Bachelor of Education (B.Ed.)

Title of the Course: Pedagogy IIA: P.2.9A: Integrated Science

(Semester: I)

Credits: 2
MM: 50 (External: 35 Internal: 15)
Contact Week: 15

Introduction of the Course

This course is aimed at developing the insights, competencies and skills among the pupil-teachers to effectively transact the science curriculum so as to evolve as a reflective practitioner, capable of translating theoretical perspectives into pedagogical practices.

Learning Outcomes

After completion of the course student will be able to:

1. Develop an in-depth understanding of the role of science in the school curriculum and its relation with other disciplines and integration within different branches of science.
2. Develop understanding of Technological, Pedagogical And Content Knowledge (TPACK) and its implications for effective science teaching.
3. Exhibit competency in selecting and designing diverse teaching-learning resources, including textbooks, reference materials, improvisations, and multimedia packages, aligning them with content, learner needs, and the broader educational context.
4. Develop insights and critically view the role of laboratories in science.
5. Develop competencies, and skills in organizing and managing a science laboratory in its various forms.

Number of Units 3 **Weeks 15 = 30 hours**

Unit 1: Pedagogical Underpinning **(5 weeks = 10 hours)**

- Place of science in school curriculum and it's linkages with other disciplines.
- Aims of teaching science at the middle and secondary level with linkages to primary level.
- Objectives of teaching science with special reference to the development of thinking and process skills

Head/Dean
विभागाध्यक्ष एवं संकाय अध्यक्ष
शिक्षा विभाग/Deptt. of Education
दिल्ली विश्वविद्यालय, दिल्ली-110007
University of Delhi, Delhi-110007

- Integration of STEM principles in science education: interdisciplinary approaches and collaborative projects.
- The concept of Technological, Pedagogical And Content knowledge (TPACK) and its implications for science teaching.

Unit 2: Teaching- Learning Resources **(6 weeks = 12 hours)**

1. Criteria for selecting/designing Teaching-Learning Resources: content based, learner based and context based.
2. Textbook, reference books, encyclopedia, newspaper and alike
3. Improvisations and Science Kits
4. Instructional aides, computer aided instruction, multi-media packages, interactive software and simulations, websites, Open Education Resources (OER) etc.
5. Artificial Intelligence based tools and pedagogy.
6. Planning of extended experiences like science quiz, science fair, science corner/resource room, science club and excursion etc.

Unit 3: Organization of the Science Laboratory **(4 week = 8 hours)**

- Layout and design of the science laboratory.
- Storage of apparatus, consumable and non-consumable items/materials
- Maintenance of laboratory records.
- Making arrangements for the conduct of experiments.
- Virtual Labs and STEM Labs

Practicum/ Suggested Projects / Assignments (Any Two)

1. Write a reflective essay on the significance of integrated science at Middle level
2. Developing Teaching-Learning resources for a blended learning classroom
3. Visit science park, museum etc. and document how it can be utilized as an extended experience in science teaching for learners.
4. Develop collaborative projects on types of Laboratory like mobile laboratory, virtual laboratory etc.

Note: On the basis of the above, the teacher may design his/her own relevant projects/ assignments.

Head/Dean
विभागाध्यक्ष एवं संकाय अध्यक्ष
शिक्षा विभाग/Deptt. of Education
दिल्ली विश्वविद्यालय, Delhi-110007
University of Delhi, Delhi-110007

Essential/ Recommended Readings

- Chander, S., & Chetna Arora. (2020). Integrating Technology into Classroom Learning. *Indian Journal of Educational Technology, 2*(1).
- Cobern, W. W. (Ed.). (1998). *Socio-Cultural Perspectives on Science Education: An International Dialogue.* Netherlands: Kluwer Academic Publishers.
- Cole, J. R., & Zuckerman, H. (1987). Marriage and Motherhood and Research Performance in Science. *Scientific American, 256*, 119-125.
- Collette, Alfred T. and Eugene L. Chappetta, (1994) *Science Education in the Middle and Secondary Schools;* MacMillan : N. Y.
- Kumar, N. (Ed.). (2009). *Women and Science in India: A Reader.* India: Oxford University Press.
- Martin R., Sexton, C. Wagner, K. Gerlorich, J. (1998) *Science for all Children*: Allyn and Bacon: USA.
- NCERT (2013). *Pedagogy of Science. Physical Science Part I: Textbook for B.Ed.* New Delhi: NCERT.
- NCERT (2013). *Pedagogy of Science. Physical Science Part II: Textbook for B.Ed.* New Delhi: NCERT.
- NCERT (2019). Vigyan Shiksha shastra (Bhautik Vigyan Bhag I). New Delhi: NCERT.
- NCERT (2019). Vigyan Shiksha shastra (Bhautik Vigyan Bhag II). New Delhi: NCERT.
- Oakes, J. (2007). More than misplaced technology: A normative and political response to Hallinan on tracking. In A. R. Sadovnik (Ed.), *Sociology of Education.* New York: Routledge.
- Okebukola, O. J. (1991). The Effect of Instruction on Socio-Cultural Beliefs Hindering the Learning of Science. *Journal of Research in Science Teaching, 28*(3), 275-285.
- Osborne, J. F. (1996). Beyond Constructivism. *Science Education, 80*(1), 53-82.
- Pollard, A (2005) *Reflective Teaching*, London: Continuum.Routledge Publication, USA.
- Singhal,M. & Baveja, B. (2022). Science Education Teaching Learning and Assessment (1st ed.). Paragon International publisher.
- Sur, A. (2011). *Dispersed Radiance: Caste, Gender and Modern Science in India.* Navayana: India.
- Taylor, P. C., & Cobern, W. W. (1998). Towards a Critical Science Education. In W. Cobern (Ed.), *Socio-Cultural Perspectives on Science Education: An International Dialogue.* Dordrecht: Kluwer Academic Publishers.
- Turner, T. & *Dimatea, W. (*1998) *Learning to Teach Science in Secondary School,*
- UNESCO (1966) Source Book for Science Teaching: UNESCO: Paris.

Head/Dean
विभागाध्यक्ष/संकाय अध्यक्ष
शिक्षा विभाग/Deptt. of Education
दिल्ली विश्वविद्यालय, Delhi-110007
University of Delhi, Delhi-110007

- Vaidya N. (1999) *Science Teaching for the 21st Century,* Deep and Deep Publishers.
- Wallace, J., & Louden, W. (Eds.). (2002). *Dilemmas of Science Teaching: Perspectives on Problems of Practice.* Routledge: New York.
- Wellington, J. (2004) *Teaching and Learning Secondary Science – Contemporary Issues and Practical Approaches,* London: Routledge.

Teaching Learning Resources (Digital):

- Amrita Vishwa Vidyapeetham. (n.d.). Virtual Labs. http://www.amrita.edu/virtual-labs
- e-Yantra. (n.d.). Robotics and Embedded Systems. http://www.e-yantra.org/
- Google Arts & Culture - Science: Google. (n.d.). Google Arts & Culture - Science. https://artsandculture.google.com/project/science
- Gupta, A. (n.d.). Arvind Gupta Toys. http://www.arvindguptatoys.com/
- Indian Academy of Sciences. (n.d.). Journals. https://www.ias.ac.in/Journals
- Khan Academy. (n.d.). https://www.khanacademy.org/science
- Ministry of Education, Government of India. (n.d.). National Digital Library of India (NDLI). https://ndl.iitkgp.ac.in/
- National Aeronautics and Space Administration. (n.d.). NASA's Education Resources. https://www.nasa.gov/audience/foreducators/index.html
- National Council of Educational Research and Training. (n.d.). Diksha. https://diksha.gov.in/
- National Council of Educational Research and Training. (n.d.). National Repository of Open Educational Resources (NROER). https://nroer.gov.in/
- National Council of Educational Research and Training. (n.d.). NISHTHA. https://diksha.gov.in/nistha
- NPTEL. (n.d.). https://nptel.ac.in/
- OpenStax. (n.d.). https://openstax.org/
- University of Colorado Boulder. (n.d.). PhET Interactive Simulations. https://phet.colorado.edu/
- Vigyan Prasar. (n.d.). http://www.vigyanprasar.gov.in/
- e-PG Pathshala. (n.d.). https://epgp.inflibnet.ac.in/

Teaching Learning Process:

Head/Dean
विभागाध्यक्ष एवं संकाय अध्यक्ष
शिक्षा विभाग/Deptt. of Education
दिल्ली विश्वविद्यालय, दिल्ली-110007
University of Delhi, Delhi-110007

The course will be taught through interactive pedagogic methods such as classroom discussions, debates, collaborative learning tasks, laboratory methods with the appropriate use of digital processes, so as to enhance reflective practices and critical analytical thought processes among learners. Self-learning, self-exploration, creative expression, and comprehension & application of concepts will be encouraged.

Assessment Method:

The assessment will be formative in nature both in theory and practicum and will focus on rigorous student participation. Individual and group tasks will aim at developing scientific temper among learners. Assessment will also be based on development of creative expressions, critical understanding, reflections, and ethics in science.

Key words: Integrated Science, Pedagogy, Teaching Resources

Head/Dean
विभागाध्यक्ष एवं संकायाध्यक्ष
शिक्षा विभाग Dept. of Education
दिल्ली विश्वविद्यालय, Delhi-110007
University of Delhi, Delhi-110007