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| |  |  | | --- | --- | | Course title : **ICT in Science Education ( Elective )** | Full marks : 100 (50T + 50P) | | Course No. : Sc. Ed. 444 | Pass marks : 18T + 18P | | Nature of the course : Theoretical (T) & Practical (P)  Level : B.Ed. (4 Year)  Year : Fourth | Total teaching hrs : 225( 75T +150 P)  Periods per week : 10 (2T + 8P) ,  Practical ( 8P) : 2 pds /day /gr.  Total Periods : 150 | |  |  | |  |  | |  |
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1. **Introduction to the Course**

This course is designed with the aims to provide students with basic knowledge and skills on use of ICT in science Education and to provide basic knowledge and understanding of basic research. There are seven chapters in this course that comprises ICT and ICT education, computer hard ware and operating system, basic digital literacy for science teachers, learning theories and technology based instructional methods, media and cloud based Science teaching learning, software based material designing and teaching learning, and research in science education.

1. **General Objectives**

The general objectives of this course are as follows

* To provide knowledge related to ICT and Policy and practices of ICT in Education
* To explore the important aspects of ICT in science Education.
* To apply and work with basic digital literacy skills in science teaching learning.
* To prepare and demonstrate science teaching learning materials using ICT software.
* To provide basic research knowledge and understanding in education

1. **Specific Objectives and Contents**

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| * Elaborate the meaning of ICT Education and ICT in Education. * Differentiate between ICT Education and ICT in Education in terms of aims, contents and practices. * Analyze the ICT policy and ICT in Education master Plan in Nepal * Describe the ICT practice in Nepalese education. * List the importance of ICT in science Education. * Prepare a summary report of ICT policy and ICT policy master plan | **Unit I: ICT and ICT Education (5 T)**   1. Meaning of ICT and ICT Education 2. ICT use in education in different countries a review (South Korea, Philippines and Sri Lanka) 3. ICT education in Nepal: National ICT policy 2015, ICT Education Master Plan 2013, 4. Practice of ICT in education in Nepal 5. Importance of ICT in science education |
| * Explain a relation between theories of learning and use of ICT in teaching science subjects in schools * Describe the implication of learning theories in making different educational software and tools that are used in education. * Prepare a summary report of different types of learning theories * Illustrate and explain how ICTs use can enhance actionable, engaged and interactive learning environment. * Examine the ways of learning through networking. * Describe the innovations in ICT based science teaching and learning | **Unit II: Learning Theories and ICT Tools (5T)**   * 1. Behaviourism, cognitivism, constructivism and connectivism in relation to ICT based science teaching and learning.   2. Use of ICT tools for related learning theory principles   3. ICT use for actionable, engaged, interactive, inquiry based and creative learning   4. Learning through networking: Web 2.0 and E-Learning 2.0   5. Innovations in ICT based science teaching learning |
| * State the inclusion of ICTs in school curriculum in different subjects. * Explain the needs of ICT competencies for a teachers based on different professional standards | **Unit III: ICTs in Curriculum and Professional Standards (5T)**   * 1. Review of the curriculum framework and professional standards of teachers in relation to ICT use for different subjects   2. Professional standards of science teachers in terms of ICT competences standards of (UNESCO and NCED Nepal). |
| * Handle computer and ICT devices and use them in learning facilitation. * Enhance skill to operate the operating system. | **Unit IV: Computer hardware and Operating system (5T+10 P)**   * 1. Personal computer (PCs)   2. Configurations of PCs,   3. PCs specifications.   4. Computer system architecture   5. Basic components of a computer system   6. Input devices and use of Scanner, Digital camera   7. Output devices and installation of web cam and printer   8. CPU and its components   9. Memory: RAM, ROM, EPROM, PROM   10. Secondary storage device   **Lab Work:**   * Demonstration of PC components and installations * Prepared specification of PC system   1. Introduction to Window Operating System   2. GUI environments   3. Working with Files & Folders   4. Working with windows application programs   5. Customizing the taskbar and desktops   6. Customizing windows   7. Use of accessories.   8. Working with control panel   9. Mobile Computing   **Lab work**   * Performing activities using window based operating system * Demonstration of the mobile operating system |
| * Work with different features of MS-word in word processing, spreadsheet and power point slide in science teaching and learning activities * Design power points for different purpose of presentation for different subjects and issues * Design spreadsheet as per needs of teaching learning tasks | **Unit V: Basic Digital Literacy for Science Teachers (10T+30 P)**  5: Office Automation Software   * 1. Word processor      1. Characteristics of word processor      2. Creating and formatting documents      3. Managing page numbers, header and footer      4. Proofing a document      5. Inserting citation in APA and table of contents      6. Inserting objects from other applications      7. Mail merge      8. Printing documents   2. Spreadsheet Application      1. Characteristics of Spreadsheet      2. Creating, formatting and printing worksheets.      3. Financial and statistical Functions in Excel      4. Creating, formatting and printing graphs   3. Presentation Application      1. Characteristics of presentation      2. Creating and save presentations      3. Applying template      4. Design slides.      5. Animation on slide      6. Inserting hyperlink, slide number, date and time      7. Slide Transactions      8. Master Slides      9. Slides printing   **Lab Work**   * Performing the word processing activities using office * Performing the spread sheet activities using Office automation software like MS Excel * Performing the presentation activities using Office automation software like MS Power Point |
| * Use web technologies and communication in science teaching * Create and use Google email, drive and blog features * Design and disseminate a blog * Store in data and extract from cloud storage * Handle social media and use in science teaching learning * Use audio and video multimedia system to prepare learning materials * Use web based science teaching learning resources by using different sites | **Unit VI: ICT tools and apps for Science Teaching learning (10T + 30 P)**   * 1. Web Technologies      1. Internet and email      2. Use of search engine      3. Blogging using (Google id or wordpress or joomla)      4. Cloud computing and cloud computing tools to store and share documents (Google drive, One drive)      5. Use of Social media (Skype, Face book, You tube, Twitter) in academic activities   2. Recording audio video by using Multimedia System for podcast and vodcast learning materials: Audacity , movie maker, padlet, Bigblue button)   3. Web based science teaching learning:   Science Kids: http://sciencekids.co.nz  Understanding science: <https://undsci.berkeley.edu/>  Khanacademy:<https://www.khanacademy.org/>  **Lab Work**   * Creating an email Account and creating a blog of Scinece Eduation * Use and implementation of Google drive, Dropbox * Sound recording using sound cloud or audacity, Creating quiz using Padlet and managing web conferencing using big blue button * Search and design teaching learning materials using given websites |
| * Explain the cyber security laws and issues * Use ICTs with full ethical consideration * Create awareness program for students in security, ethics and use and misuse of ICTs | **Unit VII: Security and Ethical Consideration in ICT use (5T+ 10P)**   * 1. Computer system protection from malware and spyware   2. Information Security   3. Protection from Cyber security and Cyber Crime   4. Online safety methods.   5. Ethics in using digital documents, ICT use and communication   6. Use and misuse of ICTs |
| * Prepare and demonstrate the digital materials on the given topics from physics, chemistry, biology and astronomy and geology by use of soft ware. | **Unit VIII: Software based material designing and teaching learning (15T + 50 P)**   * 1. Software for Material Designing: phET, Chemdoodle, Science apps, NSDL Teacher Domain, Google sky, , physics centre, physics simulation   2. **Teaching Physics**       1. **Motion:** Inertia and Moment**,** Newton’s law of motion, Speed, velocity and acceleration measurement      2. **Force:** Law of gravity**,** Free fall and weightlessness      3. **Pressure and its laws:** Hydraulic press, Archimedes’ principle, law of flotation, Pascal’s law, atmospheric pressure      4. **Simple machine**: Lever, Pulley, Inclined plane, wheel and axle: calculation of velocity ratio and Mechanical advantage      5. **Light phenomenon:** Diffraction, refraction, reflection and total internal reflection, Real and apparent depth, polarization, lens and mirror, telescope, binocular, compound microscope.      6. **Electricity and Magnetism:** Ohm’s law, electromagnetic induction**,** Hydroelectricity, dynamo, generator   3. **Teaching Chemistry**       1. Chemical Reactions: Types of Chemical reaction, role of catalysts and promote**r**      2. Periodic classification of elements      3. Preparation and properties of some gases: H2, O2, NH3 and CO2,      4. Bonding: Ionic, covalent, coordinate covalent, dipole moment,      5. Metallurgy: General steps of metallurgy, Extraction of some metals      6. Organic Chemistry and Organic Compounds   4. **Teaching Biology**       1. Classification of plants and animal**s**      2. Cell structure and cell division      3. Structure and life cycle of silkworm and honey bee.      4. Human systems: Nervous system, Digestive system, Respiratory system, Glandular system, Skeleton system, Circulatory system, Reproductive system, Excretory system   5. **Teaching Astronomy and Geology**       1. Earth’s motion      2. Phases of moon      3. Eclipses      4. Structure of universe: Galaxies, meteors, meteorites, star, solar system      5. Geo- structure of Nepal, Rocks and minerals  |  | | --- | | **Lab Work:** | | * Demonstration of all above topics using simulation tools and apps | | * Creating and use of all above topics using different appls such as creating/designing/ implementing different tools used in science education | |
| * Introduce and apply LMS and LMS tools * Manage course in LMS tools such as moodle * Design and develop lessons in Moodle * Handle learning resources and activities using LMS tools | **Unit IX : Web 2.0 technology and LMS in education (5T+15 P)**   * 1. Introduction, importance, and application of LMS   2. LMS tools   3. Managing Virtual Learning Environment using LMS tools such as Moodle.   4. Creating and managing roles in moodle to handle Super Admin, teacher and student   5. Handling Learning resources and activities  |  | | --- | | **Lab Works:** | | * Creating an user account, Editing user profile, Creating course structure, | | * Moodle course editing, Managing learning resources | | * Managing learning activities, managing grades | |
| * Define educational research. * Describe the philosophical basis of quantitative and qualitative research * Describe the action research and its use in science education * Discuss the science education research in terms of its components * Elaborate the need and importance of literature review in education research * Discuss the purpose, planning , sources of literature for educational research * Describe sources of data, sample and population * Discuss the approaches and tools of data processing and analysis in quantitative and qualitative data. * Describe the components of research proposal * Develop the research proposal on the topics relevant to science education. * Illustrate the use of APA in word file formatting, citation and referencing. | **Unit X: Research in Science Education (10 T + 5 P)**   * 1. Introduction to research   2. Types of Research and their philosophical basis (Quantitative, Qualitative)   3. Action Research and its use in science education   4. Science Education Research: Title Selection, Problem statement, setting objectives, hypothesis, research question   5. Literature review: Purpose, planning, sources, citation and Importance   6. Sources of data, Sample and population   7. Data processing and analysis of quantitative and qualitative data   8. Writing Research proposal   9. Citation and Referencing (APA)   **Lab Works:**   * Creating and managing forms using Google forms for questionnaires and survey * Editing Citation and references in word docs * Data analysis and chart presentation using data analysis tools |

# **Instructional Techniques**

# **4.1 General Instructional Techniques**

The instructor will select the method or methods of instruction most suitable for a particular topic. It is quite acceptable to select more than one method and combine them into a single period of instruction whenever it is needed. For example, an instructor could combine a structured-lesson-method to impart theory and follow it up with demonstration method in order to enforce understanding. So, following general method of instruction will be adopted:

* Lecture
* Demonstration
* Discussion
* Group Work

# **4.2 Specific Instructional Techniques**

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| --- | --- | --- |
| **Unit** | **Activity and Instructional Techniques** | **Hours (225)** |
| 1, 2, 3 and 10 | * Develop multimedia presentation. * Assign Project work, * Report writing | 30 |
| 4, 5, 6, 7, 8 and 9 | * Modeling on science content * Assign Project work * Report Writing * Students presentation * Demonstration, Blogging | 195 |

# **Evaluation**

# **5.1Theory: External Examination (Full Marks 50)**

# The Office of the Controller of the Examination will conduct annual examination at the end of the academic session to evaluate student’s performance. The types, number and marks of the subjective and objective questions will be as follows.

|  |  |  |  |
| --- | --- | --- | --- |
| Types of questions | Total questions to be asked | Number of questions to be answered and marks allocated | Total marks |
| Multiple choice items | 10 questions | 10x1 mark | 10 |
| Short answer questions | 4 with 2 alternative questions | 4x7 marks | 28 |
| Long answer questions | 1 with 1 alternative question | 1x12 marks | 12 |

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# **5.2 Practical Examination (50 marks)**

# **5.2.1 Internal Evaluation (Subject Teacher) (20 marks)**

Subject teacher will keep log record of students’ practical activities, and assign marks internally for 20 points. The subject teacher will consider following framework as guideline for his/her internal evaluation.

|  |  |  |
| --- | --- | --- |
| Units | Unit-wise weightage in Practical (periods) | |
| Hours | Marks |
| I | 0 | - |
| II | 0 | - |
| III | 0 | - |
| IV | 10 | 2 |
| V | 30 | 3 |
| VI | 30 | 3 |
| VII | 10 | 2 |
| VIII | 50 | 6 |
| IX | 15 | 3 |
| X | 5 | 1 |
| Total | 150 | 20 |

# **5.2.2 External Evaluation (30 marks)**

# The Office of the Controller of the Examination will appoint an external examiner to conduct final practical examination at the end of the academic session. He/she will conduct final practical examination as mentioned in the framework given below or as designed by internal and external examiners.

# Framework (or Guideline) for External Evaluation:

|  |  |  |
| --- | --- | --- |
| Units | Unit-wise weightage in Practical (periods) | |
| Hours | Marks |
| I | 0 | - |
| II | 0 | - |
| III | 0 | - |
| IV | 10 | 2 |
| V | 30 | 5 |
| VI | 30 | 5 |
| VII | 10 | 2 |
| VIII | 50 | 10 |
| IX | 15 | 4 |
| X | 5 | 2 |
| Total | 150 | 30 |

***Note: Students must pass separately in theory and practical examinations.***

1. **Recommended learning resources and References**

**Learning resources**

A compendium of teaching learning material will be developed by FOE, Dean’s Office, Kirtipur specifying following components unit-wise.

* + - 1. Learning Contents
      2. Learning Objectives
      3. Learning Resources
      4. Learning Activities/Guided Activities
      5. Learning Assessment/Evaluation

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