Bachelor of Education (B.Ed.)

Title of the Course: P.2.6 B: Physics

Semester II

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 Physics curriculum and evolve as a reflective practitioner, capable of translating theoretical perspectives into pedagogical practices. The program unfolds across three cohesive units, each meticulously crafted to inculcate a profound understanding of the pedagogical underpinnings, classroom processes, teaching-learning resources, organization of the physics laboratory, and the intricacies of assessment in the domain of Physics education.

It delves into the pivotal role of Physics in the school curriculum, exploring its nature as a scientific discipline and its interconnectedness with other fields. It tries to underscores the importance of judiciously selecting and designing teaching-learning resources, embracing both traditional and digital formats.

Practical components are woven seamlessly into the fabric of the course, ensuring experiences in planning lessons, developing resources, and managing the physics laboratory. The focus extends to the evaluation sphere, encompassing formative and summative assessments, as well as the creative expression of learners. By the course's culmination, participants are envisioned to emerge as adept educators equipped to inspire and guide students through the fascinating realm of Physics.

Learning Outcomes

After completion of the course student will be able to:

1. Demonstrate proficiency in employing a repertoire of teaching-learning processes

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using diverse learning resources.

2. 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.
3. Develop skills in organizing and managing a physics laboratory, including the layout and design, storage of apparatus, and maintenance of records, ensuring a conducive environment for experiments, activities, and project work.
4. Explore the integration of digital tools, educational apps, and online platforms to enhance physics teaching. Discuss strategies for effective online and blended learning environments.

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

Unit 1: Teaching- Learning Resources (5 weeks = 10 hours)

- Criteria for selecting/designing Teaching-Learning Resources: content based, learner based and context based.
- Textbook, reference books, encyclopaedia, newspaper and alike
- Improvisations and Science Kits
- Instructional aides, computer aided instruction, multi-media packages, interactive software, websites, Open Education Resources(OER) etc.
- Artificial Intelligence based tools and pedagogy.

Unit 2: Organization of the Physics Laboratory (5 weeks = 10 hours)

- Layout and design of the physics laboratory.
- Storage of apparatus, consumable and non-consumable items/materials

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- Maintenance of laboratory records.
- Making arrangements for the conduct of experiments.
- Planning of extended experiences, science quiz, science fair, science corner/resource room, science club, excursion and related SUPW activities.

Unit 3: Assessment **(5 weeks = 10 hours)**

- Nature of learning and assessment, analysis and critique of the present pattern of examinations.
- Design and analysis of
    - Formative assessment tasks
    - Summative Assessment
- Assessment of laboratory work and project work
- Contemporary assessment technologies, including computer-based testing, online quizzes, and adaptive learning platforms
- Assessment through creative expression-drawing, posters, drama, poetry, etc as part of formative assessment for continuous assessment of thinking and process skills
- Developing learner profiles and portfolios; participatory and peer assessment.

Practicum/ Suggested Projects / Assignments (Any Two)

1. Laboratory work- management of laboratory, activities and project work.
2. Developing Teaching-Learning resources
3. Preparation of a detailed Assessment Report of learners' continuous and comprehensive assessment.

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

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Essential/ Recommended Readings

- Bal, V. (2005). Women scientists in India: Nowhere near the glass ceiling. Current Science, 88(6), 872-878.
- Bevilacqua, F., Giannetto, E., & Mathews, M. R. (Eds.). (2001). Science Education and Culture: The Contribution of History and Philosophy of Science. Netherlands: Kluwer Academic Publishers.
- Bowling, J., & Martin, B. (1985). Science: a masculine disorder? Science and Public Policy, 12(6), 308-316.
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- Chander, S. (2018). Developments in Information and Communication Technology for Inclusive Education: Issues of Access and Pedagogy. In V. Saxena & S. Kumar (Eds.), Psychological and Sociological Perspectives in Diversity and Inclusion: An Anthology for Researchers and Practitioners. Kanishka Publication.
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- 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.
- Gurumoorthy, B., Chander, S., & Rajalakshmi, R. (2019). Integrating Artificial Intelligence in Physics Education: A Pedagogical Approach. Journal of Science Education and Technology, 28(6), 632-643.

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https://link.springer.com/article/10.1007/s10956-019-09765-2

- Hiroko, H. (2012). Modernity, Technology and Progress of Women in Japan: Problems and Prospects. In D. Jain & D. Elson (Eds.), Harvesting feminist Knowledge for Public Policy Rebuilding Progress. New Delhi: Sage Publication.
- Kumar, N. (Ed.). (2009). Women and Science in India: A Reader. India: Oxford University Press.
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- Ma, L., & Lee, L. (2020). Enhancing Physics Learning with Artificial Intelligence: A Case Study in High School Education. Computers & Education, 145, 103711. https://www.sciencedirect.com/science/article/pii/S0360835219301920
- 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.
- 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.
- Wallace, J., & Louden, W. (Eds.). (2002). Dilemmas of Science Teaching: Perspectives on Problems of Practice. Routledge: New York.

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Teaching Learning Resources (Digital and others):

- 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.). Physics. https://www.khanacademy.org/science/physics
- 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

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This paper endeavors to cultivate a robust understanding of the pedagogy of physics through interactive and discussion modes. Emphasizing learner-centric approaches, it aims to foster competency development among students by incorporating diverse teaching-learning processes. The course structure encourages active engagement through inquiry-based methods, inductive and deductive approaches, experimental learning, group work, and peer collaboration. Practical components, including lesson planning and laboratory management, are integrated to provide a comprehensive learning experience. The paper prioritizes a dynamic and participatory teaching-learning environment, equipping educators with strategies to effectively translate theoretical physics concepts into engaging pedagogical practices.

Assessment Method

The assessment strategy encompasses diverse modes to thoroughly evaluate students' proficiency in translating pedagogical principles into effective physics teaching. Presentations, requiring students to articulate their understanding of innovative teaching methods, complement assignments that assess theoretical knowledge and critical thinking. Practicums involve real or simulated teaching experiences, and a final written examination gauges overall comprehension. Additionally, a detailed assessment report and portfolio submissions provide a comprehensive view of their learning journey. Peer assessment fosters collaborative learning. This multifaceted approach ensures a holistic evaluation, aligning with the course's goal of nurturing reflective and competent physics educators.

Key words: Teaching-Learning Resources, Science Kits, Assessment.

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