Choice Based Credit System (CBCS)

UNIVERSITY OF DELHI

DEPARTMENT OF OPERATIONAL RESEARCH

UNDERGRADUATE PROGRAMME
(Courses effective from Academic Year 2015-16)

SYLLABUS OF COURSES TO BE OFFERED
Skill Enhancement Course papers for B.Sc. (Prog.) Mathematical Sciences/Physical Sciences/Applied Physical Science/B.A. (Prog.)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   2.1 **Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   2.2 **Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   2.3 **Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.
   P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
   3.1 AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
   3.2 AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of Courses Under Undergraduate Programme (B.Sc.)

Course	*Credits	
	Theory+ Practical	Theory+Tutorials
I. Core Course	12X4= 48	12X5=60
(12 Papers)		
04 Courses from each of the		
03 disciplines of choice		
Core Course Practical / Tutorial*	12X2=24	12X1=12
(12 Practical/ Tutorials*)		
04 Courses from each of the		
03 Disciplines of choice		
II. Elective Course	6x4=24	6X5=30
(6 Papers)		
Two papers from each discipline of choice		
including paper of interdisciplinary nature.		
Elective Course Practical / Tutorials*	6 X 2=12	6X1=6
(6 Practical / Tutorials*)		
Two Papers from each discipline of choice		
including paper of interdisciplinary nature		

- **Optional Dissertation or project work in place of one Discipline elective paper (6 credits) in 6th Semester**

III. Ability Enhancement Courses		
1**. Ability Enhancement Compulsory**	2 X 2=4	2X2=4
(2 Papers of 2 credits each)		
Environmental Science		
English/MIL Communication		
2**. Ability Enhancement Elective**	4 X 2=8	4 X 2=8
(Skill Based)		
(4 Papers of 2 credits each)	_____	_____
	Total credit= 120	**Total credit= 120**

Institute should evolve a system/policy about ECA/ General Interest/Hobby/Sports/NCC/NSS/related courses on its own.

*wherever there is practical there will be no tutorials and vice -versa

Skill Enhancement Course (SEC) (Credit: 02 each)

SEC - OR 1
1. Operational Research Applications

SEC - OR 2
1. Project Management

SEC - OR 3
1. Portfolio Optimization

SEC - OR 4
1. Business Data Analysis

SEC - OR 1: Operational Research Applications

Media allocation problem, Cargo Loading Problem, Production Scheduling Problem, Cutting stock problem, School bus routing problem using spanning tree, Simulation, Knapsack problem, Set Covering Problem, Fixed Charge Transportation Problem, Project Selection Problem.

References /Suggested Readings:

1. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010.
2. A. Ravindran, Don T. Phillips, James J. Solberg: Operations Research. Principles and Practice, John Wiley & Sons, 2005.
3. Frederick Hillier and Gerald Lieberman, Introduction to Operations Research. 9th Edition, McGraw-Hill Professional, 2010.
4. Wayne L. Winston, Operations Research: Applications and Algorithms, 4th Edition, Duxbury Press, 2003.

SEC - OR 2: Project Management

Basics of project management, feasibility and technical analysis: materials and equipment, project costing & financing, financial aspects, cost benefit analysis, success criteria and success factors, risk management.

Mathematical models: project selection, project planning, cost-time trade-off, resource handling/leveling.

References /Suggested Readings:

1. Ravi Ravindran: Operations Research and Management Science Handbook, CRC Press, 2008.
2. Harold Kerzner: Applied Project Management: Best Practices on Implementation, John Wiley & Sons, Inc., 2000.
3. Goodpasture, J. C.: Quantitative Methods in Project Management, J Ross Publishing, Boca Raton, Florida, USA, 2003.
4. Meredith, J. R. and Mantel Jr., S. J.: Project Management: A Managerial Approach, John Wiley, New York. 2004.

SEC - OR 3: Portfolio Optimization

Financial markets. Investment objectives. Measures of return and risk. Types of risks. Portfolio of assets. Expected risk and return of portfolio. Diversification. Mean-variance portfolio optimization- the Markowitz model and the two-fund theorem, risk-free assets and one fund theorem, efficient frontier. Portfolio performance evaluation measures.

Books Recommended

1. F.K. Reilly, Keith C. Brown, *Investment Analysis and Portfolio Management*, 10th Ed., South-Western Publishers, 2011.
2. H.M. Markowitz, *Mean-Variance Analysis in Portfolio Choice and Capital Markets*, Blackwell, New York, 1987.
3. D.G. Luenberger, *Investment Science*, 2nd Ed., Oxford University Press, 2013.

SEC - OR 4: Business Data Analysis

Business fundamentals, Importance of business data analytics, Evolution of business data analytics, Scope of business data analytics

Data processing and data warehousing

Data Management, Data Summarization, Data Cleaning, Data integration, Data reduction, Data warehousing, OLAP vs. OLTP, ROLAP, MOLAP Techniques for data analysis.

Association rule mining- Market Basket Analysis, Prediction Analysis, Unsupervised and supervised learning.

References /Suggested Readings:

1. Randy Bartlett, A practitioner's guide to business analytics: Using Data Analysis Tools to Improve Your Organization's Decision Making and Strategy, McGraw Hill Professional, 2013
2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP, , Tata McGraw – Hill Edition, Tenth Reprint 2007
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson Education, 2007
4. G. K. Gupta, Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006