Department of Botany

School of Basic and Applied Sciences

Central University of Punjab, Bathinda

Ph.D Program in Botany

Academic Session

2021

Department of Botany

Graduate Attributes/Program Outcome:

Ph.D. Program in Botany will

1) Develop research aptitude and desired skills to undertake challenging and new opportunities in academia and industry with reference to basic and applied fields.
2) Generate human resource to cater academia and research in higher education and research institutions.

Semester-1						
Compulsory course						
S.No	Paper Code	Course Title	L	T	P	Cr
1	BOT.701	Research Methodology and Computer Applications	4	-	-	4
2	BOT.751	Research and Publication Ethics	2	0	0	2
3	BOT.752	Teaching Assistantship	0	0	2	1
4	UNI.753	Curriculum, Pedagogy and Evaluation	1	0	0	1
Electives (Any one)						
3	BOT.703	Advanced Genomics	3	1	-	4
4	BOT.704	Advances in Stress Biology	3	1	-	4
5	BOT.705	Advanced Molecular Systematics	3	1	-	4
6	BOT.706	Plant Molecular Biology	3	1	-	4
	Total		10	1	2	12

L: Lectures T: Tutorial P: Practical Cr: Credits

- ***Credits required: Minimum-12 are required to fulfill Ph.D course work requirement, student may opt for any one electives based on recommendations of the supervisor**
- **BOT.701, BOT.751, BOT.752 and UNI.753 are compulsory.**

Transaction Mode:

1) Lecture
2) Demonstration
3) Lecture cum demonstration
4) Seminar
5) Group discussion
6) Field visit
7) Tutorial
8) Problem solving
9) Self-learning

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Course Title: Research Methodology and Computer Applications
Course Code: BCH.701

L	T	P	Credits
4	0	0	4

Learning Outcomes

Students will be able to:

- Illustrate the basic good practices to be followed in research.
- Formulate the principles of ethics in research which will help them to understand the set of conduct norms applied in science.
- Interpret the ethical issues involved in human, animals and plants research.
- Judge the misconduct, fraud and plagiarism in research.
- Utilize the computer and bioinformatics tools for analyzing and interpreting the data.

Unit-I **15 hours**

General Principles of Research: Meaning and importance of research, Critical thinking, Formulating hypothesis and development of research plan, Review of literature, Interpretation of results and discussion. Bibliographic index
Technical Writing: Scientific writing, writing synopsis, Research paper, Poster preparation, oral presentations and Dissertations. Reference Management using various softwares such as Endnote, reference manager, Refworks, etc. Communication skills: defining communication; type of communication; techniques of communication, etc.

Unit-II **15 hours**

Introduction and Principles of Good Lab Practices: Good laboratory practices, Biosafety for human health and environment. Biosafety issues for using cloned genes in medicine, agriculture, industry, and eco-protection, Biological containment and physical containment, Biosafety in Clinical laboratories and biohazard management, Physical, Chemical & Biological hazards and their mitigation. Biosafety level/category of pathogens. Biosafety level of laboratories, WHO/CDC/DBT guidelines for biosafety.
Research Ethics: Ethical theories, Ethical considerations during research, consent. Animal handling/testing, Animal experimental models and animal ethics. Perspectives and methodology & Ethical issues of the human genome project, ICMR guidelines for biomedical and health research. Intellectual property protection (IPP) and intellectual property rights (IPR), WTO (World Trade Organization), WIPO (World Intellectual Property Organization), GATT (General Agreement on Tariff and Trade), TRIPs (Trade Related Intellectual Property Rights), TRIMS (Trade Related Investment Measures) and GATS (General Agreement on Trades in Services). Patents, Technology Development/Transfer Commercialization Related Aspects, Ethics.

Unit-III **15 hours**

Computer Application and Biostatistics: Spreadsheet, Presentation, Image processing and Reference Management software. Internet browsers, World Wide Web: Origin and concepts, internet and its application for quality literature collection and secondary data related to research work. Exploring websites, search engines and Cloud computing. Statistical packages and their applications (Graphpad, Prism, SPSS). Statistical tests: Student's t-test, Paired t-test, Mann-Whitney U-test, Wilcoxon signed-rank, One-way and two-way analysis of variance (ANOVA), Critical difference (CD), Fisher's LSD (Least significant difference), Kruskal–Wallis one-way ANOVA by ranks, Friedman two-way ANOVA by ranks, Chi-square test. Regression and correlation.

Unit-IV **15 hours**

Bioinformatics: Biological databases (DNA/RNA/Protein; Predicting features of individual residues), Alignment tools, BLAST, FASTA, multiple sequence alignment, Pathway and molecular interactions, Primers designing (degenerative and gene specific primers), Genome projects (human, *Arabidopsis* and other genome projects), NCBI, UCSC and other database searches. *In silico* approaches for drug designing, Virtual and Quantitative Screening, identification of cell types epitopes for vaccine designing.

Suggested Reading:

1. Gupta, S. (2010). *Research Methodology and Statistical Techniques*. Deep & Deep Publications (P) Limited, New Delhi.
2. Kothari, C.R., Garg, G. (2019). *Research Methodology: Methods and Techniques.* 4th Edition, New Age International (p) Limited. New Delhi.
3. Sahay, Vinaya and Pradumna Singh (2009). *Encyclopedia of Research Methodology in Life Sciences.* Anmol Publications. New Delhi.
4. Kauda J. (2012). *Research Methodology: A Project Guide for University Students*. Samfunds literature Publications.
5. Dharmapalan B. (2012). *Scientific Research Methodology*. Narosa Publishing
6. Norman, G. and Streiner, D. (2014). *Biostatistics:* The Bare Essentials. 4th Edition, PMPH-USA Limited.
7. Rao, P. P., S. Sundar and Richard, J. (2009). *Introduction to Biostatistics and Research Methods.* PHI learning.
8. Christensen, L. (2007). *Experimental Methodology*. Boston: Allyn & Bacon.

9. Fleming, D. O. and Hunt, D.L. (2006). *Biological Safety: Principles and Practices*. American Society for Microbiology, USA.
10. Rockman, H. B. (2004). *Intellectual Property Law for Engineers and Scientists*. Wiley-IEEE Press, USA.
11. Shannon, T. A. (2009). *An Introduction to Bioethics*. Paulist Press, USA.
12. Vaughn, L. (2012). *Bioethics: Principles, Issues, and Cases*. 2nd Edition, Oxford University Press, UK
13. Lesk, A.M. (2019). Introduction to Bioinformatics. 5th Edition, Oxford University Press, UK.
14. Ramsden, J. (2021). Bioinformatics: An Introduction (Series: Computational Biology). 4th Edition, Springer International Publishing.

BOT.703: Advanced Genomics

Credit Hours: 4.

Course Description: The course is focused on the advancements in the area of genomics and its application in finding out the answers for complex traits and diseases. The course is divided into classroom lectures, Assignments and mutual discussions, experimental planning, presentation of recent research papers from international journals. The overall aim of the course is to develop research aptitude of the student in Genomics.

Scope of the course:

1. The students will be expected to gain knowledge in the frontier fields of high throughput DNA sequencing and applied aspects of genomics.
2. Understand the core concepts of plant biotechnology and genetic engineering.
3. Analyze the vectors for genetic manipulations, gene cloning, gene transfer and applications of transgenic technology.

Essential Background Knowledge: Advanced Genetics.

Unit. I **18 Lectures**

Gene expression Microarray technology, Methodology and data mining tools, Applications of microarray. Next Generation sequencing Technology, Methodology, Generation of Tissue specific data, Data mining tools, Applications of NGS.

Unit. II **18 Lectures**

cDNA library construction, Subtractive Library EST database generation, Transcriptomics analysis targeted via NGS, Unravelling the genetic regulatory circuits.

Unit. III **18 Lectures**

Molecular Markers, Generation of Molecular Markers, Molecular dissection of genetic relationships, Genetic basis of trait and trait dissection.

Unit. IV
18 Lectures

Genomics and Comparative Genomics, Phenomics, Quantitative Trait Analysis and Marker
assisted breeding, Molecular mapping, Genome sequencing.

Suggested Reading:

1. Lodish, H., Berk, A., Chris, A. K., Krieger, M. (2008), Molecular Cell Biology. W.H. Freeman.
2. Bruton E. Trop. (2008), Molecular Biotechnology: Genes to Protein. J&B Publishers.
3. David P. Clark. (2010), Molecular Biology. Elsevier.
4. Benjamin A. Pierce. (2008), Genetics: A conceptual approach. Palgrave Macmillan

BOT. 704: Advances in Stress Biology.

Credits: 4.

Course Description: The content of the course is based on the basic theoretical understanding of stresses, their occurrence and after effects, molecular mechanisms associated with tolerance to the advanced research based implications to counter and confer stress injuries.

Scope of the course:

1. The student/scholar shall be benefited with the focused course on recent advances in oxidative stress biology and its management.
2. A special section is kept to familiarise the scholar with methodology used in measurement and understanding the defence strategies to confer/ counter stress in general and at molecular level, which would be relevant to the future research.
3. The student/scholar shall be able to use acquired knowledge for scientific research, recognisable in national and international platform.
4. Explain different types of stress with examples, various physiological mechanisms that protect the plant from environmental stress i.e. adaptation, avoidance and tolerance.

Essential Background Knowledge: Biochemistry and metabolism; Advanced Plant Physiology.

Unit. I **18 Lectures**

Recent advances in Stress Biology: Types of stresses, Stress factors and occurrence, Avoidance, acclimation and tolerance, Molecular mechanisms of Drought, Temperature, salt and heavy metals tolerance.Climate change and sustainability Perspectives: Impact and adaptation of multiple stresses. Antagonism and synergism in multiple stress tolerance, Factors supporting sustainable development, CO2 enrichment.

Unit. II **18 Lectures**

Signal transduction during stress: Perception, Transduction and response trigger, Induction of specific gene expression, Convergence and divergence of signaling pathways, ROS signaling, Hydrogen peroxide; versatile molecule of the reactive oxygen species network. Management of stress:Secondary metabolites and stress, chemistry and functional genomics their biosynthesis and stress management.

Unit. III **18 Lectures**

Oxidative stress, antioxidants and stress tolerance: ROS/NOX and their production, DNA damage, Control mechanisms, Glutathion ascorbate pathway, Role of different antioxidantsin stress management. Metabolomics of stress.

Unit. IV **18 Lectures**

Gene regulation during stress: Transcription factors involved stress tolerance, Stress proteins; Heat shock (HSP's) and cold shock proteins (dehydrins), CFB, ABRE and DREB proteins etc.**RNA biology and stress:** Cellular stress and RNA Splicing, Si, RNAi, Micro RNA their implications in oxidative stress tolerance. Genome Editing and its scope.

Suggested Reading:

1. Ahmad, S. (1995). *Oxidative Stress and Antioxidant Defenses in Biology*. 1st Edition Springer.
2. Brown, T.A. (2010). *Gene Cloning and DNA analysis: An Introduction*. Blackwell PublishingProfessional. USA.
3. Buchanan, B.B. and Gruissem, W. (2005). *Biochemistry and molecular biology of plants*. IKInternational Pvt. Ltd. New Delhi, India.
4. Forman, H.J. and Cadenas E. (1997). *Oxidative Stress and Signal Transduction*. 1st EditionSpringer.
5. Hensley, K. and Robert, A.F. (2009). *Methods in Biological Oxidative Stress*. 1st editionAcademic Press.
6. Hopkins, W.G. (2007). *Plant Biotechnology*. Infobase Publications Inc.. USA.

7. Inze D. and Montagu M. V. (2001). *Oxidative Stress in Plants*, 1st Edition, CRC Press.
8. Nelson, D. and Cox, M.M. (2009). *Lehninger Principles of Biochemistry*. W.H. Freeman and
   Company, New York.
9. Primrose, S.B and Twyman, R. (2011) *Principles of Gene Manipulation and Genomics*, 8thedn. Blackwell Publishing. Society of Plant Biologists, USA
10. Sunkar, R. 2012. MicroRNAs in Plant Development and Stress Responses (Signaling andCommunication in Plants). Springer Publications. New Delhi.

BOT.705: Advanced Molecular Systematics.

Credits: 4

Course description: This PhD-level course is a comprehensive introduction to the theory and practice of molecular systematics, including concepts of molecular evolution, sequence analysis, computational phylogenetics, codes of taxonomy, rules of nomenclature, specimen and curation.

Scope of the course:

1. This graduate-level course is suitable to students working on taxonomy, molecular systematics, phylogenetic systematics, biodiversity, DNA barcoding and allied disciplines.
2. The student will be expected to have background knowledge on molecular biology, biosystematics, biodiversity, bioinformatics and computational biology.

Unit. I **15 Lectures**

General Introduction to Molecular Systematics: Evolutionary theory and Tree of Life, Tree thinking, Convergent Vs. Divergent evolution, Homologous and Analogous traits, Character states: Synapomorphy, Symplesiomorphy and Homoplasy, Types of Clades: Monophyly, Paraphyly and Polyphyly, Orthologous Vs. Paralogous Sequences, Phenetics Vs. Cladistics, DNA Barcoding, and Major Loci Used in Molecular Systematics.

Unit. II **15 Lectures**

Molecular Evolution: Neutral theory of molecular evolution, Models of nucleotide substitution, p-distance, poisson correction, Jukes-Cantor 69, Kimura-2-Parameter, Felsenstein 81, Hasegawa, Kishino and Yano 85, General Time Reversible (GTR), Rate heterogeneity (G), Rate Invariability (I),Model selection, Hierarchical Likelihood Ratio Test (hLRT), and locus selection.

Unit. III **15 Lectures**

DNA Sequence Analysis: Basics ofDNA Sequencing, Base calling, Sequence Assembly and Contig construction, Consensus Sequences, Multiple Sequence Alignment, Concatenation of datasets and construction of supermatrix, Sequence annotation and deposition in Genbank, DNA Flatfiles, rDNA Secondary structure construction, and *in-silico* translation. NCBI BLAST and its variants, Vienna RNA Package and RNAalifold, Primer design using primer BLAST, CodonCodeAligner, Geneious, and MEGA.

Unit. IV **15 Lectures**

Computational Phylogenetics: Theoretical framework of phylogenetics, Distance Vs. Discrete methods, Minimum Evolution, UPGMA, Neighbour Joining, Maximum Likelihood, Maximum Parsimony, Bayesian Inference, reconstruction of phylogeny from morphological data, Gene Tree Vs. Species tree, and lineage sorting. Morphometry using ImageJ, Specimens and Curation, Herbarium Voucher preparation, Typification, Geographical sampling design, Taxonomic literature survey, Species description, Taxonomic publication and codes, Rules of nomenclature

Suggested readings:

1. Describing Species, Judith Winston, Columbia University Press,978-0231068253
1. Phylogenetic Analysis of Morphological Data (Smithsonian Series in Comparative Evolutionary Biology), John J. Wiens. Smithsonian Books, 978-1560988168
2. Phylogenetics: Theory and Practice of Phylogenetic Systematics, E. O. Wiley & Bruce S. Lieberman, Wiley-Blackwell, 978-0470905968
3. Phylogenetic Trees Made Easy: A How To Manual, Fourth Edition, Barry G. Hall, Sinauer Associates, Inc. 978-0878936069
4. Inferring Phylogenies, Joseph Felsenstein, Sinauer Associates, 978-0878931774
5. Phylogenetics (Oxford Lecture Series in Mathematics and Its Applications), Charles Semple & Mike Steel, Oxford University Press, 978-0198509424
6. Plant Systematics: A Phylogenetic Approach, Walter S. Judd, Christopher S. Campbell, Elizabeth A. Kellog, Peter F. Stevens & Michael J. Donoghue, Sinauer Associates, 978-0878934072

7. Bast, F (2013) Sequence Similarity Search, Multiple Sequence Alignment, Model Selection, Distance Matrix and Phylogeny Reconstruction. *Nature Protocol Exchange*. Nature Publishing Group. doi: 10.1038/protex.2013.065 Accessible at:http://www.nature.com/protocolexchange/protocols/2740
8. Bast, F (2015) Tutorial on Phylogenetic Inference Part-1. *Resonance* 20 (4) 360-367
9. Bast, F (2015) Tutorial on Phylogenetic Inference Part-2. *Resonance* 20 (5) 445-457
10. Tree Thinking 2015) An Introduction to Phylogenetic Biology. David Baum and Stacey Smith. Roberts and Company Publishers

BOT.706: Plant Molecular Biology

Credit: 4

Course Descriptor:

This course is comprehensively disseminating the knowledge that is necessary for anyone who would like to work in plant biology with different techniques. In-fact this course helps to understand the potential roles of all techniques involved in plant molecular biology.

Scope of the Course:

1. This graduate-level course is suitable to all those students working with all advanced technology to solve their biological problems
2. The student will be expected to have background knowledge of basic of Botany and this work is definitively help to understand the principles of all those techniques which are required during doctoral research.

Unit. I **18 Lectures**

Classification of biomolecules, primary and secondary metabolites. Isolation and separation of biomolecules, extraction and isolation of DNA, RNA and proteins, isoelectric precipitation. Photometry and spectrometry, physical laws of light absorbance and transmittance and their relationship, radiant energy source, recorder and display devices, applications.

Unit. II **18 Lectures**

Electrophoretic techniques, horizontal and vertical gel electrophoresis, PAGE, native and SDS, physical laws governing electrophoresis, electrophoretic mobility, resistance, isoelectric focusing, use of Gel-Doc in recording and interpretation of results. DNA based molecular techniques, hybridization and PCR based techniques, RAPD, AFLP, RFLP and PCR-RFLP restriction digestion and amplification, molecular characterization, RAPD and AFLP fingerprints, applications in varietal identification and taxonomy, PIC value, Shannon's diversity index. Methods of sequencing of DNA, RNA and Proteins, Blotting techniques, Artificial synthesis of gene, complementary DNA synthesis.

Unit. III **18 Lectures**

Chromatographic techniques: principles and applications of HPLC, Low pressure column chromatography, Adsorption chromatography, Partition chromatography, Ion-exchange chromatography, Molecular exclusion chromatography, Affinity chromatography, Gas- liquid chromatography, Thin-layer chromatography, Hydrophobic Interaction Chromatography (HIC).

Unit. IV **18 Lectures**

Basic concepts of Gene cloning, construction of genomic and cDNA libraries, screening of genomic and cDNA libraries, physical methods of gene transfer, gene knock out, gene therapy, in-vitro mutagenesis, microarrays and DNA microchips. Immunosorbent techniques, principles, methodology and applications of ELISA in the detection and estimation of simple and conjugated proteins, storage and functional proteins, levels of solubility and clarification of proteins, Hybridoma technology and monoclonal antibodies, immunoprecipitation, immunoblotting etc.

Suggested Readings:

1. Beedu Sashidhar Rao, Vijay Deshpande (2005). *Experimental Biochemtristry*. I.K. International Pvt. Ltd.
2. M. Daniel (1991). *Methods in Plant Chemistry and Economic Botany*. Kalyani Publishers.

3. Keith Wilson and John Walker (2000), *Practical biochemistry- Principles and techniques*. Cambridge University Press.
4. Avinash Upadhyay, Kakoli Upadhyay, Nirmalendu Nath (2006). *Biophysical Chemistry- Principles and Techniques*. Himalaya Publishing House.

Course Code: BOT.751
Course Title: Research and Publication Ethics

L	T	P	Credits
2	0	0	2

Unit I Philosophy and Ethics **3 hours**

- Introduction to Philosophy : definition, nature and scope, content, branches
- Ethics : definition, moral philosophy, nature of moral judgements and reactions

Unit II Scientific Conduct **5 hours**

- Ethics with respect to science and research
- Intellectual honesty and research integrity
- Scientific misconducts : Falsification, Fabrication, and Plagiarism (FFP)
- Redundant publications : duplicate and overlapping publications, salami slicing
- Selective reporting and misrepresentation of data

Unit III: Publication Ethics **7 hours**

- Publication ethics : definition, introduction and importance
- Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc.
- Conflicts of interest
- Publication misconduct : definition, concept, problems that lead to unethical behaviour and vice versa, types
- Violation of publication ethics, authorship and contributor ship
- Identification of publication misconduct, complaints and appeals
- Predatory publishers and journals

Unit IV Open Access publishing **4 hours**

- Open access publications and initiatives
- SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
- Software tool to identify predatory publication developed by SPPU

- Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer, Journal Suggester etc.

Unit V Publication Misconduct **4 hours**

- Group Discussions: Subject specific ethical issues, FFP, authorship; conflicts of interest; complaints and appeals: examples and fraud from India and abroad
- Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools

Unit IV Databases and Research Metrics **7 hours**

- Databases: Indexing databases; Citation database: Web of Science, Scopus etc.
- Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics : h-index, g-index, i10 index, almetrics

Course Code: BOT.752
Course Title: TEACHING ASSISTANTSHIP

L	T	P	Credit
0	0	2	1

Total Hours: 30

Learning Outcome:

At the end of this skill development course, the scholars shall be able to

1. familiarize themselves with the pedagogical practices of effective class room delivery and knowledge evaluation system
2. manage large and small classes using appropriate pedagogical techniques for different types of content

Activities and Evaluation:

- The scholars shall attend Master degree classes of his/her supervisor to observe the various transaction modes that the supervisor follows in the class room delivery or transaction process one period per week.
- The scholars shall be assigned one period per week under the direct supervision of his/her supervisor to teach the Master degree students adopting appropriate teaching strategy(s).
- The scholars shall be involved in examination and evaluation system of the Master degree students such as preparation of questions, conduct of examination and preparation of results under the direction of the supervisor.
- At the end of the semester, the supervisor shall conduct an examination of teaching skills learned by the scholar as per the following evaluation criteria:

- The scholars shall be given a topic relevant to the Master degree course of the current semester as his/her specialization to prepare lessons and deliver in the class room before the master degree students for one hour (45 minutes teaching + 15 minutes interaction).
- The scholars shall be evaluated for a total of 50 marks comprising content knowledge (10 marks), explanation and demonstration skills (10 marks), communication skills (10 marks), teaching techniques employed (10 marks), and classroom interactions (10).

Course Title: CURRICULUM, PEDAGOGY AND EVALUATION
Course Code: UNI.753

L	T	P	Credit
1	0	0	1

Learning outcomes: **Total Hours: 15**

After completion of the course, scholars shall be able to:

- analyze the principles and bases of curriculum design and development
- examine the processes involved in curriculum development
- develop the skills of adopting innovative pedagogies and conducting students' assessment
- develop curriculum of a specific course/programme

Course Content

Unit I Bases and Principles of Curriculum **4 hours**

1. Curriculum: Concept and Principles of curriculum development, Foundations of Curriculum Development.
2. Types of Curriculum Designs- Subject centered, learner centered, experience centered and core curriculum. Designing local, national, regional and global specific curriculum. Choice Based Credit System and its implementation.

Unit II Curriculum Development **4 hours**

1. Process of Curriculum Development: Formulation of graduate attributes, course/learning outcomes, content selection, organization of content and learning experiences, transaction process.
2. Comparison among Interdisciplinary, multidisciplinary and trans-disciplinary approaches to curriculum.

Unit III Curriculum and Pedagogy **3 hours**

1. Conceptual understanding of Pedagogy.

2. Pedagogies: Peeragogy, Cybergogy and Heutagogy with special emphasis on Blended learning, Flipped learning, Dialogue, cooperative and collaborative learning
3. Three e- techniques: Moodle, Edmodo, Google classroom

Unit IV Learners' Assessment 4 hours

1. Assessment Preparation: Concept, purpose, and principles of preparing objective and subjective questions.
2. Conducting Assessment: Modes of conducting assessment – offline and online; use of ICT in conducting assessments.
3. Evaluation: Formative and Summative assessments, Outcome based assessment, and scoring criteria.

Transaction Mode

Lecture, dialogue, peer group discussion, workshop

Evaluation criteria

There shall be an end term evaluation of the course for 50 marks for duration of 2 hours. The course coordinator shall conduct the evaluation.

Suggested Readings

- Allyn, B., Beane, J. A., Conrad, E. P., & Samuel J. A., (1986). Curriculum Planning and Development. Boston: Allyn & Bacon.
- Brady, L. (1995). Curriculum Development. Prentice Hall: Delhi. National Council of Educational Research and Training.
- Deng, Z. (2007). Knowing the subject matter of science curriculum, Journal of Curriculum Studies, 39(5), 503-535. https://doi.org/10.1080/00220270701305362
- Gronlund, N. E. & Linn, R. L. (2003). Measurement and Assessment in teaching.
- Singapore: Pearson Education
- McNeil, J. D. (1990). Curriculum: A Comprehensive Introduction, London: Scott,
- Foreman/Little
- Nehru, R. S. S. (2015). Principles of Curriculum. New Delhi: APH Publishing Corporation.
- Oliva, P. F. (2001). Developing the curriculum (Fifth Ed.). New York, NY: Longman
- Stein, J. and Graham, C. (2014). Essentials for Blended Learning: A Standards-Based Guide. New York, NY: Routledge.

Web Resources

- https://www.westernsydney.edu.au/__data/assets/pdf_file/0004/467095/Fundamentals_of_Blended_Learning.pdf

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- https://www.uhd.edu/academics/university-college/centers-offices/teaching-learningexcellence/Pages/Principles-of-a-Flipped-Classroom.aspx
- http://leerwegdialoog.nl/wp-content/uploads/2018/06/180621-Article-The-BasicPrinciples-of-Dialogue-by-Renate-van-der-Veen-and-Olga-Plokhooij.pdf