, animals, mineral & marine [1]. Their medicinal uses, properties, uses, toxicology are also described in some details. Ayurveda also has also tried to describe the rationale behind their properties. It is interesting to see that Ayurveda also believes that properties of drugs are a product of its constitutional structure [2].

Basic principle of Drug action:

The most basic principle for drug action as per Ayurveda is Samanya Vishesha Sidhanta [3] (Principle of similarity and difference). It simply says that when two same substances come together they will increase the effective volume. Similarly when two different substances with same property or function come together, it will result in an increase in the effective property or function. On the other hand, when two opposite substances come together it will result in decrease in effective volume and when two different substances with opposite properties or function come together, it will result in a complete or partial loss of effective property or function. So on what basis similarity and difference are calculated?

Ayurveda says that all substances including living and non-living things in the universe are made up of only 5 basic elements. Those are Aakash, Vayu, Teja, Jala, Prithvi. They all have their particular properties and functions. Hence when two or more substances merged, similarity or difference in their elements, properties and functions will be altered accordingly.

Constitution of substance according to Ayurveda:

Five subtle particles, come together to form five elements i.e. Panchamahabhuta namely Aakash, Vayu, Teja, Jala, Prithvi. These five elements again combine together to form the basic unit of any object or drug. The proportion of elements is different in different drugs. The drug shows properties of element or elements which are present in larger amounts. Infinite permutation & combinations of elements can produce infinite drugs with different properties [4].

Like drugs, our body is also composed of these five elements only [5]. Hence due to this similarity drugs can affect the body positively or negatively depending on the use. Hence it is advised to use drugs judicially to avail positive effects only or with minimum adverse effects. The combination of elements gives rise to unique physical and biological properties of the drug. For example, drugs with Prithvi Mahabhuta as a major constituent show heavy, hard, dry, properties And will increase similar properties in the body. In a way the drugs will target the organs or systems that are made of mainly Prithvi Mahabhuta like muscles & bones. Below chart will give more details about what properties each element can show and body parts with similar elemental constitution.

Table 1: Mahabhuta, their properties, body constituents and functions:

Mahabhuta	Properties [6]	Body Constituents and Functions [6, 7]
Akash	Clear, light, subtle, soft, smooth	Sound, auditory sensation, lightness, fineness and space, hollow parts, Vaata Dosha
Vayu	Light, Cold, Dry, Rough, Non-slimy, Fine, subtle, Unstable	Tangibility, sense of touch, roughness, impulsion, structuring of body tissues and maintaining of movements of the body, Vaata Dosha
Teja	Hot, Sharp, Subtle, Light, Dry, Rough, non-slimy,	Visible form, vision, brightness, digestion and heat, Pitta Dosha
Jala	Liquid, Cold, Unctuous, Slow, Soft, thick, Slimy, Flowy	Taste, sense of taste, coldness, softness, unctuousness and moisture, Kapha And Pitta Dosha
Prithvi	Heavy, Hard, Rough, Stable, Thick, Gross	Odor, sensation of smell, heaviness, steadiness and material form, Kapha Dosha

Tridosha Theory

For some reasons Ayurveda does not directly talk in the language of Mahabhuta while describing disease process or drug action. It mainly speaks in the Language of TriDosha (Three Offenders of Body). They are namely Vaata Dosha, Pitta Dosha, Kapha Dosha. These are again made up of combinations of Mahabhuta only. They also show properties similar to their constitution only.

Table 2: Mahabhuta Constitution and properties of Dosha

Dosha	Mahabhuta constitution [8]	Properties [9]
Vaata	Akash and Vayu	Dry, Light, Cold, Rough, Subtle, Unstable
Pitta	Agni and Jala	Hot, Sharp, Some Slimy, Flowy, Subtle, Stinky, Light, Liquid
Kapha	Prithvi and Jala	Slimy, Cold, Heavy, Slow, Smooth, Stable

Guna (Properties) Theory:

In the above discussion we already see that properties play an important role in understanding action of substance, because only properties are perceptible. And we know or identify any substance only through its properties like color, shape and other physical and chemical properties. Hence understanding the constitution of a drug is only possible with the knowledge of its properties. So we mainly relate properties with their functions which are solely dependent on the constitution of the substance.

For diagnosis and etiopathogenesis also Ayurveda uses language of Guna