CHARUSAT
CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ACADEMIC REGULATIONS & SYLLABUS

(Choice Based Credit System)

Faculty of Technology & Engineering

Master of Technology Programme

(Civil-Structural Engineering)

2016-17

Education Campus – Changa, (ECC), hitherto a conglomerate of institutes of professional education in Engineering, Pharmacy, Computer Applications, Management, Applied Sciences, Physiotherapy and Nursing, is one of the choicest destinations by students. It has been transformed into **Charotar University of Science and Technology(CHARUSAT)** through an Act by Government of Gujarat. CHARUSAT is permitted to grant degrees under Section-22 of UGC- Govt. of India.

The journey of CHARUSAT started in the year 2000, with only 240 Students, 4 Programmes, one Institute and an investment of about Rs. 3 Crores (INR 30 million). At present there are seven different institutes falling under ambit of six different faculties. The programmes offered by these faculties range from undergraduate (UG) to Ph.D degrees including M.Phil. These faculties, in all offer 23 different programmes. A quick glimpse in as under:

Faculty	Institute	Programmes Offered
Faculty of Technology & Engineering	Charotar Institute of Technology	B. Tech M. Tech MTM Ph. D
Faculty of Pharmacy	Ramanbhai Patel College of Pharmacy	B. Pharm M. Pharm MPM PGDCT/ PGDPT Ph. D
Faculty of Management Studies	IndukakaIpcowala Institute of Management	M.B.A PGDM Dual Degree BBA+MBA Ph.D
Faculty of Computer Applications	Smt. ChandabenMohanbhai Patel Institute of Computer Applications	M.C.A/MCAL M.Sc (IT) Dual Degree BCA+MCA Ph. D
Faculty of Applied Sciences	P.D.Patel Institute of Applied Sciences	M.Sc

		Dual Degree B.Sc+M.Sc Ph.D
Faculty of Medical Sciences	Ashok and Rita Institute of Physiotherapy ManikakaTopawala Institute of Nursing Charotar Institute of Paramedical Sciences	B.PT M.PT Ph.D B.Sc (Nursing) M.Sc PGDHA PGDMLT GNM Ph.D

The development and growth of the institutes have already led to an investment of over Rs.125 Crores (INR 1250 Million). The future outlay is planned with an estimate of Rs.250 Crores (INR 2500 Million).

The University is characterized by state-of-the-art infrastructural facilities, innovative teaching methods and highly learned faculty members. The University Campus sprawls over 105 acres of land and is Wi-Fi enabled. It is also recognized as the Greenest Campus of Gujarat.

CHARUSAT is privileged to have 360 core faculty members, educated and trained in IITs, IIMs and leading Indian Universities, and with long exposure to industry. It is also proud of its past students who are employed in prestigious national and multinational corporations.

From one college to the level of a forward-looking University, **CHARUSAT** has the vision of entering the club of premier Universities initially in the country and then globally. **High Moral Values like Honesty, Integrity and Transparency** which has been the foundation of ECC continues to anchor the functioning of **CHARUSAT**. Banking on the world class infrastructure and highly qualified and competent faculty, the University is expected to be catapulted into top 20 Universities in the coming five years. In order to align with the global requirements, the University has collaborated with internationally reputed organizations like Pennsylvania State University – USA, University at Alabama at Birmingham – USA, Northwick Park Institute –UK, ISRO, BARC, etc.

CHARUSAT has designed curricula for all its programmes in line with the current international practices and emerging requirements. Industrial Visits, Study Tours, Expert Lectures and Interactive IT enabled Teaching Practice form an integral part of the unique **CHARUSAT** pedagogy.

The programmes are credit-based and have continuous evaluation as an important feature. The pedagogy is student-centred, augurs well for self-learning and motivation for enquiry and research, and contains innumerable unique features like:

- Participatory and interactive discussion-based classes.
- Sessions by visiting faculty members drawn from leading academic institutions and industry.
- Regular weekly seminars.
- Distinguished lecture series.
- Practical, field-based projects and assignments.
- Summer training in leading organizations under faculty supervision in relevant programmes.
- Industrial tours and visits.
- Extensive use of technology for learning.
- Final Placement through campus interviews.

Exploration in the field of knowledge through research and development and comprehensive industrial linkages will be a hallmark of the University, which will mould the students for global assignments through technology-based knowledge and critical skills.

The evaluation of the student is based on grading system. A student has to pursue his/her programme with diligence for scoring a good Cumulative Grade Point Average (CGPA) and for succeeding in the chosen profession and life.

CHARUSAT welcomes you for a Bright Future

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

Faculty of Technology and Engineering

ACADEMIC REGULATIONS

Masters of Technology (Civil-Structural Engineering) Programme

(Choice Based Credit System)

Charotar University of Science and Technology (CHARUSAT)
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CHARUSAT

FACULTY OF TECHNOLOGY AND ENGINEERING
ACADEMIC REGULATIONS
Master of Technology Programmes

To ensure uniform system of education, duration of undergraduate and post graduate programmes, eligibility criteria for and mode of admission, credit load requirement and its distribution between course and system of examination and other related aspects, following academic rules and regulations are recommended.

1. System of Education

Choice based Credit System with Semester pattern of education shall be followed across the Charotar University of Science and Technology (CHARUSAT) at Master's levels. Each semester will be at least 90 working day duration. Every enrolled student will be required to take a course works in the chosen subject of specialization and also complete a project/dissertation if any. Apart from the Programme Core courses, provision for choosing University/Institute level electives and Programme level electives are available under the Choice based credit system.

2. Duration of Programme

Post graduate programme	(M. Tech.)
Minimum	4 semesters (2 academic years)
Maximum	8 semesters (4 academic years)

3. Eligibility for admissions

As enacted by Govt. of Gujarat from time to time.

4. Mode of admissions

As enacted by Govt. of Gujarat from time to time.

5. *Programme structure and Credits*

As per annexure – 1 attached

6. Attendance

All activities prescribed under these regulations and enlisted by the course faculty members in their respective course outlines are compulsory for all students pursuing the courses. No exemption will be given to any student regarding attendance except on account of serious personal illness or accident or family calamity that may genuinely prevent a student from attending a particular session or a few sessions. However, such unexpected absence from classes and other activities will be required to be condoned by the Principal.

Student's attendance in a course should be 80%.

7 Course Evaluation

7.1 The performance of every student in each course will be evaluated as follows:

7.1.1. Internal evaluation by the course faculty member(s) based on continuous assessment, for 30% of the marks for the course; and

7.1.2 Final examination by the University through modes such as; written paper or practical test or oral test or presentation by the student or a combination of any two or more of these, is set to 70% of the marks for each the course.

7.2 Internal Evaluation

As per Annexure – I attached

7.3 University Examination

The final examination by the University for 70% of the evaluation for the course will be through written paper or practical test or oral test or presentation by the student or a combination of any two or more of these.

7.4 In order to earn the credit in a course a student has to obtain grade other than FF.

7.5 Performance at Internal & University Examination

7.5.1 Minimum performance with respect to internal marks as well as university examination will be an important consideration for passing a course.
Details of minimum percentage of marks to be obtained in the examinations (internal/external) are as follows

Minimum marks in University Exam per course	Minimum marks Overall per course
40%	50%

7.5.2 A student failing to score 40% in the final examination will get an FF grade.

7.5.3 If a candidate obtains minimum required marks in each course but fails to obtain minimum required overall marks, he/she has to repeat the university examination till the minimum required overall marks are obtained.

8 Grading

8.1 The total of the internal evaluation marks and final University examination marks in each course will be converted to a letter grade **on** a ten-point scale as per the following scheme:

Table: Grading Scheme (UG)

Range of Marks (%)	**≥80**	**‹80 ≥75**	**‹75 ≥70**	**‹70 ≥65**	**‹65 ≥60**	**‹60 ≥55**	**‹55 ≥50**	**‹50**
Corresponding Letter Grade	**AA**	**AB**	**BB**	**BC**	**CC**	**CD**	**DD**	**FF**
Numerical point (Grade Point) corresponding to the letter grade	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**0**

8.2 The student's performance in any semester will be assessed by the Semester Grade Point Average (SGPA). Similarly, his/her performance at the end of two or more consecutive semesters will be denoted by the Cumulative Grade Point Average (CGPA). The SGPA and CGPA are calculated as follows:

(i) SGPA = $\Sigma C_i G_i / \Sigma C_i$ where C_i is the number of credits of course i
G_i is the Grade Point for the course i
andi = 1 to n, n = number of courses in the semester

(ii) CGPA = $\Sigma C_i G_i / \Sigma C_i$ where C_i is the number of credits of course i
G_i is the Grade Point for the course i
andi = 1 to n, n = number of courses of all semesters up to which CGPA is computed.

(iii) No student will be allowed to move further in next semester if CGPA is less than 3 at the end of an academic year.

(iv) A student will not be allowed to move to third year if he/she has not cleared all the courses of first year.

(v) A student will not be allowed to move to fourth year if he/she has not cleared all the courses of second year.

9. Award of Degree

9.1 Every student of the programme who fulfils the following criteria will be eligible for the award of the degree:

9.1.1 He/She should have earned minimum required credits as prescribed in course structure; and

9.1.2 He/She should have cleared all internal and external evaluation components in every course; and

9.1.3 He/She should have secured a minimum CGPA of 5 at the end of the programme;

9.1.4 In addition to above, the student has to complete the required formalities as per the regulatory bodies, if any.

9.2 The student who fails to satisfy minimum requirement of CGPA will be allowed to improve the grades so as to secure a minimum CGPA for award of degree. Only latest grade will be considered.

10 Award of Class:

The class awarded to a student in the programme is decided by the final CGPA as per the following scheme:

Distinction:	CGPA ≥ 7.5
First class:	CGPA ≥ 6.0
Second Class:	CGPA≥ 5.0

11 Transcript:

The transcript issued to the student at the time of leaving the University will contain a consolidated record of all the courses taken, credits earned, grades obtained, SGPA,CGPA, class obtained, etc.

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
(CHARUSAT)

FACULTY OF TECHNOLOGY & ENGINEERING (FTE)

CHOICE BASED CREDIT SYSTEM

FOR

MASTER OF TECHNOLOGY & ENGINEERING

A. Choice Based Credit System:

With the aim of incorporating the various guidelines initiated by the University Grands Commission (UGC) to bring equality, efficiency and excellence in the Higher Education System, Choice Based Credit System (CBCS) has been adopted.CBCS offers wide range of choices to students in all semesters to choose the courses based on their aptitude and career objectives. It accelerates the teaching-learning process and provides flexibility to students to opt for the courses of their choice and / or undergo additional courses to strengthen their Knowledge, Skills and Attitude.

1. CBCS – Conceptual Definitions / Key Terms (Terminologies)

1.1. Core Courses

1.1.1 University Core (UC)

University Core Courses are those courses which all students of the University of a Particular Level (PG/UG) will study irrespective of their Programme/specialization.

1.1.2 Programme Core (PC)

A 'Core Course' is a course which acts as a fundamental or conceptual base for Chosen Specialization of Engineering. It is mandatory for all students of a particular Programme and will not have any other choice for the same.

1.2 Elective Course (EC)

An 'Elective Course' is a course in which options / choices for course will be offered. It can either be for a Functional Course / Area or Streams of Specialization / Concentration which is / are offered or decided or declared by the University/Institute/Department (as the case may be) from time to time.

1.2.1 **University Elective/Institutional Elective Course (UE/IE)**

University/Institute Elective Courses are those courses which any students of the University/Institute of a Particular Level (PG/UG) will choose as offered or decided by the University from time-to-time irrespective of their Programme /Specialization

1.2.2 Programme Elective Course (PEC):

A 'Programme Elective Course' is a course for the specific programme in which students will opt for specific course(s) from the given set of functional course/ Area or Streams of Specialization options as offered or decided by the department from time-to-time

1.2.3 Cluster Elective Course (CEC):

A 'Cluster Elective Course' is a course which students can choose from the given set of functional course/ Area or Streams of Specialization options (eg. Common Courses to EC/CE/IT) as offered or decided by the Institute from time-to-time.

1.3 Non Credit Course (NCC) - AUDIT Course

A 'Non Credit Course' is a course where students will receive Participation or Course Completion certificate. This will not be reflected in Student's Grade Sheet. Attendance and Course Assessment is compulsory for Non Credit Courses

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
PROPOSEED TEACHING AND EXAMINATION SCHEME FOR M TECH (CIVIL –STRUCTURAL ENGG.)
CHOICE BASED CREDIT SYSTEM SCHEME (JULY 2015)

Semester	Course Code	Course Title	Teaching Scheme				Examination Scheme				
			Theory	Practical/Tutorial	Total	Credit	Theory		Practical		Total
							Internal	External	Internal	External	
Sem 1	**HS701**	Advanced Critical Thinking & Logic (University Core -I)	2	0	2	2	30	70	0	0	100
	MA741	Application of Numerical Methods in Civil Engineering (Programme Core I)	3	2	5	4	30	70	25	25	150
	CL741	Advanced Structural Analysis (Programme Core II)	4	2	5	5	30	70	25	25	150
	CL742	Design Practices-I (Programme Core III)	2	4	6	4	0	0	100	100	200
	CLXXX	Programme Elective-I	3	2	5	4	30	70	25	25	150
	CLXXX	Programme Elective-II	3	2	5	4	30	70	25	25	150
	XXXXX	University Elective I	2	0	2	2	30	70	0	0	100
			19	**12**	**31**	**25**					**1000**
	HS702	Academic Writing & Communication Skills (University Core -II)	**0**	2	2	2	0	0	30	70	100
	CL743	Finite Element Analysis (Programme Core IV)	3	2	5	4	30	70	25	25	150
Sem 2	CL744	Structural Dynamics & Earthquake Engineering Programme Core V)	4	2	5	5	30	70	25	25	150

	CL745	Design Practice II Programme Core VI)	2	4	6	4	0	0	100		100	200
	CLXXX	Programme Elective-III	3	2	5	4	30	70	25		25	150
	CLXXX	Programme Elective-IV	3	2	5	4	30	70	25		25	150
	XXXXX	University Elective II	**2**	0	2	2	0	0	30		70	100
			17	**14**	**31**	**25**						**1000**
							Internal		**External**			
							Report	**Seminar**	**Report**	**Seminar**	**Viva**	**Total**
Sem 3	**CL801**	Project Preliminaries				4	50	50	--	50	50	200
	CL802	Project Phase – I				16	100	100	100	100	100	500
						20						**700**
Sem 4	**CL803**	Project Phase - II				3	200	200	200	200	200	1000
						32						**1000**
		GRAND TOTAL				**102**						**3700**

University Electives (IE)

Semester 1 (University Elective I)		**Semester 2 (University Elective II)**	
MA771	Reliability and Risk Analysis	EE782	Energy Audit and Management
EE 781	Optimization Techniques	CE771	Project Management
ME781	Occupational Health & Safety	IT771	Cyber Security and Laws
CE772	Research Methodology	CA 842	Mobile Application Development
CA730	Internet & Web Designing	PT796	Fitness & Nutrition
PT795	Health & Physical Activity	NR 752	Epidemiology and Community Health
NR 751	Women's Health	OC733	Introduction to Polymer Science
RD701	Introduction to Analytical Techniques	MB651	Software based Statistical Analysis
RD702	Introduction to Nanoscience & Technology	PH826	Intellectual Property Rights
MB650	Creative Leadership	MA772	Design of Experiments
PH825	Community Pharmacy Ownership		

Programme Electives

Semester 1 (Programme Elective-1)		Semester 1 (Programme Elective-2)	
CL761	Design of Foundation Systems	CL764	Advanced Concrete Technology
CL762	Prestressed Concrete Structures	CL765	Theory and Application of Plate & Shells
CL763	Stability Analysis	CL766	Design of Tall Structures

Semester 2 (Programme Elective-III)		Semester 2 (Programme Elective-IV)	
CL767	Design of Offshore Structures	CL770	Structural Optimization & Reliability
CL768	Design of Composite Structures	CL771	Bridge Engineering
CL769	Design of Cold Formed Steel Structures	CL772	Behaviour of Structures under Extreme Loading

M. Tech. (Civil-Structural Engineering) Programme

SYLLABI

(Semester – I)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

HS701: ADVANCED CRITICAL THINKING & LOGIC

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	0	2	2
Marks	100	-	100	

A. Objective of the Course:

To facilitate learners to:

- Critically and logically read, listen, and write
- Develop intellectual and personal discipline
- Recognize both the need and complexity of good reasoning, logic and critical thinking
- Provide intellectual tools for more rigorous self-reflection and critical assessment of other people's arguments
- Develop a sense of fairness and respect for opposing positions
- Develop advance thinking skills that are applicable to a variety of academic subjects and learners' lives as citizens, consumers, leaders, and moral agents
- Improve ability to argue fairly, and to handle bias, emotion, and propaganda
- Develop scientific approach of thinking
- Develop questioning competencies for logical and critical thinking

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Critical Thinking & Logic	02
2	Study of Theories and Critical Thinkers & Logicians	08
3	Socratic Questioning	06
4	Scientific Approach & Critical Thinking	04
5	Logic and Arguments	06
6	Contemporary Issues, Critical Thinking & Logic	04

Total Hours (Theory& Lab): 30

C. Detailed Syllabus:

1.	**Introduction to Critical Thinking & Logic**	**02 Hours**	**07%**
1.1	Concept and Meaning of Thinking & Mind		
1.2	Concept and Meaning of Critical Thinking		
1.3	Concept and Meaning of Logic		
1.4	History of Critical Thinking and Logic		
2	**Study of Theories and Critical Thinkers & Logicians**	**08 Hours**	**27%**
2.1	Socrates, Aristotle and Contemporary Theorists		
2.2	Asian Critical Thinking Theories		
3	**Socratic Questioning**	**06 Hours**	**20%**
3.1	Background of Socratic Questioning		
3.2	Importance of Socratic Questioning for Critical Thinking		
3.3	Methods of Socratic Questing & Critical Thinking		
4	**Scientific Approach & Critical Thinking**	**04 Hours**	**13%**
4.1	Meaning and Concept of Science Approach & Critical thinking		
4.2	Relationship of Critical Thinking to the Scientific Method		
5	**Logic and Arguments**	**06 Hours**	**20%**
5.1	Nature and Concept of Logic and Arguments		
5.2	Application of Arguments for Logical Thinking		
6	**Contemporary Issues, Critical Thinking & Logic**	**04 Hours**	**13%**
6.1	Critical Thinking, Society and Moral Reasoning		
6.2	Case Study		

D. Instructional Method and Pedagogy:

The course is based on pragmatic learning. Teaching will be facilitated by Reading Material, Discussion, Task-based learning, projects, assignments and various interpersonal activities like case studies, critical reading, group work, independent and collaborative research, presentations, etc.

E. Evaluation

The students will be evaluated continuously in the form of internal as well as external examinations. The evaluation (Theory) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
3	Assignment / Project Work	2	25	25
4	Attendance and Class Participation			05
			Total	**30**

External Evaluation

The University Theory examination will be of 70 marks and will test the reasoning, logic and critical thinking skills of the students by asking them theoretical as well as application based questions. The examination will avoid, as far as possible, grammatical errors and will focus on applications. There will be at least one question on case analysis relevant to the components of the course.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

F. Students Learning Outcomes:

At the end of the course, learners will be able to:

- Demonstrate the ability to use the elements of thought in developing their thinking process to effectively solve problems and make decisions.
- Consistently apply the critical thinking standards to their thinking process to engage in the process of application, analysis, synthesis, and evaluation in order to make informed and effective decisions.
- Become independent thinker.
- Develop system thinking.
- Develop moral reasoning.
- Apply good reasoning to issues in professional and personal contexts.
- Evaluate evidence and make appropriate inferences from that evidence.

- Determine what evidence is necessary and know how to find that evidence, if possible.
- Construct and defend arguments in support of or in opposition to particular propositions.

G. Recommended Study Material:

Reference Books:

1. Critical Thinking : Introduction, by Alec Fisher, Cambridge
2. Introduction to Logic by Harry J Gensler, Routledge

Web Materials:

1. http://www.skepdic.com/essays/haskins.pdf
2. https://www.palgrave.com/PDFs/1403996857.Pdf
3. www.criticalthinking.org
4. philosophy.hku.hk/think/critical/ct.php

MA741: APPLICATION OF NUMERICAL METHODS IN CIVIL ENGINEERING

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- Structural analysis is based on mathematical operations. To find out solutions of various structural problems, knowledge of applications of various methods of mathematics is a must.
- The main objective of the course is to equip the students of structural engineering with applications of numerical and statistical methods to solve problems related to structural engineering.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Approximate solutions of nonlinear equations	09
2	Interpolation	09
3	Correlation and Regression	09
4	Functions of complex variable and Fourier transforms	09
5	Matrices	09

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1.	**Approximate solutions of nonlinear equations**	**09 Hours**	**20%**
1.1	Bisection method, Method of false position.		
1.2	Newton- Raphson method for single variable.		
1.3	Numerical solutions of ordinary differential equations by Euler's, Taylor's series, Picard's, Rungekutta (2^{nd} and 4^{th} order) methods and their applications to structural engineering problems.		
2	**Interpolation**	**09 Hours**	**20%**
2.1	Finite difference, Forward and backward differences, Interpolation.		
2.2	Newton's forward interpolation formula, Newton's backward interpolation formula.		
2.3	Lagrange's interpolation formula and Newton's divided difference formula.		
3	**Correlation and Regression**	**09 Hours**	**20%**
3.1	Measure of association between two variables. Types of Correlation, Karl Pearson's Coefficient of correlation and its mathematical properties.		
3.2	Spearman's Rank correlation and its interpretations.		
3.3	Least squares curve fitting methods, linear and nonlinear curve fitting and their application to structural engineering problems.		
4	**Functions of complex variable and Fourier transforms**	**09 Hours**	**20%**
4.1	Analytic function, Cauchy-Riemann equations (Cartesian and polar forms), Necessary and sufficient condition for the function to be analytic.		
4.2	Harmonic function and Harmonic conjugate.		
4.3	Fourier transforms, Fourier sine transforms, Fourier cosine transforms and their application to structural engineering problems.		
5	**Matrices**	**09 Hours**	**20%**
5.1	Eigen values and Eigen vector of matrices.		

5.2 Cayley - Hamilton theorem and its applications.

5.3 Special matrices viz Symmetric, Skew-symmetric, Hermitian, skew Hermitian.

5.4 Orthogonal and Unitary matrices and their properties and their application to structural engineering problems.

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- MATLAB based tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course, students will be

- Equipped with adequate knowledge of mathematics that will enable them in formulating problems and solving problems analytically.
- Able to handle linear systems using matrices.
- Able to apply integration method/s for structural analysis.
- Able to perform matrix operations.
- Able to do interpolations.
- Able to apply fourier series & numerical methods for structural analysis.

F. Recommended Study Material:

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics 42nd Edition, Khanna Publishers.
2. Chapra&Canane, Numerical Methods for Engineers, McGraw-Hill Science/Engineering/Math; 6th edition, April 20, 2009.
3. Salvadori& Baron, Numerical Methods in Engineering, Prentice-Hall International, 1961.

Reference Books:

1. Jain &Iyengar, Advanced Engineering Mathematics, CRC Press, 2002.
2. Veeranjan& Ramachandran, Theory and problems in Numerical Methods, Tata McGraw-Hill Publishing Company, New Delhi-2004.

CL741: ADVANCED STRUCTURAL ANALYSIS

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Objective of the Course:

The main objectives of the course are:

- To strengthen theoretical concepts of structural analysis by most versatile methods, i.e. force and displacement method.
- To develop learning skill for analysis of civil engineering structures subjected to axial, flexural, and thermal loadings.
- To study the behavior patterns of structural materials.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	10
2	Concepts of Flexibility	14
3	Stiffness Methods	24
4	Analysis of Elastic Instability and Second Order Response	12

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1.	**Introduction**	**10 Hours**	**17%**
1.1	Concepts of structural analysis		
1.2	Introduction to matrix structural analysis		
1.3	Basis for principal of virtual work		
1.4	Principal of virtual force-standard and matrix formulation		
1.5	Principal of virtual displacement-standard and matrix formulation		
1.6	Extension of displacement method to the generalized stiffness method		
2	**Concepts of Flexibility**	**14 Hours**	**23%**
2.1	Analysis of beam and plane truss by member approach		
2.2	Analysis of plane frame and grid by member approach.		
3	**Stiffness Method**	**24 Hours**	**40%**
3.1	Analysis of beam, plane truss, plane frames, grids, space truss, space frame and composite structures by member approach		
3.2	Special problems such as member discontinuities, non prismatic members, curved members and beams on elastic supports		
3.3	Secondary effects due to temperature changes, pre-strains and support displacement		
3.4	Symmetry / Anti-symmetry		
4	**Analysis of Elastic Instability and Second Order Response**	**12 Hours**	**20%**
4.1	Introduction		
4.2	Effects of Axial Force on Flexural Stiffness		
4.3	Matrix method of analysis		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course

- Students will be able to evaluate and analyse results provided by the commercial software for the purpose of analysis & design.
- Students will be able to use variety of Structural Engineering software for their projects and research work.
- The course will give in-depth knowledge of mathematical modeling and computational methods in the areas of non-linear, static and dynamic analysis of structures.

F. Recommended Study Material:

Text Books:

1. Gere & Weaver, Matrix Analysis of Framed Structures, Cbs publisher, 2004.
2. Dawe, D.J., Matrix and Finite Element Displacement Analysis of Structures, Clarendon Press.
3. MenonDevdas, Advanced Structural Analysis, Narosa Publishing House.
4. Ghali&Nevelle, Structural Analysis, Palgrave Macmillan.

Reference Books:

1. Wang & Chu-Kia, Matrix Methods of Structural Analysis, International Textbook Company, Limited.
2. Fleming & John, F., Computer Analysis of Structural System, Prentice Hall; First Edition edition (November 1996).

CL742: DESIGN PRACTICES-I

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	6	6	6
Marks	-	300	300	

A. Objective of the Course:

The main objectives of this course are:

- To review the design of various RCC elements
- To plan, analyze and design a structure which meets basic requirements of structural science for the benefit of client or end user.
- To learn to design various structures like MS Building, Flat Slab, Water tank, Bridges etc. which are very common structures in day to day life.

B. Outline of the Course

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Review of RCC Element Design	10
2	Multistoried Building	20
3	Flat Slab	10
4	Shear Wall	10
5	Water Tanks	15
6	Chimney	10
7	Bridges	15

Total Hours (Theory): 00

Total Hours (Lab): 90

Total Hours: 90

C. Detailed Syllabus:

1	**Review of RCC Element Design**	**10 Hours**	**11%**
1.1	Slab: One Way, Two Way, Continuous		
1.2	Beam: Singly, Doubly, Continuous		
1.3	Column: Short & Long Columns subjected to various Loadings		
1.4	Footing: Isolated, Combined		
1.5	Staircase		
2	**Multi-Storied Buildings**	**20Hours**	**22%**
2.1	Determination of dead load, live load, wind load and earthquake load on various components of the buildings and appropriate design		
2.2	Detailing of reinforcement and bar bending schedule		
2.3	Different lateral load resisting system		
3	**Flat Slabs**	**10 Hours**	**11%**
3.1	Proportioning, analysis by direct design method and equivalent frame method		
3.2	Slab design and detailing		
4	**Shear Wall**	**10 Hours**	**11%**
4.1	Forces on Shear Wall, Shear Wall Design		
5	**Water Tanks**	**15 Hours**	**17%**
5.1	Classification, Codal Provisions		
5.2	Intze/Conical Water Tank Design		
6	**Chimney**		
6.1	Basic Design Philosophy & Design Considerations	**10 Hours**	**11%**
6.2	Loads acting and codal provisions		
6.3	Analysis & Design		
7	**Bridges**	**15 Hours**	**17%**
7.1	Design Philosophy & Considerations		
7.2	IRC Loads and codal provisions		
7.3	Analysis & Design		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- The full course will be covered in laboratory only.
- Laboratory will be conducted with the aid of multi-media projector, black board, OHP etc.
- Tutorials related to course content will be carried out in the laboratory.
- Detailed drawings of any designed structured is to be prepared preferred using AutoCad.

E. Students Learning Outcomes:

On the successful completion of this course

- Students will gain the knowledge of necessary tools to analyze the structures as competing points of view using empirical techniques and statistical inference.
- Students will be able to apply the knowledge gained and skills to analyze and design various types of structures.
- Students will develop the understanding of qualitative design services at competitive costs.

F. Recommended Study Material:

Text Books:

1. Pillai, S., &Menon, D., Reinforced Concrete Design, TATA McGraw-Hill.
2. Krishna Raju, Advanced Reinforced Concrete Design, CBS Publishers, New Delhi.
3. Variyani and Radhaji, Manual of Limit State Design, CBS Publishers, New Delhi.

Reference Books:

1. Shah &Karve, Illustrated Design of G + 3 Building, Standard Book House.

Other Material:

1. IS: 456-2000, Plain and Reinforced Concrete
2. IS: 875,Code of Practice for Design Loads
3. IS: 1893-2002 (Part-I), Criteria for Earthquake Resistant Design
4. IS: 4326-1993, Earthquake Resisting Design & Construction Building
5. IS: 13920-1993, Ductile Detailing of RC Structures

CL761: DESIGN OF FOUNDATION SYSTEMS (PROGRAMME ELECTIVE-1)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

The main objectives of the course are:

- To learn about types and purposes of different foundation systems and structures.
- To provide exposure to the students regarding systematic methods for designing foundations.
- To discuss and evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behavior.
- To build the necessary theoretical background for design and construction of foundation systems.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Foundation System	04
2	Bearing Capacity	11
3	Shallow Foundations	08
4	Pile Foundations	08
5	Well Foundation	08
6	Foundations on Difficult Soils	06

Total Hours (Theory): 45

Total Hours (Lab): 00

Total Hours: 45

C. Detailed Syllabus:

1.	**Introduction to Foundation System**	**04 Hours**	**08%**
1.1	Soil exploration, Classification of foundations (Flexible, rigid, shallow and deep foundations).		
1.2	Terminology: Gross bearing capacity, ultimate bearing capacity, net-ultimate bearing capacity, safe bearing capacity, net safe bearing capacity, safe bearing pressure, allowable bearing pressure.		
1.3	Factors for Selection of Type of Foundation: Function of the structure and the loads it must carry, sub-surface condition of the soil, cost of super-structure.		
2.	**Bearing Capacity**	**11 Hours**	**25%**
2.1	Bearing capacity based on the classical earth pressure theory of Rankine		
2.2	Semi-empirical solutions based on theory of plasticity (a). Prandtl's theory (b). Terzaghi's theory (c). Meyerhof's theory		
2.3	Bearing capacity of shallow footings in clays. Effect of water table on Ultimate Bearing Capacity.		
2.4	Allowable Bearing Capacity, Safe Bearing Capacity in clays		
2.5	IS code Design practice		
2.6	Penetration Tests (insitu-tests): SPT- Standard penetration test, SCPT- Static cone penetration test DCPT- Dynamic cone penetration test PMT- pressure meter test. VST- vane shear test. PLT- plate load test (Insitu- test).		
3.	**Shallow Foundations**	**08 Hours**	**18%**
3.1	Types of foundations		
3.2	Spread footing		
3.3	Safe Bearing Pressure		

3.4	Settlement of Footing		
3.5	Combined Footing & Strap Footing		
3.6	Mat or Raft Footing		
3.7	IS code of Practice for Design of Raft Foundations		
4.	**Pile Foundations**	**08 Hours**	**18%**
4.1	Introduction, Types		
4.2	Estimation of Pile Length		
4.3	Installation of Piles		
4.4	Load Transfer Mechanism		
4.5	Static Formula		
4.6	Pile Load Test		
4.7	Group Actions in Piles		
4.8	Various types of Piles		
5.	**Well Foundation**	**08 Hours**	**18%**
5.1	Introduction: Cassions		
5.2	Shapes of Well Foundation, Components		
5.3	Forces Acting & Analysis of Well Foundations		
5.4	Simplified analysis of heavy wells		
5.5	IRC method, Illustrative examples		
6.	**Foundations on Difficult Soils**	**06 Hours**	**13%**
6.1	Foundations of Collapsible Soil		
6.2	Foundations of Expansive Soil		
6.3	Sanitary Landfills		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- A field visit related subject will be carried out for further understanding of subject. Report will be prepared by the students for the same.

E. Students Learning Outcomes:

On the successful completion of this course, students will be capable to

- Select appropriate foundation system for the different structure.
- Analyse and design of shallow foundation
- Analyse and design of raft, pile and well foundations

F. Recommended Study Material:

Text Books:

1. Kasmalkar, J. B., Foundation Engineering, Pune VidyarthiGraha Prakashan-1786,Pune-411030.
2. Bowels, Joseph E., Practical Foundation Engineering Handbook. 5th edition, McGraw- Hill, New York.
3. Das, Braja M., Principles of foundation Engineering, 4th edition, PWS publishing, Pacific Grov. Calif.
4. Peck, Ralph B., Hansen, Walter E., &Thornburn, Thomas H., Foundation Engineering. John Wiley & Sons, New York.
5. Punamia B C, Soil Mechanics & Foundation Engineering, Laxmi Publications
6. Arors K R, Soil Mechanics & Foundation Engineering, Standard Publishers

Reference Books:

1. Praksh, Shamsher, & Sharma, Hari D., Pile foundation in Engineering Practice, John Wiley & Sons, New York.
2. Som, N. N., & Das, S. C., Foundation Engineering: Principles and Practice. Prentice –Hall of India Pvt. Ltd. New Delhi-001.
3. Varghese, P. C., Foundation Engineering Prentice –Hall of India Pvt. Ltd. New Delhi-001.

   Tomlonson, Michael J., Foundation Design and Construction. 6th edition. John Wiley & Sons, New York.

CL762: PRESTRESSED CONCRETE STRUCTURES (PROGRAMME ELECTIVE-1)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To learn more deeply the concepts related to the modeling of prestressed concrete structure behavior and to the design of concrete structures.
- To learn different methods and techniques for concrete structural analyses, design and implementation of laminar concrete structures and prestressed concrete structures.
- To identify different techniques for applying prestress on concrete structures and the respective methods of analysis and design.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	06
2	Deflection of prestressed concrete member	06
3	Flexural strength of prestressed concrete sections	06
4	Design of Flexure Members	08
5	Ultimate strength and Design in Shear and Torsion	10
6	Composite construction	09

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. **Detailed Syllabus:**

1.	**Introduction**	**06 Hours**	**13 %**
1.1	Development of prestressed concrete		
1.2	Classification of types of prestressing		
1.3	Concepts of prestressing		
1.4	Losses of prestress		
2.	**Deflection of prestressed concrete member**	**06 Hours**	**13 %**
2.1	Factors influencing deflection		
2.2	Short-Term deflection of uncracked members		
2.3	Prediction of Long time deflection		
3.	**Flexural strength of prestressed concrete sections**	**06 Hours**	**13 %**
3.1	Behavior under flexure, Types of flexure failure		
3.2	Strain compatibility method		
3.3	Indian code procedure		
4	**Design of Flexure Members**	**08 Hours**	**19 %**
4.1	Introduction		
4.2	Flexural design using allowable stresses at service load		
4.3	Stress range approach		
4.4	Magnel's approach		
5.	**Ultimate strength and Design in Shear and Torsion**	**10 Hours**	**22 %**
5.1	Concept of shear		
5.2	Mechanism of shear resistance in concrete in concrete beams		
5.3	Ultimate shear resistance of PSC members		
5.4	Design of Prestressed sections for shear		
5.5	Behaviour of PSC member under torsion		
6.	**Composite construction**	**09 Hours**	**20 %**
6.1	Introduction, Need for composite construction		
6.2	Types of composite construction		
6.3	Behaviour of composite construction		
6.4	Flexural strength of composite section		
6.5	Shear strength of composite section		
6.6	Design of composite section		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory which carries 5 Marks weightage.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course

- The students will learn how to calculate and develop solutions based on learned structural methods.
- The students will learn the theories and practical aspects of prestressing along with the design and management applications.

F. Recommended Study Material:

Text Books:

1. Krishna Raju, N., Design of Prestressed Concrete Structures, Tata Mcgraw-hill, Fourth Edition
2. Lin, T.Y., & Burns, N.H., Design of Pre-stressed Concrete Structures, Wiley India Pvt Ltd.
3. Ragagopalan, Prestressed Concrete, Narosa Publishing House.

Reference Books:

1. Mallick, D.K., & Gupta, A.P., Limit State Design of Prestressed Concrete Structures, Oxford and IBH Publishing Company.

   IS 1343:1980, Code of practice for Prestressed Concrete, (First Revision)

CL763: STABILITY ANALYSIS (PROGRAMME ELECTIVE-1)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

The main objectives of the course are:

- To develop fundamental understanding in regards to stability of structures and its applications to diverse problems in Civil Engineering.
- To enhance design analysis process with usage of stability analysis in regards to structural system.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Fundamental concepts	06
2	Elastic Buckling of Columns and Frames	10
3	Torsional Bucking	10
4	Lateral Buckling of Beams	10
5	Dynamic stability	09

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

Detailed Syllabus:

1.	**Fundamental concepts**	**06 Hours**	**14%**
1.1	Definitions of stability		
1.2	Structural instability		
1.3	Analytical approaches to structural instability		
1.4	Continuous deformable elastic bodies		
2.	**Elastic Buckling of Columns and Frames**	**10 Hours**	**22%**
2.1	Special Functions, bending theory		
2.2	Critical load of perfect columns with various end restraints		
2.3	Bucking of columns		
2.4	Critical load for various boundary conditions		
2.5	Columns with geometric imperfection, Large deflection theory of columns		
2.6	Orthogonality of buckling modes, eccentrically loaded columns		
2.7	Post critical behaviour of frames		
3.	**Torsional Bucking**	**10 Hours**	**22%**
3.1	Introduction		
3.2	Pure torsion of thin walled bars of open sections		
3.3	Non-uniform torsion of thin walled bars of open section		
3.4	Torsional buckling		
3.5	Buckling by torsion and flexure		
4.	**Lateral Buckling of Beams**	**10 Hours**	**22%**
4.1	Differential equations for lateral buckling of columns		
4.2	Lateral buckling of beams in pure bending		
4.3	Lateral buckling of Cantilever beams with point load at the free end		
4.4	Application of Rayleigh-Ritz method		
5.	**Dynamic stability**	**09 Hours**	**20%**
5.1	Introduction		
5.2	Need of dynamic investigation		
5.3	Discrete systems		
5.4	Langrange – Hamilton formulation for continues systems		
5.5	Stability of continues systems		

C. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

D. **Students Learning Outcomes:**

On the successful completion of this course

- The students will be able to understand the analysis of different types of structures pertaining to its stability aspects.

E. **Recommended Study Material:**

Text Books:

1. Timoshenko, S.P., and Gere, J.M., Theory of Elastic Stability, McGraw Hill Intl Edition
2. Ashwini Kumar, Stability of Structures, Tata McGraw Hill Publishing Company Ltd., New Delhi.

Reference Books:

1. Gambhir, M. Lal., Stability Analysis and Design of Structures, Springer, 1st edition 2004.
2. Iyengar NGR, Elastic Stability of Structural Elements, Macmillan Publication.
3. Bazant, Z., &Cedolin, L., Stability of Structures, Oxford University Press, Inc., 1991
4. Simitses George J. and Hodges Dewey H., Fundamentals of structural stability, Elsevier Inc., 2006.
5. W. Xie, Dynamic Stability of Structures, Cambridge University Press, 2006.

CL764: ADVANCED CONCRETE TECHNOLOGY (PROGRAMME ELECTIVE-II)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- The objective of the course is to provide a teaching and learning experience for participants such that they obtain an in-depth knowledge at an advanced level of a wide variety of topics within the field of concrete technology.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Cement	05
2	Admixtures	04
3	Performance of Concrete	08
4	Additions to concrete & Special Concretes	10
5	Testing of hardened concrete	08
6	Mix design	10

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1.	**Cement**	**05 Hours**	**11%**
1.1	Review of cements including blended cements		
1.2	Manufacture, chemical composition, chemical and physical processes of hydration		
1.3	Chemical composition of OPC and Modified Portland Cements, Hydration of cement, Microstructure of hydrated cement paste and concrete		
1.4	Aggregate: Properties and grading, Mineral and chemical admixtures in concrete, Structure-property relationships		
2	**Admixtures**	**04 Hours**	**09%**
2.1	Review of types and classification		
2.2	Effects on properties of concretes		
2.3	Use & Dosage of Admixtures		
3	**Performance of Concrete**	**08 Hours**	**18%**
3.1	Properties of fresh concrete and hardened concrete, Shrinkage, Creep, Durability of Concrete, Relation between durability and permeability		
3.2	Cracks and crack propagation in concrete, Fracture Strength, Stability of constituents		
3.3	Chemical attack, Corrosion of reinforcing steel, Fire resistance		
3.4	Use of corrosion inhibitors and types of inhibitors, Testing of concretes		
4	**Additions to concrete & Special Concretes**	**10 Hours**	**22%**
4.1	Review of types		
4.2	Concrete with different cementitious materials		
4.3	General features of use of fly ash, ggbs and silica fume, durability aspects		
4.4	Properties and applications of High strength and high performance concrete		
4.5	Reactive powder concrete, Lightweight, heavyweight, and mass concrete, Fibre reinforced concrete, Self-compacting concrete,		
4.6	Shotcrete and other special concretes, Polymer Concrete,		

	Epoxy resins and screeds.		
5	**Testing of hardened concrete**		
5.1	Test for strength in compression	**08 Hours**	**18%**
5.2	Test for strength in tension		
5.3	Test Cores		
5.4	Non Destructive Tests		
6	**Mix design**	**10 Hours**	**22%**
6.1	Review of methods and philosophies, simplifying assumptions		
6.2	Principles of concrete mix design, packing density and rheology		
6.3	Methods of concrete mix design, IS Method, ACI Method, DOE Method – Statistical quality control – Sampling and acceptance criteria.		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course

1. The learner is expected to be able to select the cement type, aggregates, need for admixture and to decide the mix proportions of concrete, and to develop a sight for testing and evaluation of strength and durability of concrete.

F. Recommended Study Material:

Text Books:

1. Neville, A.M., Properties of Concrete. ELBS Edition (4th ed.) Longman Ltd., London.

2. Gambhir, M.L., Concrete Technology, Tata McGraw Hill.
3. Neville, A.M., & Brooks, Concrete Technology, ELBS Edition, London.
4. Gupta.B.L., Amit Gupta, "Concrete Technology, Jain Book Agency, 2010
5. Krishnaraju, N., "Advanced Concrete Technology", CBS Publishers.

Reference Books:

1. Taylor, Concrete Technology, Orchid.
2. Mehta, P.K., Monteiro, P. J. M., Concrete, Prentice Hall, New Jersey.
3. Varshney, R.S., Concrete Technology, Oxford, IBH Publisher.
4. John Newman, B. S. Choo., Advance Concrete Technology 3: process (vol 3).
5. Malhotra, V.M., and Ramezaniaanpour, A.A., Fly Ash In Concrete, Canmet.
6. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2003.

CL765: THEORY & APPLICATIONS OF PLATES & SHELLS (PROGRAMME ELECTIVE-II)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To study the behavior of the plates and shells with different geometry under various types of loads.
- To provide comprehensive and methodical presentation of the principles of plate and shell theories and their applications to numerous structural elements.
- Classical approaches will be used to provide the student with a firm grasp of the fundamentals necessary to perform critical interpretations, required when computer-based solutions are employed in practice.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Pure Bending of Plates	05
2	Laterally Loaded Rectangular Plates & Circular plates	14
3	Shells	04
4	Membrane Analysis	10
5	General Theory of Cylindrical Shells	12

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1.	**Pure Bending of Plates**	**05 Hours**	**11%**
1.1	Introduction, classification of plates, thin plates and thick plates, small deflection theory and large deflection theory		
1.2	Slope & curvature of slightly bent plates		
1.3	Relations between bending moments and curvature in pure bending of plates		
1.4	Derivation of differential plate equation for isotropic and orthotropic plate element		
1.5	Small deflection theory of thin plates		
2	**Laterally Loaded Rectangular Plates & Circular plates**	**14 Hours**	**31%**
2.1	Differential equation of plates, Boundary conditions – Navier solution for simply supported plates subjected to uniformly distributed load and point load		
2.2	Levy's method of solution for plates having two opposite edges simply supported with various symmetrical boundary conditions along the other two edges loaded with u. d. l.		
2.3	Effect of transverse shear deformation, plates of variable thickness, anisotropic plates - thick plates, orthotropic plates and grids, Large Deflection theory		
2.4	Particular cases or solution for circular plates of different boundary conditions under uniformly distributed pressure		
3	**Shells**	**04 Hours**	**9%**
3.1	Classification of shell structures		
3.2	Stress-strain & force displacement relations		
3.3	Spherical dome, conical shells, cylindrical shells, Elliptic paraboloid, hyperbolic parabolod and conoids		
4	**Membrane analysis**	**10 Hours**	**22%**
4.1	Importance of membrane theory of shells, shells in the form of a surface of revolution and loaded un-symmetrically with respect to their axes		
4.2	Membrane analysis of shells of revolution and cylindrical shells under different loads		

4.3	Use of stress function in calculating membrane forces of shells		
4.4	Applications of membrane solution of elliptic paraboloids and hyperboloids		
5	**General Theory of Cylindrical Shells**	**12 Hours**	**27%**
5.1	A circular cylindrical shell loaded symmetrically with respect to its axis		
5.2	Symmetrical deformation, pressure vessels, cylindrical tanks		
5.3	Thermal stresses, in extensional deformation, general case of deformation		
5.4	Cylindrical shells with supported edges, approximate investigation of the bending of cylindrical shells		
5.5	Use of a strain and stress function, stress analysis of cylindrical roof shells.		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course

- The student will demonstrate key factual knowledge of the underlying assumptions in the theory of plates and shells.
- The student will be able to relate the academic material of the theory of plates and shells to real-life problems.

- The solutions will be developed by the students towards understanding of structural behavior using applications of plates & shells.
- Student shall understand the rudimentary principles involved in the analysis and design of plates and shells.

F. Recommended Study Material:

Text Books:

1. Timoshenko, S. P., Winowsky. S., and Kreger, Theory of Plates and Shells, Mcgraw Hill Internal, New Delhi.
2. Chandrashekhara, K., Theory of Plates, University Press, 2001
3. Bairagi, N. K., Plate Analysis, Khanna Publishers, Delhi.
4. Bairagi, N. K., Shell Analysis, Khanna Publishers, Delhi.

Reference Books:

1. Ramaswamy, G. S., Design & construction of concrete shell roofs, CBS Publishers Distributors.
2. Brush and Almorth, Buckling of bars, plates and shells, McGraw-Hill, Kogakusha.
3. Hass A.M., Design of Thin Concrete Shells, John Wiley & Sons
4. Urugal, A. C., Stress in plates and shells, McGraw-Hill Ryerson, Limited.

Web Materials:

1. http://www.rh.edu/~bakm.

CL766: DESIGN OF TALL STRUCTURES (PROGRAMME ELECTIVE-1I)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To study the behavior, analysis and design of tall structures.

Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Tall Building	18
2	Cooling towers	10
3	Transmission Line towers	9
4	Microwave towers	8

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

1.	**Tall Building**	**18 Hours**	**40%**
1.1	Structural systems for (a) floor systems (b) vertical load resisting systems (c) lateral load resisting systems, and (d) connections		
1.2	Interaction of frames and shear wall, Twist of frames, Effects of opening		
1.3	Behaviour of Braced frame structures, rigid frame structures, in filled frame structure		
1.4	flat plate and flat-slab structures, shear wall structures, wall-frame structures, framed-tube structures		
1.5	outrigger-braced structures, suspended structures, core-structures, space and hybrid structures, Analysis of coupled shear walls		
1.6	Various methods of analysis like static linear/nonlinear, dynamic, buckling analysis, construction stage analysis etc.		
1.7	Structural control and energy dissipation devices for tall building		
2	**Cooling towers**	**10 Hours**	**22%**
2.1	Types, components, analysis and design of towers		
3	**Transmission Line towers**	**09 Hours**	**20%**
3.1	Types of loads, Tower Configuration, Analysis and Design of towers		
4	**Microwave towers**	**08 Hours**	**18%**
4.1	Types of loads, Tower Configuration, Analysis and Design of towers		

C. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

D. Students Learning Outcomes:

On the successful completion of this course

- The student will demonstrate key factual knowledge of the underlying assumptions in the theory of plates and shells.
- The student will be able to relate the academic material of the theory of plates and shells to real-life problems.
- The solutions will be developed by the students towards understanding of structural behavior using applications of plates & shells.
- Student shall understand the rudimentary principles involved in the analysis and design of plates and shells.

E. Recommended Study Material:

Text Books:

- Woltang Schuller, High- rise building Structures, John wiley and Sons, New York 1976.
- Lynn S. Beedle, Advances in Tall Buildings, CBS Publishers and Distributors Delhi, 1996.
- B.S. Taranath, Structural Analysis & Design of tall Buildings, McGraw Hill, 1998.
- B.S. Taranath, Steel, concrete and composite design of tall buildings, McGraw Hill, 1997.
- Handbook of Concrete Engineering - Mark Fintel, Springer

Reference Books:

1. Tall Building Structures: Analysis and Design- Coull and Smith John Wiley & Sons

2. Structural Design of Multi-storeyed buildings - U. H. Variani, South Asian Publishers
3. Transmission Line Structures – A. R. Santhakumar & S. S. Murthy, Tata McGraw-Hill Book Co.
4. Lin T.Y and Stotes Burry D, "Structural Concepts and systems for Architects and Engineers", John Wiley, 1988
5. IS: 4091 Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles
6. IS : 11233-1985 code of practice for design and construction of radar antenna, microwave and TV tower foundations
7. Indian Standard: "Code of Practice for Use of Structural Steel in Overhead Transmission Line Towers- Materials and Loads", IS: 802(Part1/Sec1), 1995.
8. Indian Standard : "Code of Practice for Use of Structural Steel in Overhead Transmission Line Towers-Permissible Stresses", IS:802(Part1/Sec2), 1992
9. Khanna R.L. and CB of I & P New Delhi (1997) "Manual on "Transmission Line Towers"

IS Codes:

1. IS: 4091 Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles
2. IS : 11233-1985 code of practice for design and construction of radar antenna, microwave and TV tower foundations
3. Indian Standard: "Code of Practice for Use of Structural Steel in Overhead Transmission Line Towers- Materials and Loads", IS: 802(Part1/Sec1), 1995.
4. Indian Standard: "Code of Practice for Use of Structural Steel in Overhead Transmission Line Towers-Permissible Stresses", IS:802(Part1/Sec2), 1992

M. Tech. (Civil-Structural Engineering) Programme

SYLLABI

(Semester – II)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

HS 702: ACADEMIC WRITING & COMMUNICATION SKILLS

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week		2	2	2
Marks	-	100	100	

A. Objective of the Course:

To facilitate learners to:

- understand how communications work
- explorethebasics ofcommunication skills
- learn and practice letter writing
- demonstrate active-listening skills and accurate comprehension
- demonstrate speaking skills and practice functional dialogues
- explore demonstrate thepresentation skills
- Understand the concept and application of Academic Writing
- learn and practice Academic Writing
- demonstrate various components of Academic Writing Skills

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Basics of Communication Skills	02
2	Comprehensional& Expressional Skills	07
3	Presentation Skills	07
4	Letter Writing	02
5	Academic Writing 1	06
6	Academic Writing 2	06

Total Hours (Theory & LAB): 30

Total Hours: 30

C. Detailed Syllabus:

1.	**Basics of Communication Skills**	**02 Hours**	**07%**
1.1	Meaning and definition of is communication		
1.2	Concept and Process of Communication		
1.3	Types and Levels of Communication		
1.4	Principles of Effective Communication		
1.5	Verbal and Non-verbal Communication		
2	**Comprehensional& Expressional Skills**	**07 Hours**	**23%**
2.1	Basics and importance of developing listening and comprehension skills		
2.2	Listening and Comprehension Exercises (self-introduction, meeting unknown, meeting teacher, telephone inquiry, tourism inquiry, college life communication, interaction for apartment for rent, travel arrangements, career research, and general news and interviews)		
2.3	Basics of speaking and body language		
2.4	Speaking exercises (basic greeting exchange, self-introduction, asking various questions, meeting teacher, fixing-cancelling, revising an appointment, talking to a receptionist, talking about weather, making reservations, tourism conversations, and others)		
3	**Presentation Skills**	**07 Hours**	**23%**
3.1	Basics of presentations.		
3.2	Ways and methods of presentations		
3.3	Exercise presentations skills		
4	**Letter Writing**	**02 Hours**	**07%**
4.1	Basics of letter writing		
4.2	Format and design of letter writing		
4.3	Inquiry letter, reply to inquiry, order letter, reply to order, complaint letter, reply to complaint, invitation letter etc.		
5	**Academic Writing I**	**06 Hours**	**20%**
5.1	Background to academic writing		

5.2 Reading: finding suitable sources & Reading: developing critical approaches

5.3 Plagiarism

5.4 Finding Key -points and Note-making

6 Academic Writing 2 **06 Hours 20%**

6.1 Organizing paragraphs

6.2 Abstract writing

D. Instructional Method and Pedagogy:

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, task-based learning, projects, assignments and various interpersonal activities like case studies, critical reading, group work, independent and collaborative research, presentations etc.

E. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Journal / workbook Writing	-	25	25
2	Attendance and Class Participation			05
			Total	**30**

External Evaluation

The University Practical examination will be for 70 marks and will test the professional communication skills and academic writing.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical	-	70	70
			Total	**70**

F. Students Learning Outcomes:

At the end of the course, learners will be able to:

- Understand and demonstrate communication skills and academic writing.
- Demonstrate active-listening skills and accurate comprehension.
- Demonstrate speaking skills and practice functional dialogues.
- Explore demonstrate thepresentation skills.
- Understand and practice academic writing.

G. Recommended Study Material:

Reference Books:

1. Writing Your Thesis (2nd Edition) by Paul Oliver, Sage
2. Academic Writing for international students, Routledge
3. Development Communication In Practice by Vilanilam V J, Sage
4. Intercultural Communication by Mingsheng Li, Patel Fay, Sage

Web Materials:

1. www.owl.perdue.edu

CL743: FINITE ELEMENT ANALYSIS

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- The finite element method (FEM) is the dominant discretization technique in structural mechanics. The basic concept in the physical interpretation of the FEM is the subdivision of the mathematical model into disjoint (non-overlapping) components of simple geometry called finite elements or elements for short.
- The main objectives of this course are:

1. To understand the fundamental ideas of the FEM
2. To know the behavior and usage of each type of elements covered in this course.
3. To be able to prepare a suitable FE model for structural mechanical analysis problems.
4. To interpret and evaluate the quality of the results (know the physics of the problems)
5. To be aware of the limitations of the FEM (don't misuse the FEM - a numerical tool)

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Finite Element Method	02
2	Plane stress and Plane strain	04
3	One Dimensional Finite Elements	08
4	Finite Elements for Two Dimensional Planar Bodies	10
5	Finite Elements for Three Dimensional Analysis	10
6	Advanced Concepts In The Formulation of Two & Three Dimensional Elasticity Elements	06
7	Finite Elements for Plate Bending Analysis	05

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1.	**Introduction to Finite Element Method**	**02 Hours**	**05%**
1.1	Brief history of the development		
1.2	Advantages & disadvantages of finite element method		
1.3	Displacement approach		
1.4	Foundations of the FEM-energy principles		
2	**Plane stress and Plane strain**	**04 Hours**	**09%**
2.1	Linear elasticity, equations of equilibrium, stress, strain, constitutive relations		
2.2	Boundary conditions, description of an elasticity problem as a boundary value problem		
2.3	Plane stress, strain, axial symmetric problems		
2.4	Introduction to plasticity, yield condition, ideal elasto-plastic material		
3	**One Dimensional Finite Elements**	**08 Hours**	**18%**
3.1	Stiffness matrix for the basic bar & beam element representation of distributed loading		
3.2	The assembly process within the PMPE approach		
3.3	Element stresses, shape functions & interpolation polynomials, refined one dimensional elements		
4	**Finite Elements for Two Dimensional Planar Bodies**	**10 Hours**	**22%**
4.1	Triangular elements for plane stress or strain conditions		
4.2	Higher order triangular elements		
4.3	Rectangular elements for plane stress or strain conditions		
4.4	Higher order rectangular elements: Lagrange element family		
5	**Finite Elements for Three Dimensional Analysis**	**10 Hours**	**22%**
5.1	Tetrahedral elements, higher-order tetrahedra		
5.2	Rectangular hexahedral elements, higher-order rectangular hexehedra: Lagrange element family		
6	**Advanced Concepts in the Formulation of Two & Three**	**06 Hours**	**13%**

Dimensional Elasticity Elements

6.1 Natural co-ordinates

6.2 Area or triangular co-ordinates

6.3 Serendipity rectangles & hexahedra

6.4 Isoparametric concept, properties of isoparametric elements, numerical integration

7 Finite Elements For Plate Bending Analysis **05 Hours 11%**

7.1 12-Degree of Freedom rectangular element

7.2 Triangular Elements

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course

- Students will be able to solve realistic engineering problems through computational simulations using finite element code.
- Students will be in a position to develop computer codes for any real time problem using Finite Element technique.

F. Recommended Study Material:

Text Books:

1. Desai &Ables, Finite Element Method, CRC Pr I Llc.
2. Chandrupatla and Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall PTR, 2002.
3. Mukhopadhyay, M., Matrix Finite Element Computer & Structural Analysis, Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi, India.
4. Weaver, W., and Gere, J. M., Matrix Analysis of Framed Structure, CBS Publishers & Distributors, New Delhi, India.

Reference Books:

1. Krishnamoorthy C.S., Finite Element Analysis, Tata McGraw-Hill.
2. Dawe, D.J., Matrix & Finite Element Displacement Analysis of Structures, Clarendon Press, 1984.
3. Cook, R.D., Concepts & Applications of Finite Element Analysis, Wiley.
4. Yang, T.Y., Finite Element Structural Analysis, Prentice Hall.
5. Rao, S.S., Finite Element Analysis, Elsevier Butterworth-Heinemann.

CL 744: STRUCTURAL DYNAMICS & EARTHQUAKE ENGINEERING

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Objective of the Course:

- This course aims to introduce the analysis of structures to determine their dynamic properties and the response of the structures subjected to dynamic loads in relation to structure's own dynamic properties and time varying characteristics of the loads.
- To learn fundamental structural dynamics, seismology, structural earthquake response.
- To gather knowledge regarding earthquake mechanics, earthquake-induced effects, hazard and risk assessment and earthquake resistant design, as well as emergency response.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	02
2	Single-Degree-of-Freedom (SDOF) Systems	12
3	Multi-Degree-of-Freedom (MDOF) Systems	12
4	Continuous Systems	06
5	Earthquake Basics	04
6	Earthquake Resistant Design	16
7	Special problems and case studies	08

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1.	**Introduction**	**02 Hours**	**03%**
1.1	Role of dynamic analysis in structural engineering		
1.2	Dynamics of particles, system of particles & rigid bodies		
1.3	Nature of dynamic loading: Harmonic, Earthquake & Blast loading		
2	**Single-Degree-of-Freedom (SDOF) Systems**	**12 Hours**	**20%**
2.1	Free and forced vibration of single degree of freedom (SDOF) system		
2.2	Response to harmonic, periodic, impulsive and general dynamic loading on an element		
2.3	Numerical evaluation of dynamic response		
2.4	Earthquake response of linear systems		
3	**Multi-Degree-of-Freedom (MDOF) Systems**	**12 Hours**	**20%**
3.1	Free and forced vibrations of lumped MDOF systems		
3.2	Dynamic analysis and response of linear systems		
3.3	Earthquake analysis of linear systems		
3.4	Numerical evaluation of dynamic response		
3.5	Damped motion of shear building		
4	**Continuous Systems**	**06 Hours**	**10%**
4.1	Equation of motion		
4.2	Undamped free vibrations		
4.3	Forced vibration of bars and beams		
5	**Earthquake Basics**	**04 Hours**	**07%**
5.1	Engineering seismology, rebound theory, plate tectonics, seismic waves, earthquake size and various scales, local site effects, Indian seismicity, seismic zones of India,		
5.2	Theory of vibration, near ground and far ground rotation and their effects		
6	**Earthquake Resistant Design**	**16 Hours**	**27%**
6.1	Concept of seismic design		
6.2	Earthquake resistant design of R.C.C structures as per IS 1893 (Part 1):2002		

6.3 Earthquake resistant construction of R.C.C. elements and detailing aspects as per IS 13920:1993

6.4 Earthquake resistant design of brick masonry structures as per IS 4326

7 Special problems and case studies **08 Hours 13%**

7.1 Structural configuration, Seismic performance, Soil performance

7.2 Modern concepts, Base isolation, Adoptive system

7.3 Case studies

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course, the students will demonstrate the ability to:

- Determine the natural frequency of a single degree of freedom dynamic system for given mass, structural properties, and damping.
- Determine the maximum dynamic response of an elastic vibrating structure to a giving forcing function.
- Understand basic earthquake mechanisms, tectonics, types of ground motion, and propagation of ground motion.
- Understand and interpret earthquake ground motion data.
- Understand qualitative and quantitative representations of earthquake magnitude.

- Understand and utilize concepts of "Peak Ground Acceleration", "Effective Peak Ground Acceleration", and "Spectral Response".
- Understand the effects of damping, hysteresis and plasticity on structural response to earthquakes.
- Determine the static design base shear based on the type of structural system, irregularity, location and occupancy.
- Distribute the static base shear to the structure based on vertical distribution of mass, horizontal distribution of mass, and centers of rigidity.
- The course allows structural engineers to consolidate their knowledge on the effect of earthquake ground motions on civil engineering structures.
- The course will also call upon the critical sense of structural engineers in order to allow the seismic evaluation of existing structures.
- Finally, the course will allow structural engineers to acquire new basic knowledge in earthquake engineering that will allow them to communicate better with scientists and engineers of other disciplines in earthquake engineering.

F. Recommended Study Material:

Text Books:

1. Chopra, A.K., Dynamics of Structures, 3rd edition, Prentice Hall, N.J.
2. Mario Paz, Structural Dynamics Theory and Computation, CBS Publishers & Distributors.
3. Newmark, N.M. and Rosenblueth E., Fundamentals of Earthquake Engineering, Prentice Hall PTR.
4. Agarwal, P. and Shrikhande, M., Earthquake Resistant Design of Structures, PHI Learning Private Limited.
5. Datta, T.K., Seismic Analysis of structures, John Wiely International, May 2010

Reference Books:

1. Clough, R. and Penzien, J. Dynamics of Structures, McGraw-Hill Book Co.
2. Mukhopadhyay, M., Structural Dynamics Vibrations and Systems, Ane Books India Publishers.
3. Roy, R.C., Structural Dynamics an Introduction to Computer Methods, John Wiley & Sons Publications.
4. Chen, W.F., and Charles, S., Earthquake Engineering Handbook, CRC Press London.

5. Duggal S.K., Earthquake Resistant Design of Structures, OXFORD University Press.
6. Jaikrishna&Chandrasekaran, Elements of earthquake engineering, SaritaPrakashan, Nauchandi.

Web Materials:

1. http://www.nicee.org/Publications.php
2. https://www.eeri.org/
3. http://www.earthquakeengineering.com/
4. http://www.curee.org

Other Material:

1. IS: 875,Code of Practice for Design Loads
2. IS: 1893-2002 (Part-I), Criteria for Earthquake Resistant Design
3. IS: 4326-1993, Earthquake Resisting Design & Construction Building
4. IS: 13920-1993, Ductile Detailing of Rc Structures
5. IS: 13827-1993, Earthquake Resistance of Earthen Buildings
6. IS: 13828-1993, Earthquake Resistance Low Strength Masonry Buildings

CL745: DESIGN PRACTICES-II

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	6	6	3
Marks	-	300	300	

A. Objective of the Course:

- Design practices–II involves in depth analysis and designing of structures from preliminary stage to construction stage.
- The objective of the module is to deal with real life project for steel and masonary structures.

B. Outline of the Course:

The students will be dealing and working on following current/past real life projects.

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Review of Steel Design Concepts	15
2	Design of single storey steel building	15
3	Design of multi storey steel building	15
4	Design of industrial building	15
5	Design of steel bridges	15
6	Design of masonry building	15

Total Hours (Theory): 0

Total Hours (Lab): 90

Total Hours: 90

C. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- The full course will be covered in laboratory only.
- Laboratory will be conducted with the aid of multi-media projector, black board, OHP etc.
- Tutorials related to course content will be carried out in the laboratory.
- Detailed drawings of any designed structured is to be prepared preferred using AutoCad.

D. Students Learning Outcomes:

On the successful completion of this course

- The students will acquire diverse knowledge about steel and masonry structures during this module.
- This course provides detailed knowledge about how to integrate real life projects from scratch to end.

E. Recommended Study Material:

Text Books:

1. Arya, A.S., &Ajmani, J.L., Design of Steel Structures, Nem Chand &Bros.,India.
2. Ramchandran, Design of Steel Structures Vol. I & II, Standard Book House.

Reference Books:

1. Subramanian, N., Design of Steel Structures, Oxford University Press, USA. Dayarathnam& Wheeler, Design of Steel Structure, Wheeler Publishing, New Delhi.

CL767: DESIGN OF OFFSHORE STRUCTURES (PROGRAMME ELECTIVE-3)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To make students familiar with different types of offshore structures.
- Provide necessary information regarding the loads which are acting on offshore structures
- To provide the fundamental concepts for the analysis of offshore structures.
- To provide the fundamental concepts for the design of offshore structures.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Offshore Structures	04
2	Offshore Structure Loads	06
3	Analysis & Design of Offshore Structures	18
4	Corrosion Protection	08
5	Design of tubular Joints	09

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. **Detailed Syllabus:**

1.	**Introduction to Offshore Structures**	**04 Hours**	**09%**
1.1	Introduction		
1.2	History of Offshore Structures		
1.3	Overview of Field Development		
1.4	Feed Requirements		
1.5	Types of Offshore Platforms		
1.6	Different Types of Offshore Structures		
1.7	Minimal Offshore Structure		
2.	**Offshore Structure Loads**	**06 Hours**	**13%**
2.1	Introduction		
2.2	Gravity Loads, Hydrostatic loads		
2.3	Wind Load, Operational loads, Environmental loads due to wind, wave, current and buoyancy, Morison's Equation		
2.4	Offshore Loads, Maximum wave force on offshore structure, Collision Events		
2.5	Fires and Explosions, Material Strength		
2.6	Materials and their behaviour under static and dynamic loads		
2.7	Various design methods and Code Provisions		
2.8	Concept of Return waves		
3.	**Analysis & Design of Offshore Structures**	**18 Hours**	**40%**
3.1	Jacket tower, Analytical models for jacket structures		
3.2	Static method of analysis		
3.3	Design specification		
3.4	Principles of Static and dynamic analyses of fixed platforms		
3.5	Use of approximate methods		
3.6	Design of structural elements		
3.7	Foundation analysis and dynamics of offshore structures		
3.8	Design of platforms, helipads, Mooring cables and pipe lines.		
4.	**Corrosion Protection**	**08 Hours**	**18%**
4.1	Corrosion		
4.2	Corrosion mechanism and types of corrosion, Biological corrosion		

4.3 Offshore structure corrosion zones

4.4 Coatings and Corrosion Protection of Steel Structures

4.5 Corrosion Stresses Due to the Atmosphere, Water and Soil

4.6 Principles of cathode protection systems

4.7 Sacrificial anode method and impressed current method

5. Design of tubular Joints **09 Hours** **20%**

5.1 Introduction to tubular joints, Possible modes of failure

5.2 Eccentric connections and offset connections, Cylindrical and rectangular structural members

5.3 In plane and multi plane connections, Parameters of in-plane tubular joints, Kuang's formulae

5.4 Elastic stress distribution, Punching shear Stress, Overlapping braces, Stress concentration

5.5 Chord collapse and ring stiffener spacing, Stiffened tubes

5.6 Fatigue of tubular joints, Fatigue behaviour

5.7 S-N curves – Palmgren

5.8 Design of tubular joints as per API Code

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course

- Students will be able to analyze and design of offshore structures. Also students will be able to design the joints.

F. Recommended Study Material:

Text Books:

1. Chakrabarti, S.K., Handbook on offshore Engineering, Vol.1 & 2, Plainfield, Illinois, USA. 2005.
2. El-Reedy Mohamad., Offshore structures design, construction and maintenance, Gulf priting publishers.
3. Dawson, T. H., Offshore Structural Engineering, Prentice Hall Inc Englewood Cliffs, N.J. 1983.
4. Reddy, D. V., & Arockiasamy, M., Offshore Structures Vol.1 & 2, Kreiger Publ.Co.1991.

Reference Books:

1. Chakrabarti, S. K., Hydrodynamics of Offshore Structures, Computational Mechanics Publications, 1987.
2. McClelland, B., & Reifel, M. D., Planning & Design of fixed Offshore Platforms, VanNostrand, 1986.
3. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
4. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.
5. API, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RP2A, Dalls, Tex.
6. Wiegel, R.L., Oceanographical Engineering, Prentice Hall Inc, Englewood Cliffs, N.J. 1964.
7. Reddy, D.V., &Arockiasamy, M., Offshore Structures, Vol.1, Krieger Publishing Company, Malabar, Florida, 1991.

CL768: DESIGN OF COMPOSITE STRUCTURES (PROGRAMME ELECTIVE-3)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- Designing of composite structure and elements using the latest theories and design practices.
- The objective of module is to learn about most distinct structure type other than conventioanal structure.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	02
2	Design of composite slab	12
3	Design of composite beam	12
4	Design of composte column	12
5	Advances in composite and hybrid structures	07

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1.	**Introduction**	**02 Hours**	**4%**
1.1	Overview of composite structure		
2	**Design of composite slab**	**13 Hours**	**30%**
2.1	Definition and general description		
2.2	Design for the construction condition		
2.3	Design of conposite slabs, design for shear and concentrated loads		
2.4	Serviceablity limits, crack control, shrinkage and creep		
2.5	Fire Resistance		
3	**Design of composite beam**	**13 Hours**	**30%**
3.1	Introduction,Material properties		
3.2	Composite beams, Plastic analysis of composite section, shear resistance, shear connection		
3.3	Full and partial shear connection, transverse reinforcement, Primary and edge beams, serviceablity limit state		
3.4	Continuous composite beams		
4	**Design of Composite columns**	**13 Hours**	**30%**
4.1	Introduction, Design of composite columns		
4.2	Simplified design method		
4.3	Illustrative examples of design of composte columns		
4.4.	Longitudinal and transverse shear forces		
5	**Advances in composite and hybrid structures**	**04 Hours**	**6%**

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.

- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course

- The course provides an education in the fundamentals of composite elements and structures also provides experience in realistic design practice for students engaged primarily in the areas of structural and construction engineering.
- The students will get a diverse knowledge of failure modes of steel members and structures practices and its solution to real life problems.

CL769: DESIGN OF COLD FORMED STEEL STRUCTURES (PROGRAMME ELECTIVE-3)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To study the behaviour and design of Cold-formed steel structures

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	03
2	Tension Members	07
3	Beams	07
4	Columns	07
5	Connections	07
6	Roof Truss	07
7	Direct Strength Method	07

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1.	**Introduction**	**03 Hours**	**7%**
1.1	Introduction, Applications, advantages of cold formed sections, Concept of member buckling, Instability of Thin plates, Plate Buckling effects, Effective width of cold formed steel elements, Codal provisions on load buckling, Effective widths of unstiffened plate elements		
2	**Tension Members**	**07 Hours**	**15%**
2.1	Design of tension members		
3	**Beams**	**07 Hours**	**15%**
3.1	Design of Beams		
4	**Columns**	**07 Hours**	**16%**
4.1	Design of axially compressed column		
4.2	combined bending & compression		
5	**Connections**	**07 Hours**	**16%**
5.1	Design of welded connections,		
5.2	Design of a connection with mechanical fasteners		
6	**Roof Truss**	**07 Hours**	**15%**
6.1	Design of welded roof truss		
7	**Direct Strength Method**	**07 Hours**	**16%**
7.1	Effective Width Method and Direct Strength Method		
7.2	Direct strength method for cold formed steel design		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course

- Develop an understanding of the behavior of cold-formed steel members and connections
- Develop an understanding of the design provisions in the IS 801 and IS : 811
- Become proficient with both Effective Width Method and Direct Strength Method

F. Recommended Study Material:

Text Books:

1. Gambhir & Tata Mc Graw Hill, Fundamentals of Structural Steel Design
2. Sairam K S, Design of Steel Structures, by, Pearson Education India
3. Punmia B. C., Jain A. K., Comprehensive Design of Steel Structures 2nd ed., 2008, Laxmi, New Delhi.
4. Wie - Wen Yu., Cold-formed Steel Structures, McGraw Hill Book Company
5. Duggal, Design of Steel Structure -, Tata Mc Graw Hill.

Other Materials:

1. I.S 800: 2007, "Indian Standard General Construction in Steel - Code of Practice", Bureau of Indian Standards, New Delhi. India
2. IS 801: Code of Practice for Use of Cold Formed Light Gauge Steel Structural Members In General Building Construction
3. IS : 811-1987 Specification for cold formed light gauge structural steel sections

CL770: STRUCTURAL OPTIMIZATION AND RELIABILITY (PROGRAMME ELECTIVE-4)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To make students aware, about the different optimization techniques used for structural optimization.
- To introduce structural optimization and reliability as tool for future research activity.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Optimization	02
2	Classical Optimization	10
3	Optimization of trusses, frame etc.	08
4	Introduction to Reliability	05
5	Reliability of structural components	10
6	Reliability based design	10

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1	**Introduction to Optimization**	**02Hours**	**04%**
1.1	optimization techniques for unconstrained and constrained optimization problems		
2	**Classical Optimization**	**10Hours**	**22%**
2.1	Lagrange Multiplier technique		

2.2	Kuhn – Tucker conditions		
2.3	Solution of NLP by direct methods and by series of unconstrained optimization problems, formulation of different types of structural optimization problems.		
3	**Optimization of trusses, frame etc.**	**08Hours**	**18%**
3.1	Minimum weight design of truss and frame.		
4	**Introduction to Reliability**	**05Hours**	**12%**
4.1	Structural safety- variations - probability distributions - allowable stresses for specified reliability - Probabilistic analysis of loads		
5	**Reliability of structural components**	**10Hours**	**22%**
5.1	Reliability of structural components - Reliability Methods - Reliability index - Partial safety factors		
6	**Reliability based design**	**10Hours**	**22%**
6.1	Reliability based design and reliability of simple structural systems		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course

- To apply different optimization techniques in structural engineering.
- To apply different structural reliability methods.

- Can develop research proposal on optimization and reliability in design practice.

F. Recommended Study Material:

Text Books:

1. Arora, J.S , Introduction to optimization, MGH(Int,Ed.), 1989.
2. Rao, S.S, Optimization: Theory and applications , Wiley Eastern,1992.
3. Structural optimization Majid
4. Kresysig, Advanced mathematics, Wiley; 10 edition (August 16, 2011).
5. Marris, Foundation of structural optimization, Wiley, 1982.
6. Madsen, H. O., Krenk, S., & Lind, N .C., Methods of Structural Safety, Dover Publications, 2006.

Reference Books:

1. Ranganathan, R., Structural Reliability Analysis and Design, 1st Edition, Jaico Publishing House, 1999.
2. Melchers, R.E., Structural Reliability Analysis and Prediction, 2nd Edition, John Wiley & Sons,1999.
3. Thoft, C.P., & Baker, M.J., Structural Reliability Theory and its Application, Springer Verlag, 1982.

CL771: BRIDGE ENGINEERING (PROGRAMME ELECTIVE-4)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

The main objectives of the course are:

- To make students aware, about the different types of bridges.
- To make them ready to understand design philosophy.
- To mould them to be ready to inspect brides & suggest remedial measures if needed.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	4.5
2	Type of Bridges & Loading Standards	13.5
3	Super-Structure Design Aspects	13.5
4	Inspection & Maintenance of Bridges	9
5	Advances in Bridge Engineering	4.5

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. **Detailed Syllabus:**

1	**Introduction**	**4.5 Hours**	**10%**
1.1	Definition & History		
1.2	Classification		
1.3	Planning for a Bridge & Stages of Planning		
2	**Type of Bridges & Loading Standards**	**13.5 Hours**	**30%**
2.1	Classification & Components		
2.2	Need for Loading Standards		
2.3	Loading Requirements		
2.4	Railway Loading Standards		
2.5	Road Bridge Loading		
2.6	Any Important topic in the relevant unit		
3	**Super-Structure Design Aspects**	**13.5 Hours**	**30%**
3.1	Historical Development, Types of Bridges & Choice of Materials		
3.2	Design Principles		
3.3	Design Procedure for Bridge Super Structure		
3.4	Composite Construction		
3.5	Any Important topic in the relevant unit		
4	**Inspection & Maintenance of Bridges**	**9 Hours**	**20%**
4.1	Necessary for Inspection of Bridges		
4.2	Procedure & Aspects of Inspection		
4.3	Testing of Bridges		
4.4	Aids for Bridge Inspection & Maintenance		
4.5	Maintenance of Bridge Substructure & Superstructure		
5	**Advances in Bridge Engineering**	**4.5 Hours**	**10%**
5.1	Any advance topic in bridge engineering		

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course students will be able to

- Select type of bridge for based on the necessity
- To understand design philosophy & design procedure.
- To carry out inspection & suggest remedial measures if needed.

F. Recommended Study Material:

Text Books:

1. Ponnuswamy, S , Bridge Engineering, TMH, 2009
2. Raina V K, Raina's Concrete Bridge Practice Analysis, Design and Economics, Shroff
3. Jagadeesh&Jayaram, Design of Bridge Structures, PHI

Reference Books:

1. David P. Billington, The Tower and the Bridge: The New Art of Structural Engineering, Princeton University Press, 1985.
2. David J. Brown, Bridges: Three Thousand Years of Defying Nature, MBI Pub., 2001
3. Peter Bishop, Bridge, Reaktion Books, 2008
4. David Blockley, Bridges: The Science and Art of the World's Most Inspiring Structures, Oxford University Press, 2012
5. Frank Johnstone Taylor, Modern Bridge Construction: A Treatise Setting Forth the Elements of Bridge Design and Illustrating Modern Methods of Construction, Technical Press, 1951
6. David Young Hill, Bridge Calculation and Design: For Steel Bridges For steel bridges, Griffin, 1962.
7. M. J. Ryall, G. A. R. Parke, J. E. Harding, The Manual of Bridge Engineering ICE manuals, Thomas Telford, 2000

CL772: BEHAVIOUR OF STRUCTURES UNDER EXTREME LOADING (WIND, BLAST, FIRE) (PROGRAMME ELECTIVE-4)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- The objective of the course is to offer insight knowledge about the behavior of structures under extreme loading such as fire, wind, blast etc...

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	1
2	Behavior of structure under Fire	16
3	Behavior of structure under Wind	14
4	Behavior of structure under Blast	14

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1.	**Introduction**	**01Hour**	**4%**
1.1	Introduction to various loading		
2	**Behavior of structure under Fire**	**16 Hours**	**36%**
2.1	Design methodology		
2.2	Fire Behavior		
2.3	Thermal response and structural behavior		
2.4	Simplified calculation methods for steel, concrete, timber, masonry members		
2.5	Whole building behavior with help of computer programme and case study		
3	**Behavior of structure under Wind**	**14 Hours**	**30%**

3.1 Overview of wind loading

3.2 Wind effect of building and structures

3.3 Dynamic effects of wind on structures

4 Behavior of structure under Blast **14 Hours** **30%**

4.1 Overview of Blast loading

4.2 Structural blast response analysis

4.3 Calculation of reaction forces and blast panel connection forces

4.4 Structural element and connection design for blast loading

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the successful completion of this course

- The students will be able to understand the behavior of structure under loading such as wind, blast, fire etc...

Semester 1

UNIVERSITY ELECTIVES

MA771: RELIABILITY AND RISK ANALYSIS-I

Credits and Hours:

Teaching Scheme	Theory	Practical/Tutorial	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

The course is designed for Engineers, Mathematician, and Industrial Managers. This course covers basics of Probability and Statistics for prediction of failures in system and quantification of risk

The objectives of the course are to:

1. Understand basics of Probability and Probability distributions
2. Define the system to be analyzed.
3. Identify the system performance measures (Measuring Reliability and Risk)

B. Outline of the course:

Sr No.	Title of the unit	Minimum number of hours
1.	Introduction to Probability and Statistics	06
2.	Characteristics of Reliability	06
3.	Reliability of Simple Systems	06
4.	Concept of Safety and Risk Analysis	06
5.	Reliability Modeling	06

C. Total Hours (Theory): 30

D. Detailed Syllabus:

1	**Introduction to Probability and Statistics**	**06 Hours**	**20%**
1.1	Random Event.		
1.2	Basic formula of Probability.		
1.3	Random Variable and Probability Distribution Functions.		
1.4	descriptive statistics		
2	**Characteristics of Reliability**	**06 Hours**	**20%**
2.1	Reliability of a Unit Functioning until First Failure		
2.2	System Reliability		
2.3	Testing for Reliability		
2.4	Exponential Law and Evaluation of parameter		
3.	**Reliability of Simple Systems**	**06 Hours**	**20%**
3.1	Series System		
3.2	Parallel System		
3.3	K out of N systems		
4.	**Concept of Safety and Risk Analysis**	**06 Hours**	**20%**
4.1	Qualitative definition of Risk		
4.2	Quantitative definition of Risk		
4.3	Failure Model and Effect Analysis(FMEA)		
4.4	Hazard and operability analysis(HAZOP)		
4.5	Fault Tree Analysis		
5.	**Reliability Modeling**	**06 Hours**	**20%**
5.1	Software Reliability Analysis		
5.2	Human Reliability		
5.3	Stress-Strength Analysis		

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures/laboratory which carries a 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weighting of 5%.

- Two Quizzes (surprise test) will be conducted which carries 5% component of the overall evaluation.

E. Student Learning Outcomes:

- At the end of the course the students will be able to understand the basic concepts of Reliability and Risk Analysis.
- Student will be able to apply concepts of these course in their study of specialization

F. Recommended Study Material:

❖ **Text Books:**

1. Mathematical Methods of Reliability Theory. B. V. Gnedenko, Yu. K. Belyayev, and A. D. Solovyev ,Academic Press 1969
2. An Introduction to Basics of Reliability and Risk Analysis. Enric Zio, World Scientific Publishing Co.Pte. Ltd.2007
3. Reliability and Risk Analysis. Terje Aven, Elsevier Publicaion,1992

❖ **Reference Books/Articles:**

1. On The Quantitative Definition of Risk, Stanley Kaplan and B. John Garrick, Risk Analysis, Vol. I, No. I , 1981
2. Probability concepts in engineering planning and design. Volume II – decision, risk and reliability. Ang, A.H.-S. and Tang, W.H John Wiley & Sons, Inc., New York (1984)
3. M. Modarres, Reliability and Risk Analysis, Marcel Dekker (1993).
4. N.J. McCormick, Reliability and Risk Analysis, Academic Press (1981).

EE781: OPTIMIZATION TECHNIQUES

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the course:

Optimization techniques, having reached a degree of maturity in recent years, are being used in a wide spectrum of industries, including aerospace, automotive, chemical, electrical, construction, and manufacturing industries. Optimization methods, coupled with modern tools of computer-aided design, are also being used to enhance the creative process of conceptual and detailed design of systems.

The objectives of the course are:

1. To provide an overview of state-of-the-art optimization algorithms and the theoretical principles that underpin them
2. To prepare the students with the modelling skills necessary to describe and formulate optimization problems
3. To introduce methods of optimization to students, including linear programming, network flow algorithms, integer programming, interior point methods, quadratic programming, nonlinear programming, and heuristic methods.
4. To make the students familiar with the applications of various classical and AI methods in solving various complex real-world optimization problems.
5. To introduce the students with software tool to solve optimization problem

B. Outline of the Course:

Sr. No.	Title of Unit	Min. no of hours
1	Fundamentals of Optimization	01
2	Linear Programming	05
3	Unconstrained Optimization	04
4	Nonlinear Programming	05
5	Fundamentals of Artificial Intelligence methods	01
6	Particle Swarm Optimization and Cuckoo Search Algorithm	08
7	MATLAB programming and Optimization Toolbox	06

Total Hours (Theory): 30

C. Detailed Syllabus

1	Fundamentals of Optimization	01 Hours	3.33%

Introduction, Feasibility and optimality, Convexity, constraints, Rates of convergence

2	Linear programming	05 Hours	16.66%

Introduction, Formulation of Linear programming problem, Graphical method, Simplex method, Basic solution, Basic feasible solution, Simplex algorithm, Two phase method.

3	Unconstrained Optimization	04 Hours	13.33%

Introduction, Optimality conditions, Newton's method for minimization, Line search methods, Steepest-Descent method, Quasi-Newton method, Modified newton's method

4	Nonlinear Programming	05 Hours	16.66%

Optimality conditions for constrained problems, Kuhn-Tucker conditions, Penalty function method, Barrier method, The Lagrange multipliers and the Lagrangian function, Sensitivity analysis, Computing the Lagrange multipliers, Sequential quadratic programming, Interior point method

5	Fundamentals of Artificial Intelligence methods	01 Hours	3.33%

To understand importance of AI methods and their comparison with various classical methods using various criteria.

6	Particle Swarm Optimization and Cuckoo Search Algorithm	08 Hours	26.66%

Introduction to PSO, Unconstrained and constrained optimization using PSO, Effects of various coefficients on convergence, Cuckoo Search (CS) Algorithm, Comparison between PSO and CS

7	MATLAB programming and Optimization Toolbox	06 Hours	20%

MATLAB programming of various classical and AI methods. Use of MATLAB optimization toolbox to solve various optimization problems.

D. Instructional Methods and Pedagogy

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Attendance is compulsory in lectures which carries a component of the overall evaluation.
- Minimum two internal exams will be conducted and will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students for each unit/topic and will be evaluated at regular interval and its weightage may be reflected in the overall evaluation.

E. Student Learning Outcomes:

1. The students will be able to get awareness about the optimization problems. They can differentiate the class of classical optimization methods and AI methods
2. The student will learn to handle, solve and analyzing problems using linear programming and other mathematical programming algorithms
3. The students will also be able to learn different techniques to solve Non- Linear Programming Problems. They can also use search techniques methods, which are based on iterative methods, to find optimal solutions of Non-Linear Programming Problems.
4. Ability to develop codes for evolutionary optimization techniques and to solve wide range of optimization problem.
5. The students will be able to solve optimization methods using software tools such as MATLAB and be prepared for developing case studies and simulation examples

F. Recommended Study Material:

Books:

1. "Optimization Methods for Engineers", N.V.S. Raju, PHI, 2014.
2. "Artificial intelligence and intelligent systems", N.P. Padhy, Oxford University Press, 2005
3. "Engineering Optimization: Theory and Practice", S. Rao, 4th Edition, John Wiley & Sons, Inc., 2009

ME781: OCCUPATIONAL HEALTH AND SAFETY

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

- To raise awareness of key health and safety issues in the workplace.
- To provide knowledge of occupational health and safety, emergency planning and environmental management.
- To ingrain the consciousness in students related to occupational health, occupational hygiene, ergonomics, safety and risk management, research methods, and legal studies.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to occupational health and safety	02
2	Occupational safety and management standards, and regulations for health, safety and environment	04
3	Identifying safety and health hazards, and risk analysis	04
4	Occupational physiology and psychosocial factors, and work organization	04
5	Ergonomic workplace design and musculoskeletal diseases	04
6	Control of workplace hazards	04
7	E-waste management	04
8	Work practices in industries and global strategy on occupational safety and health	04

Total Hours (Theory): 30

C. Detailed Syllabus:

1	**Introduction to occupational health and safety**	**02 Hours**	**9%**
	Definition and history of occupational health & safety, workplace hazards.		
2	**Occupational safety & management standards and regulations for health, safety and environment**	**04 Hours**	**13%**
2.1	Factories act and rules; Workmen compensation act. Indian explosive act - Gas cylinder rules - SMPV Act - Indian petroleum act and rules.		
2.2	Environmental pollution act. Manufacturing, storage and import of Hazardous Chemical rules 1989, Indian Electricity act and rules. Overview of OHSAS 18000 and ISO 14000 National legislation and public organizations.		
3	**Identifying safety and health hazards, and risk analysis**	**04 Hours**	**13%**
3.1	Hazard, risk issues and hazard assessment, Introduction to hazard, hazard monitoring-risk issue.		
3.2	Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminary hazard analysis (PHA), hazard operability studies (HAZOP).		
3.3	Computer aided risk analysis, Fault tree analysis & Event tree analysis, Logic symbols, methodology, minimal cut set ranking - fire explosion and toxicity index (FETI), various indices – Hazard analysis (HAZAN).		
3.4	Failure Mode and Effect Analysis (FMEA), Basic concepts of software on risk analysis, CISCON, FETI, ALOHA.		
4	**Occupational physiology, Psychosocial factors and Work organization**	**04 Hours**	**13%**
4.1	Man as system component – allocation of functions – efficiency.		
4.2	Occupational work capacity aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job heaviness		
4.3	Work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene.		
5	**Ergonomic workplace design and Musculoskeletal diseases**	**04 Hours**	**13%**
5.1	Meaning of Ergonomic		
5.2	Meaning of Workplace Design.		

5.3	Musculoskeletal Diseases causes and prevention		
6	**Control of workplace hazards**	**04 Hours**	**13%**
6.1	Workplace hazards and risk control, Transport hazards and risk control, Musculoskeletal hazards and risk control, Work equipment hazards and risk control		
6.2	Electrical safety, Fire safety, Chemical and biological health hazards and risk control, Physical and psychological health hazards and risk control, Health and safety practical application		
7	**E-waste management**	**04 Hours**	**13%**
7.1	Waste characteristics, generation, collection, transport and disposal		
8	**Work practices in industries and global strategy on occupational safety and health**	**04 Hours**	**14%**
8.1	Work practices in industries in manufacturing industries		
8.2	Work practices in industries in service industries		

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of Multi-Media projector, Black Board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- Tutorials related to course content will be given to students.
- In the lectures discipline and behavior will be observed strictly.
- Industrial visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of the assignment.

E. Students Learning Outcomes:

- Students will be able to make models for safety at work.
- Students will be able to select safety methods.
- Students will be able to understand how hazardous the process is at work.
- Students will be able to understand proneness of accidents.

F. Recommended Study Material:

❖ **Text Books:**

1. Grimaldi and Simonds , Safety Management, AITBS Publishers , New Delhi (2001)
2. Industrial safety and health, David L. Goetsch, Macmillan Publishing Company, 1993.
3. R.K.Jain and Sunil S.Rao , Industrial Safety, Health and Environment Management Systems, Khanna publishers , New Delhi (2006)
4. Salvendy, G. (2012). Handbook of human factors and ergonomics. John Wiley & Sons.

❖ **Reference Books:**

1. Arezes, P., Baptista, J. S., Barroso, M. P., Carneiro, P., Cordeiro, P., Costa, N., & Perestrelo, G. (Eds.). (2013). Occupational Safety and Hygiene. CRC Press.
2. Chaturvedi, P. (2005). Managing Safety Challanges Ahead. Concept Publishing Company.
3. Healey, B. J., & Walker, K. T. (2009). Introduction to occupational health in public health practice (Vol. 13). John Wiley & Sons.
4. Hester, R. E., & Harrison, R. M. (2009). Electronic waste management (Vol. 27). Royal Society of Chemistry.
5. Karwowski, W., Soares, M. M., & Stanton, N. A. (Eds.). (2011). Human Factors and Ergonomics in Consumer Product Design: Uses and Applications. CRC Press.
6. Khan, B. H. (Ed.). (1997). Web-based instruction. Educational Technology.
7. Roughton, J., & Crutchfield, N. (2011). Job hazard analysis: A guide for voluntary compliance and beyond. Butterworth-Heinemann.
8. Salvendy, G. (Ed.). (2001). Handbook of industrial engineering: technology and operations management. John Wiley & Sons.
9. Smedley, J., Dick, F., & Sadhra, S. (Eds.). (2013). Oxford handbook of occupational health. Oxford University Press.
10. Tillman, C. (2006). Principles of occupational health and hygiene: an introduction. Allen & Unwin.

❖ **Web Material:**

1. International Labour Organization (ILO) http://www.ilo.org/public/english/
2. Occupational Safety & Health Administration United States Department of Laborhttps://www.osha.gov/about.html

❖ **Other Material:**

1. International Journal of Labour Research http://www.ilo.org/actrav/info/pubs/WCMS_158769/lang--en/index.htm
2. International journal of occupational safety And ergonomics (http://archiwum .ciop.pl/757).
3. Journal of Safety and Health at Work (http://www.journals.elsevier.com/safety-and-health-at-work/)

CE772: RESEARCH METHODOLOGY

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

Quite frequently these days' people talk of research, both in academic institutions and outside. Several research studies are undertaken and accomplished year after year. But in most cases very little attention is paid to an important dimension that of research methodology. A great deal of research tends to be futile. It may be noted, in the context of planning and development that the significance of research lies in its quality and not in quantity.

- To introduce the basic methods of conducting research, explore ideas in formulating research objectives and hypotheses and sample framework for taking up research studies in a structured manner.
- To facilitate for the development of an insight into different statistical tools for data analysis, interpretation and presentation of reports in different areas of research.
- To enable researchers, irrespective of their discipline, in developing the most appropriate methodology for their research.
- To pay due attention to designing and adhering to the appropriate methodology throughout for improving the quality of research
- To impact higher education in basic areas as well as interdisciplinary areas and to provide researchers a platform to carry out quality research and relevant research.
- To prepare the literature in chronological pattern and logically analyze the concerns.
- To help researchers to use tools, techniques, concepts and world's best practices to present a unique research.
- To frame the research problems to enhance the scale of understanding.
- To give guidance and support to initiate and carry out quality research with a focus on awareness of areas of potential research, guidelines to carry out literature survey in the areas of interest, selection of research area, selection of problem for research and formulation of title, justification of title in current context of research, anticipated

research outcome and its relevance, research methodology to undertake the research, month wise plan for the research work to be carried out, six monthly review of research work of Doctoral Committee with eminent well experience Guides constituted by University etc.

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	General introduction to Research	02
2	Research problem Formulation	03
3	Research Design	08
4	Research Publication & Presentation	08
5	Research Ethics and Morals	05
7	Quality indices of research publication	04

Total hours: 30

C. Detailed Syllabus:

1 General introduction to Research **02 Hours 06%**

General Introduction:

Importance of Research, Role of Research, Aims & Objectives, Research Process, Phases of Research. Introduction to Research Methodology: Meaning of Research, Objectives of Research, Motivations in Research, Types of Research, Research Approaches, Significance of Research, Research Methods v/s Methodology, Research and Scientific Methods, Research Process, Criteria of Good Research.

2. Research problem Formulation: **03 Hours 09%**

Review of Research Literature:

Defining the Research Problem: What is Research Problem, Selecting the Problem, Necessity of and Techniques in defining the problem. Purpose and use of literature review, locating relevant information, use of library & electronic databases, preparation & presentation of literature review, research article reviews, theoretical models and frame work. Identification of gaps in research, formulation of research problem, definition of research objectives.

3. Research Design: **08 Hours 27%**

Research Design: Meaning, Need, Features of Good Design, Concepts, Types. Basic Principles of Experimental Design, Developing a Research Plan.

Qualitative Methods: Types of hypothesis and characterization. *Quantitative Methods:* Statistical methods for testing and evaluation.

Characterization of experiments: Accuracy, reliability, reproducibility, sensitivity, Documentation of ongoing research.

Sample Design: Implication, Steps. Criteria for selecting a sample procedure, Characteristics of Good sampling Procedure, Types of Sample Design, Selecting Random Samples, Complex random sampling Design.

Measurement and Scaling Techniques: Measurement in Research, Measurement Scales, Sources of Errors in measurement, Tests of Second measurement, Technique of developing Measurement Tools, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques.

Methods of Data Collection: Collection of Primary Data, Observation Method, Interview method, Collection of Data through questionnaire and Schedules, Other methods. Collection of Secondary Data, Selection of appropriate method for data collection, Case Study Method, Guidelines for developing questionnaire, successful interviewing. Survey v/s Experiment.

Processing and Analysis of Data : Processing Operations (Meaning, Problems), Data Analysis (Elements), Statistics in Research, Measures of Central Tendency, Dispersion, Asymmetry, Relationship. Regression Analysis, Multiple correlation and Regression, Partial Correlation, Association in case of Attributes.

Sampling Fundamentals: Definition, Need, Important sampling Distribution, Central limit theorem Sampling Theory, Sandler's A-test, Concept of Standard Error, Estimation, Estimating population mean, proportion. Sample size and its determination, Determination of sample size.

Analysis of Variance and Covariance: Basic Principles, techniques, applications, Assumptions, limitations.

Analysis of Non-parametric or distribution-free Tests : Sign Test, Fisher-Irwin Test, McNemer Test, Wilcoxon Matched pair Test (Signed Rank Test).

Sum Tests : a) Wilcoxon-Mann-Whitney Test b)Kruskal-Wallis Test, One

sample Runs Test, Multivariate Analysis Techniques: Characteristics, Application, Classification, Variables, Techniques, Factor Analysis (Methods, Rotation), Path Analysis.

4. **Research Publication & Presentation:** **08 Hours** **27%**

Thesis, Research paper, Organization of thesis and reports, formatting issues, citation methods, references, effective oral presentation of research, Documentation of ongoing research.

5. **Research Ethics and Morals:** **05 Hours** **19%**

Issues related to plagiarism and ethics. Intellectual Property Rights: Copy rights, Patents, Industrial Designs, Trademarks.

6. **Quality indices of research publication:** **04 Hours** **12%**

Impact factor, Immediacy factor.

D. **Instructional Method and Pedagogy:**

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of Multi-Media projector, Black Board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- Tutorials related to course content will be given to students.
- In the lectures discipline and behaviour will be observed strictly.
- Industrial visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of the assignment.

E. **Student Learning Outcomes:**

- Research Methodology as a subject should help researchers to prepare the literature in chronological pattern and should logically analyse the concerns.
- This subject should help in framing the research problems to enhance the scale of understanding.
- In this world of global village, research papers are available in abundance; one thesis submitted by a scholar, in no way should be a repetition of a work already done.

- This subject should help researchers to use tools, techniques, concepts and world's best practices to present a unique research.

F. Recommended Study Material:

❖ **Text Books:**

1. Research Methodology, Methods & Techniques, C.R. Kothari, Viswa Prakashan, 2nd Edition, 2009.
2. Research Methods- A Process of Inquiry, Graziano, A.M., Raulin, M.L, Pearson Publications, 7th Edition, 2009.
3. How to Write a Thesis:, Murray, R. Tata McGraw Hill, 2nd Edition, 2010.
4. Writing For Academic Journals, Murray, R., McGraw Hill International, 2009.
5. Writing for Publication, Henson, K.T., Allyn &Bacon, 2005.

❖ **Reference Books:**

1. What is this thing called Science, Chalmers, A.F., Queensland University Press, 1999.
2. Methods &Techniques of Social Research, Bhandarkar & Wilkinson, Himalaya publications, 2009.
3. Doing your Research project, Bell J., Open University Press, Berkshire, 4thEdition, 2005
4. A Handbook of Academic Writing, Murray, R. and Moore, S., Tata McGraw Hill International, 2006.

CA730: INTERNET AND WEB DESIGNING

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

- The objective of the course is to provide basic understanding of designing professional web page templates with Markup language. This syllabus also provides the knowledge about publishing website.

Methodology & Pedagogy: During the sessions, topics related to web designing technologies will be covered with suitable examples and students will be required to design and develop entire web sites using several web designing technologies and editors.

Learning Outcome: Upon successful completion of the course, students will understand basic concepts of internet and web page architecture and will be able to develop and host web site by using markup languages and advanced technologies, including HTML and CSS. On completion, student will be able to design and create an advanced website and will be equipped to undertake complex internet projects.

B. Outline of the Course:

Sr. No.	Content
1.	Overview of Internet and WWW, Basic elements of the Internet, Internet services, Internet Browsers and Servers, Hardware and Software requirements to connect to the internet, Internet Service Provider (ISP), Introduction to Internet Protocols
2.	Introduction to Web Page, Web Site, Web Browser, Overview of HTML, Structure of HTML Documents
3.	HTML Basics Tags and HTML elements
4.	List, Marquee & Hyperlink in HTML
5.	Images and Tables in HTML
6.	Forms in HTML
7.	Media Element in HTML5
8.	Introduction to Cascading Style Sheet (CSS), Ways to embed CSS in HTML
9.	CSS selectors & Layout
10.	CSS Properties
11.	Creation of Menu with CSS
12.	Introduction to Web Publishing or Hosting : Domain Name, Web Server, Website Parking, Publishing Website through FTP

E. Total Hours (Theory): 30

❖ **Text Books:**

1. Harley Hahn: The Internet Complete Reference, 2nd Edition, Tata McGraw-HILL Edition.
2. Matthew MacDonald: HTML5: The Missing Manual, O'Reilly Media, August 2011.
3. Peter Gasston: The Book of CSS3: A Developer's Guide to the Future of Web Design, No Starch Press, April 2011.
4. Richard York: Beginning CSS: Cascading Style sheets for Web Design, Wrox Press (Wiley Publishing), 2005.

❖ **Reference Books**:

1. Ivan Bayross: Web Enabled Commercial Application Development using HTML, JavaScript, DHTML and PHP, 4th revised edition, BPB Publication.
2. Adrian Farrel: The Internet and its Protocol – A comparative approach, Morgan Kaufmann Publishers.
3. David Mc Farland: CSS: The Missing Manual, O'Reilly, 2006.

❖ **Reference Links**:

1. http://www.w3schools.com [lecture notes]
2. http://www.whatwg.org/specs/web-apps/current-work/multipage/#auto-toc-4 [HTML Materials]
3. http://people.cs.pitt.edu/~mehmud/cs134-2084/lectures.html [CSS notes]

PT795: HEALTH AND PHYSICAL ACTIVITY

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objectives of the course:

This course will make the student to understand health and physical activity and the impact inactivity have on his/her health. Health and physical activity constitute major components of a healthy lifestyle and general health promotion and protection. The knowledge and experience gained from health and physical activity course will enable students to make informed decisions about their health as it relates to quality of life and longevity.

Upon completion of this course, the student should be able to:

1. Understand the health-related benefits of physical activity and risks associated with physical inactivity
2. Comprehend the principles specific to attaining and maintaining good health and fitness throughout the lifespan
3. Realize the areas of nutrition, cardiovascular health, diseases related to physical activity, stress management, substance use and abuse, and sexually transmitted diseases.

B. Outline of the course:

S. No.	Title of the unit	Minimum number of hours
1.	Introduction to health	10
2.	Physical Activity	10
3.	Introduction to Yoga	10

Total Hours (Theory): 30

C. Detailed Syllabus:

1	**Introduction to Health**	**10 hours**
1.1	What is health?	
1.2	Healthcare delivery system: Developing Countries, Developed Countries	
1.3	Human anatomy, physiology & physical fitness	
1.4	Basics of Nutrition	
1.5	Life style disorders – obesity & diabetes	
2	**Physical Activity**	**10 hours**
2.1	What is Physical activity, exercise, physical fitness, epidemiology?	
2.2	Measurement of Physical Activity in individuals	
2.3	Physical Activity – Theoretical Perspective: Self-determination, trans theoretical	
2.4	Physical Activity and mental health – Body image, depression, problem with exercise	
2.5	Barriers & Facilitators of Physical Activity	
3	**Introduction to Yoga**	**10 hours**
3.1	What is yoga?	
3.2	Types of yoga	
3.3	Benefits of yoga to various body systems	
3.4	Asanas, Pranayam	
3.5	Yoga therapy for various back pain, asthma, stress, hypertension, diabetes	

D. Instructional Method and Pedagogy:

- Interactive classroom sessions using black-board and audio-visual aids.
- Using the available technology and resources for e-learning.
- Students will be encouraged towards self-learning and under direct interaction with course faculty.
- Students will be enabled for continuous evaluation.
- Case study, didactic mode of group discussions

E. Student Learning Outcomes:

Upon completion of the course, the student should be able to:

- Appraise the importance of exercise in maintenance of health and fitness.
- Objectively define health and physical activity in realistic environment.

F. Recommended Study Material:

- **Textbooks:**
  1. ACSM"s "Health Related Physical Fitness Assessment Manual Lippincott Williams and Walkins USA, 2005.
  2. Nilima Patel (2008) Yoga and Rehabilitation, Jaypee Publication, India
- **Reference books:**
  1. Biddle, S. J. H., & Mutrie, N. (2008). Psychology of physical activity. London: Routledge
  2. B.C. Rai. Health Education and Hygiene Published by Prakashan Kendra
  3. Puri. K. Chandra. S.S. (2005). Health and Physical Education. New Delhi: Surjeet Publications

NR751: WOMEN'S HEALTH

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

I. Course Objectives:

Upon completing the course, students will be able to

- Understand and describe the sociocultural, behavioral, and policy issues that contribute to and affect women's health at National and International Level.
- Describe the seven domains of health and their impact on women.
- Understand the value and limitations of various tools that are used to measure and monitor women's health.
- Identify major demographic, behavioral and environmental factors that are associated with women's health and how such factors may be incorporated into public health interventions, programs, and policies.
- Identify trends in major health conditions that affect women.
- Identify the interplay between health services delivery and policy issues as they impact and are impacted by health issues.

II. Outline of the Course:

Unit No.	Title of Unit	Prescribed Hours
I.	**Overview of Women Health in India**: • Women's health nationally and locally. • Women's health and the seven domains of health. • Policy initiatives related to women's health issues, as related to cost, monitoring, measures of success and impact on other policy initiatives.	3
II.	**Female Anatomy & Physiology**: • Female anatomy and physiology from the perspective of their effects on women's health, including differences from men's health • Menstrual and menopause	5
III.	**Women and relationships**: Family, social networks and exposure to intrapersonal violence: • Social meaning for women's lives • Social policies relating to women in the INDIA • Health policies relating to women • violence that affect women's lives & medical issues	5

IV.	**Non Communicable Diseases** : • Introduction of Non Communicable diseases in relation to women health • Cardiovascular Diseases: ➢ Women's risk factors for cardiovascular disease ➢ Gender differences in prognosis for and treatment of cardiovascular disease in women. ➢ Interactions between knowledge, risk, and outcomes of cardiovascular disease in women • Cancer: ➢ Most common cancers in women (excluding minor skin cancers) in terms of diagnoses as well as deaths. ➢ Levels of cancer prevention. ➢ Public health approach to screening for cancer	10
V.	Mental Health/ Substance use	2
VI.	Act & Laws : Indian legislations and law regarding Women protection (Human Rights)	5
	Total	**30 Hours**

III. Instruction Method and Pedagogy

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, microteaching, task-based learning, assignments and various interpersonal activities like case studies, critical reading, group work, independent and collaborative research, presentations etc.

IV. Evaluation: The students will be evaluated continuously in the form of internal as well as external examinations. The evaluation (Theory) is schemed as 25 marks for internal evaluation and 75 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Assignments	1	8	8
2	Internal Test/ Model Exam	1	12	12
3	Attendance and Class Participation	Minimum 80% attendance		10
			Total	**30**

External Evaluation

The University Theory examination will be of 75 marks and will test the logic and critical thinking skills of the students by asking them theoretical as well as application based questions. The examination will avoid, as far as possible, grammatical errors and will focus on applications.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

V. **Learning Outcomes:** At the end of the course, learners will be able to:

- Understand the sociocultural, behavioral, and policy issues that contribute to and affect women's health at National and International Level.
- Understand the seven domains of health and their impact on women.
- Understand the value and limitations of various tools that are used to measure and monitor women's health.
- Understand trends in major health conditions that affect women.
- Understand the health services delivery and policy issues which impact on women's health.

RD701: INTRODUCTION TO ANALYTICAL TECHNIQUES

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the course.

- The objective of the course is to introduce students to different types of experimental techniques available.
- This course will expose student to state of art equipments and their utility.
- The emphasis is given more on analyzing of the data and operating skills.
- To explore the basics of Chromatography

B. Outline of the Course

Sr. No.	Title of Unit	No. of hrs.
1.	HPLC	08
2.	TGA-DSC	09
3.	DLS	05
4.	PCR	08

Total Hours (Theory): 30

C. Syllabus Topics:

Sr. No.	Title of Unit	Topics
1.	High Performance Liquid Chromatography (HPLC)	Introduction to HPLC, Basic Principle of HPLC, Instrumentation for HPLC, Types of Detector used in HPLC, Column efficiency in liquid chromatography
2.	TGA-DSC	General Discussion, Thermogravemetry Analysis, Instruments available for Thermogravimetric analysis, Detailed Discussion, Principle and Applications in various fields of Science and Engineering. Data Analysis
3.	DLS	Concept of Dynamic light scattering and basics of Particle size analyzer, Data Analysis and applications of DLS

4.	PCR	Introduction and principle of Polymerase Chain Reaction (PCR), Principle of PCR, Primer designing, Detailed methodology of PCR, Modifications of PCR, Applications of PCR

D. Instructional Methods and Pedagogy:

The topics will be discussed in interactive class room sessions using classical black-board teaching to power-point presentations. Unit tests will be conducted regularly as a part of continuous evaluation and suggestions will be given to student in order to improve their performance.

E. Student Learning Outcomes / objectives:

- The Programme aims at providing students with the methodological concepts and tools needed to acquire top-level skills in the field of some selected instrumentation
- At the end students would gain experience in using these tools and analyzing the data.

F. Recommended Study Material:

❖ **Text books/Reference books**

1. Instrumental methods of analysis by Williard Merritt Dean Settle, 7th Ed. CBS publishers and distributors Pvt. Ltd.,
2. Instrumental methods of analysis by Williard Merritt Dean Settle, 7 th Ed. CBS publishers and distributors Pvt. Ltd.,
3. Principles of Gene Manipulation and Genomics by Sandy B. Primrose, Richard Twyman 7 th Ed. Wiley-Blackwell
4. Molecular Cloning: A Laboratory Manual by Joseph Sambrook, David William Russell 3 rd Ed.CSHL Press
5. Principles and Techniques of Biochemistry and Molecular Biology by Wilson and Walker 7 th Ed. Cambridge University Press
6. Principles of Instrumental Analysis by Douglas A. Skoog, F.James Holler and Timothy A.Nieman. Publisher: Saunders College Publishing.

RD 702: INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the course:

The objective of the course is to introduce the students:

- To provide a general and broad introduction to the multi-disciplinary field of nanoscience and nanotechnology
- During the course the students will acquire the basic knowledge of why and how the physicochemical properties change at the nanoscale.
- The students will become familiar with the typical techniques that allow the observation, characterization and manipulation of matter at the atomic, molecular and supramolecular level.
- The recent scientific and technology work in the nano world will be presented to demonstrate the potential of nanoscience and nanotechnology in diverse areas such as medicine, biotechnology, chemical industry, information and communication technology, production and storage of energy, synthesis and manufacture of new materials, etc.
- It is also attempted that the student becomes aware of the ethical, social and economic implications that can lead this new discipline.
- To cultivate interest in the research and development of nanotechnology for future advancement of the career.

B. Outline of the Course:

Sr No.	Title of Unit	Minimum No. of Hrs
1.	Nanotechnology – development history & Implications of nanotechnology	6
2.	Overview on characterization and synthesis of nanostructure materials	10
3.	Overview of nanostructures & Nano devices	10
4.	New fields of nanotechnology	4

Total Hours (Theory): 30

C. Syllabus Topics:

1. Nanotechnology – development history & Implications of nanotechnology
   Concept of nanoscience and nanotechnology, Nanotechnology in the history and in nature. Impact of the nanotechnology in the society: Ethical, social, economic and environmental implications. the nanoscale. Size dependent physical and chemical properties. Surface effects. Importance of the surface at nanoscale. The surface/volume ratio. Size dependent properties
2. Overview on synthesis and characterization of nanostructure materials.
   Physical, chemical and biological methods of synthesis of nanostructures, Electron microscopy, scanning probe microscopy, non-imaging techniques
3. Overview of nanostructures & Nano devices
   zero dimensional, one dimensional and two dimensional nanostructures , Electronic devices, magnetic devices, photonic devices, mechanical devices, fluidics devices and biomedical devices
4. New fields of nanotechnology
   quantum computing, spintronics, nanomedicines, energy, etc.

D. Instructional Methods and Pedagogy:

The topics will be discussed in interactive class room sessions using classical black-board teaching to power-point presentations. Students will be exposed to practical operations, and lab visit and experimental demonstrations of some of the equipment facilities for Nano fabrication & characterization available in UNI. Students will produce a technical report on the experiences.

E. Student Learning Outcomes / objectives:

Nanotechnology promises to be the technology of the future benefitting the humanity in a number of ways. This course is aimed at preparing students for further industrial or academic work in the field of nano-characterization techniques.

F. Recommended Study Material:

❖ **Text Books / Reference Books:**

1. Essentials of nanotechnology by Jeremy Ramsden [JR], 2009, Jeremy Ramsden & Ventus Publishing ApS,
2. Introduction to Nanoscience, S.M.Lindsay, Oxford ISBN 978-019-954421-9 (2010).
3. Guozhong Cao (2004). *Nanostructures and Nanomaterials: Synthesis, Properties & Applications*, 448 pages, Imperial College Press, ISBN-10: 1860944159.
4. NANO: The Essentials Understanding Nanoscience and Nanotechnology, T. Pradeep, Tata McGraw-Hill Publishing Co. Ltd., 2007.
5. Nanoscience and Nanotechnology, B K Parthsarathy, ISHA Books, New Delhi, 2007.

6. Nanotechnology: Principles and practices, Sulabha K Kulkarni, Capital publishing company, 2007.

MB650: CREATIVE LEADERSHIP

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Course Objectives

The objectives of this course are:

- To create awareness about traits, types, approaches /theories and contemporary issues of leadership.
- To nurture qualities of creative leadership to meet the 21st century challenges in students.

B. Outline of the Course:

Module No.	Title/Topic	Classroom Contact Sessions
1	**Introduction to Leadership** • What are Leadership Skills? • Ways of Conceptualizing Leadership • Definition and Components • A Born Leader • Traits of Successful Leader • Why Leadership? o Managerial Roles • Importance of Leadership **Leading Vs Managing** • Roles and Relationships • Developing Personality for Effective Leading Roles • Authority Vs. Responsibility • Leading the Team • Leadership–Styles, Models and Philosophy	05
2	**Leadership Approach** • Trait Approach • Skills Approach • Style Approach • Situational Approach • Psychodynamic Approach **Leadership Theories** • Contingency Theory	05

Module No.	Title/Topic	Classroom Contact Sessions
	• Path-Goal Theory • Leader-Member Exchange Theory	
3	**Leadership Processes** • Transactional Leadership • Transformational Leadership • Authentic Leadership • Team Leadership • Integrative Leadership • Liquid Leadership	**05**
4	**Women and Leadership** • Gender and Leadership Styles • Gender and Leadership Effectiveness • Glass Ceiling Turned Labyrinth • Strengths of Women Leadership • Criticism and Application	**05**
5	**Culture and Leadership** • Dimensions of Culture • Clusters of World Cultures • Leadership Behavior and Culture Clusters • Universally Desirable and Undesirable Leadership Attributes • Criticism and Application • Leadership for High Performing Organisations • General Principles for Creative Culture • Nurturing Personal Creativity	**05**
6	**Contemporary Issues in Leadership** • Power and Politics in Leadership • Ethics in Leadership • Cases in Leadership	**05**
	Total	**30**

C. **Pedagogy**

The course will emphasise self-learning and active classroom interaction based on students' prior preparation. The course instructor is expected to prepare a detailed session-wise schedule, showing the topics to be covered, the reading material and case material for every session. Wherever the material for any session is drawn from sources beyond the prescribed text-book, reference books, journals and magazines in the library, or from websites and other resources not accessible to the students, the course instructor should make the material available to the students well in advance, so that the students can come prepared for the classes. The pedagogical mix will be as follows:

- Classroom Contact Sessions ... About 20 Sessions
- Case Discussions ... About 03 Sessions

- Presentation ... About 03 Sessions
- Management Exercise/ Stimulations/Game ... About 02 Sessions
- Feedback ... About 02 Sessions

The exact division among the above components will be announced by the instructor at the beginning of the semester as a part of detailed session-wise schedule.

D. Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks	Percentage of total internal evaluation
1	Quizzes	3	10	30	10
2	Case Analysis and Presentation	2	45	90	30
3	Assignment / Project work	1	60	60	20
4	Internal Tests	2	45	90	30
5	Attendance and Class Participation			30	10
			Total	**300**	**100**

The total marks will be divided by 10 and declared as Institute-level evaluation marks for the course. The Institute-level evaluation will constitute 30% of the total marks for the course.

E. External Evaluation

The University examination will be based on oral presentation, review of students' reports and a viva-voce and will carry 70% marks for the course evaluation.

F. Learning Outcomes

At the end of the course, the student should have developed:

- Appreciation for types, traits, approaches and leadership models/theories.
- Motivation for leadership roles and responsibilities.
- Qualities of creative leadership skills.

G. Reference Material

❖ **Text-book:**

1. Leadership – Theory and Practices , Peter G. Northouse, Sage Publications India Pvt. Ltd., Latest Edition

❖ **Reference Books:**

1. Liquid Leadership by Brad Szollose, Prolibris Publishing Media, Latest Edition
2. Effective Leadership by Lussier/ Achua , Cengage Learning Publications, Latest Edition

3. Integrative Leadership by Hatala & Hatala, Pearson Power Publication, Latest Edition
4. Cases in Leadership by Rowe and Guerrero, Sage Publications India Pvt. Ltd., Latest Edition

❖ **Journals / Magazines / Newspapers:**

1. HBR Issues on Building Leadership Skills
2. International Journal of Innovation, Creativity and Change
3. Economic Times
4. Business Standard

PH825: COMMUNITY PHARMACY OWNERSHIP

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course

Community pharmacy is concerned with promoting the safe and appropriate use of drugs and common medical devices.
Ownership concept in Community Pharmacy is required to create for the effective delivery of pharmacy services in an regulated environment in which the nature of pharmacy is clearly evolving from the supply of goods (pharmaceuticals under prescription, pharmacist and pharmacy only medicines, and other goods) to the supply of services designed to support the optimal use of medication as part of a wider health care strategy.

B. Outline of course:

Sr. No.	Title of Unit	No. of Contact Hours
1	Introduction to Community pharmacy	10
2	Community Pharmacy Management	10
3	Pharmacy Business Plan	10
	Total	30

C. Detailed Syllabus:

Sr no	Title of Unit	Topics
1	Introduction to Community pharmacy	Roles & Responsibility, relationship with other health care providers, Prescribed medication order interpretation including OTC medicines, Safe use of medical devices.
2	Community Pharmacy Management	Role, process and scope of Community Pharmacy Management, modern technologies, financial, material, staff management and Drug store management, Code of ethics for Pharmacy.
3	Pharmacy Business Plan	Creating a Successful Pharmacy Business Plan, Business Owner Roles, Responsibilities, and Management Styles, Legal, Financial and Accounting Advice for the Beginning Owner, Marketing of Pharmacy Practice.

D. Instructional Methods and Pedagogy:

The content of the syllabus would be transmitted through different pedagogy tools like interactive class room sessions using classical chalk - board teaching to Power point presentations. Class room teaching would also be supplemented with group discussions, seminars, assignments and case studies.

E. Student Learning Outcomes / Objectives

At the end of the course, the student will be able to understand

- The concept of Community Pharmacy Ownership and its scope
- Students understand the role of the pharmacist in community and development
- Able to learn skill require to set Pharmacy store & its management

F. Recommended Study Material

❖ **Text / Reference Books:**

1. Mohd. Aquil, Practice of Hospital, clinical & Community Pharmacy Elsevier
2. Paul Rutter, Community Pharmacy E-Book, Symptoms, Diagnosis and Treatment, 3rd Edition
3. A Textbook of Clinical Pharmacy Practice: G. Parthasarathi, Karin Nyfort-Hansen and Milap Nahata, Universities Press.
4. Research articles as per the assignment

Semester 2
University Electives

EE782: ENERGY AUDITING AND MANAGEMENT

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objectives of the Course:

Energy auditing and management is a course where a student will deal with various types of energy conservation schemes employed in industries, power stations, domestic and commercial areas. Also they will familiar with energy auditing and management procedures. The objectives of the course are:

- To learn practical and theoretical elements of energy auditing and management
- To be able to assess the benefits and drivers of an energy audit and have knowledge of the Energy Audit Process
- To understand how to plan and carry out an energy audit and be confident with the process of reviewing energy data in the energy audit process
- To Have knowledge of the equipment and key considerations required when carrying out an energy audit
- To be aware about the energy efficient technology and energy storage system

B. Outline of the Course:

Sr. No.	Title of Unit	Min. No. of Hrs
1	**Electrical Energy Conservation**	3
2	**Electrical Energy Management**	10
3	**Financial Management**	4
4	**Energy Management & Audit**	5
5	**Energy Efficient Technologies In Electrical Systems**	3
6	**Energy Storage Systems**	3
7	**Case Studies.**	2

Total hours (Theory): 30

C. Detailed Syllabus:

1 Electrical Energy Conservation 3 Hours 11.33%

1.1 **Energy Scenario:** Introduction to energy science and energy technology, various forms of energy. Law of conservation of energy. Energy scenario of India, Introduction to global energy scenario. Carbon credit, Energy Sector Reforms, Energy Strategy for the Future, Energy Conservation Act 2001 and its features.

1.2 **Measures for energy conservation:**
Potential energy conservation opportunities in: HVAC System, Lighting systems, Motors and Transformers.

2 Electrical Energy Management 10 Hours 29.12%

2.1 Concept of energy management, Design of Energy management programmes, energy cost, Energy planning, Energy staffing, Energy Organization, Energy Requirement, Energy Costing, Energy Budgeting, Energy Monitoring, Energy consciousness, Energy Management Professionals, Environment pollution due to energy use. Need of energy planning, steps for energy planning, Energy management in industry, Energy management cell function and objective, Energy management cell roles and responsibilities, Role of energy manager, benchmarking, Social and economic cost benefits. Seven principals of energy management.

2.2 **Electrical System Optimization**
Electricity rate tariff, key to reduction in electrical energy Consumption, Methods to improve plant power factor, load management, conduction loss, switching loss, magnetic loss, harmonic Compensation, Motor control, Lighting energy saving.

2.3 **Cogeneration**
Definition, Need, Application, Advantages, Classification, Saving potentials

3 Financial Management 4 Hours 11.11%

Investment-need, Appraisal and criteria, Financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Role of ESCOs.

4. Energy Management & Audit 5 Hours 12.89%

Introduction, Definition, Energy audit- needs, types and walkthrough energy audit. Energy audit at unit level, Industrial Audit approaches. Procedure for energy audit and equipments required. Comprehensive Energy audit Site testing Measurement & Analysis of Electrical System like Induction Motors. Transformers, Illumination system, Problems on Energy Management.

5. Energy Efficient Technologies In Electrical Systems 3 Hours 11.11%

Load Management and Maximum demand control. Electrical distribution system. Maximum demand controllers, Automatic power factor controllers, Energy efficient motors, Soft starters with energy saver, Variable speed drives, Energy efficient transformers, Electronic ballast, Occupancy sensors, Energy efficient lighting controls.

6. **Energy Storage Systems** **3 Hours** **13.33%**

Introduction, Demand for energy storage, Energy storage systems: heat storage- hot water, hot solids, phase change materials; Potential energy storage: spring, compressed gas. Pumped hydro: Flywheels. Rolling mills, Electrical and magnetic energy storage systems.

7. **Case Studies.** **2 Hours** **11.11%**

D. Instructional Methods and Pedagogy

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures which carries a component of the overall evaluation.
- Minimum two internal exams will be conducted and will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students for each unit/topic and will be evaluated at regular interval and its weightage may be reflected in the overall evaluation.

E. Student Learning Outcomes:

After the completion of the course the students will be able to:

1. Analyze about energy scenario nationwide and worldwide
2. Decide about energy management in more effective way.
3. To propose the effective way for energy conservation
4. Carry out financial management.
5. Can design energy efficient technologies and provide alternative solutions for energy storage

F. Recommended Study Material:

❖ **Text Book:**

1. Amlan Chakrabarti, Energy engineering and management, PHI Learning Private Limited.
2. K. Nagabhusan Raju, Industrial Energy Conservation Techniques, Atlantic Publishers & Distributors (P) Ltd.

❖ **Reference Book:**

1. Renewable energy sources and conservation technology By- N.K.Bansal, Kleemann and Meliss
2. Non – conventional energy sources by G.D. Rai
3. Energy technology by S.Rao.
4. A guide to energy management by Barney L Capehart, William J Kennedy, Wayne C Turner.

❖ **Web Material:**

1. www.energymanagertraining.com
2. www.bee-india.gov.in

CE771: PROJECT MANAGEMENT

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

The course aims to provide and understanding management issues process during project management.

- To develop an awareness of the need for project planning and management
- To apply professional attitudes and techniques to managing a project
- Provide students with a basic understanding of project management principles and practices.
- Increase the student's ability to function effectively on a project team.
- Increase the student's ability to function effectively as a project manager.

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Overview of Project Management	03
2	Project Management Concepts and Techniques	03
3	Project Cost Estimation	04
4	Project Planning and Scheduling	05
5	Project Monitoring and Control	05
6	Material Management in Project	04
7	Management of Special Projects and Project	06

Total hours (Theory): 30

C. **Detailed Syllabus:**

1.	**Overview of Project Management** Introduction to Project Management Overview of Project Planning, Project Estimation, Project Scheduling, Organization and Team Structure, Risk Analysis and Management, Resource Allocation Project Management Process and Role of Project Manager	**03 Hours**	**10 %**
2.	**Project Management Concepts and Techniques** Project Screening and Selection Techniques Structuring Concepts and Tools (WBS,ORS,LRC) Project Planning Tools (Bar Chart, LOB, CPM and PERT) Risk Analysis and Management	**03 Hours**	**10 %**
3.	**Project Cost Estimation** Types of Estimates and Estimating Methods Project Budgeting	**04 Hours**	**13 %**
4.	**Project Planning and Scheduling** Dynamic Project Planning and Scheduling Project Scheduling with Resource Constraints	**05 Hours**	**17 %**
5.	**Project Monitoring and Control** Monitoring Techniques and Time control system Project Cost Control and Time cost tradeoff	**05 Hours**	**17 %**
6.	**Material Management in Project** Project Procurement and Material Management	**04 Hours**	**13 %**
7.	**Management of Special Projects and Project Management Software Tools** Management of SE/NPD/R&D/Hi-Tech and Mega Projects Software tools for Project Management: MS Project, Primavera, Turbo Project, Riski Project.	**06 Hours**	**20 %**

D. **Instructional Method and Pedagogy:**

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.

- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

E. Student Learning Outcomes:

Upon successful completion of this course, students will be able to understand project management process and different aspect of development process necessary for the management of the project which includes various activities, resources, quality, cost and system configuration etc.

F. Recommended Study Material:

❖ **Text Books:**

1. Project management: engineering, technology, and implementation by Shtub, Avraham, Jonathan F. Bard, and Shlomo Globerson, Prentice-Hall, Inc., 1994.
2. Project Management Handbook by Lock, Gower.
3. VNR Project Management Handbook by Cleland and King.
4. Management guide to PERT/CPM by Wiest and Levy, PHI.
5. Project Management: A Systemic Approach to Planning, Scheduling and Controlling by Horald Kerzner, CBS Publishers, 2002.
6. Project Scheduling and Monitoring in Practice by S. Choudhury,
7. Total Project Management: The Indian Context by P. K. Joy, Macmillan India Ltd.

❖ **Reference Books:**

1. Project Management for Business and Technology: Principles and Practice by John M Nicholas, Prentice Hall of India, 2002.
2. Project Management, by N. J. Smith (Ed), Blackwell Publishing, 2002.
3. Effective Project Management by Robert K. Wysocki, Robert Back Jr. and David B. Crane, John Wiley, 2002.
4. Project Management: A Managerial Approach, by Jack R Meredith and Samuel J Mantel, John Wiley, 4th Edition, 2000.

IT771: CYBER SECURITY AND LAWS

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	02	00	02	02
Marks	100	-	100	

A. Objective of the Course:

The main objectives for offering the course Cyber Security are

- To under the concepts of Cybercrimes and cyber security
- To create the awareness of how to avoid becoming victims of cybercrimes.
- To provides the content which will help the students who wish to seek career in cyber security or independent study and research in the field of cyber security.

B. Outline of the Course:

Sr No.	Title of the unit	Minimum number of hours
1.	Computer and Cyber Security Basics	06
2.	Security Threats	09
3.	Provisions in Indian Laws in dealing with Cyber Crimes	07
4.	Case Studies	08

Total hours (Theory): 30

C. Detailed Syllabus:

1. **Computer and Cyber Security Basics** **06 hours** **20 %**

   Introduction to Computers, Computer History, Software, Hardware, Classification, Computer Input-Output Devices, Windows, DOS Prompt Commands, Basic Computer Terminology, Internet, Networking, Computer Storage, Computer Ethics and Application Programs, Security : Security trends – Goal, Attacks, Services and Mechanism

2. **Security Threats** **09 hours** **30 %**

   Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e-Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.

3. **Provisions in Indian Laws in dealing with Cyber Crimes** **07 hours** **23 %**

   Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law.

4. **Case Studies** **08 hours** **27 %**

   Identity Management, Cyber Security and Terrorism: Case Studies, The DigiNotar case, Deutsche Telekom, The disruption at the IT service provider Tieto, Web Based Attacks by Symantec, Password Security

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.

- **Assignments** based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of **5 Marks** as a part of internal theory evaluation.
- Surprise Tests/Quizzes/Seminar/**Case Study** will be conducted which carries **10 Marks** as a part of internal theory evaluation.

E. Student Learning Outcome:

Learning outcomes of the course are:

- Students will able to do classification of cybercrime, methods used to perform crime, apply cyber security, and know the detailing of Information Technology Acts against offences.
- Students will understand and appreciate the legal and ethical environment impacting individuals as well as business organizations and have an understanding of the ethical implications of IT legal decisions.
- Students will have a fundamental knowledge of Information Technologies which affect organizational processes and decision-making.

F. Recommended Study Material:

❖ **Reference Books:**

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security", Pearson Education India.
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla,"Introduction to Information Security and Cyber Law" Willey Dreamtech Press.
4. Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill.
5. CHANDER, HARISH," Cyber Laws And It Protection " , PHI Learning Private Limited ,Delhi ,India

CA 842: MOBILE APPLICATION DEVELOPMENT

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. **Objective:** Develop skills to describe mobile technologies, mobile environment and todevelop Android application for mobile device using Android SDK, android application resource, application component, and Android APIs.

Prerequisites: Object Oriented Programming.

Methodology & Pedagogy: This course focuses on providing hands-on experience in designing and development of mobile application with emphasis on the real world application and techniques that enable smart phone based application development. Student shall also develop applications dealing with data storage, documents sharing among applications and application based on Google maps and integration of web service with mobile application.

Learning Outcomes:

- Describe the different mobile technologies, mobile development platform and mobile GUI.
- Comprehend how Android applications works, their life cycle, Intents, fragments and resources.
- Design and develop useful Android applications with compelling user interfaces by using View, ViewGroup, menu, and dialog elements.
- Use Android's APIs for data storage, retrieval, user preferences, files, databases, and content providers.
- Utilize the power of background services, notifications, and broadcast receiver.
- Use Android's communication APIs for SMS, telephony and location based application.

B. Outline of the Course:

Week No	Practical	Description
1	Brief about mobile technologies and challenges in mobile application development and architectural overview of an Android platform.	Different mobile application development platform overview and Android architecture overview and basic components of Android application development overview.
2	Development of first Android based mobile	Working of Android Studio IDE, Android project directory structure, Dalvik Virtual Machine Overview,

	application and overview of necessary components required for development.	Android Software development kit explanation, Virtual device creation and execution of first application on virtual as well as actual device
3	Fundamentals of User Interface designing.	XML based user interface designing using different available layouts like Relative Layout, Linear Layout, Table Layout etc.
4	User Interface Widgets-1	Hands-on demonstration of basic widgets like- TextView, EditText, Button, ToggleButton, RadioButton, RadioGroup, CheckBox, RatingBar, SeekBar etc.
5	User Interface Widgets-2	Hands-on demonstration of composite widgets like- ListView, Spinner and AutoCompleteTextView and customization of the composite controls.
6	Activity, Activity navigation and Intents.	Activity life cycle, Linking Activity using Intents:startActivity(), StartActivityForResult(). Calling built-in applications: ACTION_MAIN, ACTION_VIEW, ACTION_DIAL, ACTION_SEND
7	Android Resources, Styles and Themes.	Usage and implementation of different resources like drawable, string, color, dimes, raw and animation. Creating and Applying simple Style, Inheriting built-inStyle and User defined style, Using Styles as themes.
8	Dialogs & Menus.	Hands-on demonstration of different dialogs and menus available in Android.
9	Data Persistence Techniques.	User Preferences and Database management through SQLite
10	Broadcast Actions and Services implementation.	Service: life cycle, create and destroy service, Alarm Manager and SMS Manager. Standard Broadcast Actions.
11	PHP based web service implementation in Android	Creation and consumption of PHP based web service.
12	Simple Google Map incorporation with Android application.	Google Developer console usage, SHA-1 certificate creation and API-KEY creation and incorporation in Android application.

Total hours (Theory): 30

❖ **Text Books:**

1. Wei-Meng Lee: Beginning Android 4 Application Development, Wiley India Pvt Ltd.
2. Mark L. Murphy: The Busy Coder's Guide to Android Development

Reference Books:

1. Jonathan Simon: Head First Android Development, O'REILLY publication
2. Mark L Murphy: Beginning Android, Wiley India Pvt. Ltd.

Web References:

1. https://developer.android.com [Detail Android Development Guide]
2. https://www.youtube.com/watch?v=SUOWNXGRc6g&list=PL2F07DBCDCC01493A [200 android development tutorials]
3. www.androidhive.info/ [Advance application development with Android]

PT796: FITNESS AND NUTRITION

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objectives of the course:

This course is intended to introduce the student with the basic concepts of health and fitness and appraise the relative contribution of leading a physically active lifestyle. This shall familiarize the student with different perspectives on maintaining general health and fitness behavior and understand the nutritional information to suit individual needs and preferences.

Upon completion of this course, the student should be able to:

1. To provide general concepts of physical education, nutrition and fitness.
2. To promote and understanding of the value of sports for life skill development.
3. Introduce nutritional principles and application to improve overall health.

B. Outline of the course:

S. No.	Title of the unit	Minimum number of hours
1.	Physical Education and Physical Fitness	10
2.	Nutrition and Health	10
3.	Sports and Life Skills Education	10

Total hours (Theory): 30

C. Detailed syllabus:

1 PHYSICAL EDUCATION AND PHYSICAL FITNESS 10 hours

1.1. Concept of Physical Education, Meaning, Definition, Aims and Objectives of Physical Education, Need and Importance of Physical Education

1.2 Physical Education and its Relevance in Inter Disciplinary Context

1.3 Physical Fitness Components: Type of Fitness, Health Related Physical Fitness, Performance Related Physical Fitness

2 NUTRITION AND HEALTH 10 hours

2.1 Concept of Food and Nutrition, Balanced Diet, Food Pyramid Index

2.2 Macro and Micronutrients: Types, functions and classification system

2.3 Carbohydrates : Types, RDA data, Glycemic index, Sources of Fats, saturated, unsaturated fats, recommended intake, importance of fat in diet, fats in health and disease

2.4 Protein: Types EAA, function, assessing quality of proteins, selecting incomplete proteins, RDA sources.

2.5 Vitamins And Minerals: Types, functions, sources, and minerals - calcium, Phosphorus, iron, magnesium, sodium, potassium, and chloride. Trace elements - sources and functions.

2.6 Determining Caloric Intake and Expenditure, Obesity, Causes and Preventing Measures – Role of Diet and Exercise, Importance of hydration in exercise

3 SPORTS AND LIFE SKILLS EDUCATION 10 hours

3.1 Sports and Socialization

3.2 Physical Activity and Sport – Emotional Adjustment and Wellbeing

3.3 Substance Abuse among Youth – Preventive Measures and Remediation

3.4 Yoga, Meditation and Relaxation

3.5 Sports and Character Building

3.6 Values in Sports

3.7 Sports for World Peace and International Understanding

D. Instructional Method And Pedagogy:

- Interactive classroom sessions using black-board and audio-visual aids.
- Using the available technology and resources for e-learning.
- Students will be encouraged towards self-learning and under direct interaction with course faculty.
- Students will be enabled for continuous evaluation.
- Case study, didactic mode of group discussions

E. Student Learning Outcomes:

Upon completion of the course, the student should be able to :

- Appraise the importance of exercise in maintenance of health and fitness.

- Objectively define health and fitness in realistic environment and inculcate habits of physical activity, nutrition and sports as a behavior change and overall health promotion

F. Recommended Study Material:

❖ **Textbooks:**

1. ACSM"s "Health Related Physical Fitness Assessment Manual Lippincott Williams and Walkins USA, 2005.
2. Siedentop.D,(1994) Introduction to Physical Education and Sports (2nd ed.), California: Mayfield Publishing Company.
3. Corbin.Charles Beetal. C.A., (2004) Concepts of Fitness and Welfare Boston McGraw Hill.

NR 752: EPIDEMIOLOGY AND COMMUNITY HEALTH

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. **Course Objectives:**

Upon completing the course, students will be able to

- Familiar with epidemiologic terminology, outcome measures, and study designs; to appreciate application of epidemiology to subfields (e.g., infectious diseases, reproductive health, genetics); and to apply epidemiologic methods to current public health issues.

B. **Outline of the Course:**

UnitNo.	Title of Unit	Prescribed Hours
1	**Introduction:** • Concept, scope, definition, trends, History and development of modern Epidemiology • Contribution of epidemiology • Implications	5
2	**Health Statistics:** • Morbidity & Mortality	2
3	**Epidemiological approaches:** • Study of disease causatives (Cause & Risk) • Health promotion • Levels of prevention	4
4	**Epidemiology of** • Communicable diseases • Non-communicable diseases	10
5	**Disaster:** • Disaster preparedness, • Disaster management	3
6	**Health Organizations:** • Voluntary health organizations • International health agencies –WHO, World health assembly, UNICEF, UNFPA, SIDA, US AID, DANIDA, DFID. AusAID etc	6
	Total	**30 Hours**

C. Instruction Method and Pedagogy

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, microteaching, task-based learning, assignments, field visit and various interpersonal activities like group work, independent and collaborative research, presentations etc.

D. Evaluation:

The students will be evaluated continuously in the form of internal as well as external examinations. The evaluation (Theory) is schemed as 25 marks for internal evaluation and 75 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Assignments	1	8	8
2	Internal Test/ Model Exam	1	12	12
3	Attendance and Class Participation	Minimum 80% attendance		10
			Total	**30**

External Evaluation

The University Theory examination will be of 75 marks and will test the logic and critical thinking skills of the students by asking them theoretical as well as application based questions. The examination will avoid, as far as possible, grammatical errors and will focus on applications.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

E. Learning Outcomes: At the end of the course, learners will be able to:

- Understand the epidemiologic terminology,
- Understand the health statistic
- Understand the various methods of epidemiology
- Understand the role and functions of various health agencies
- Understand the epidemiological trends in communicable and non-communicable diseases.

OC733: INTRODUCTION TO POLYMER SCIENCE

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the course

Fundamentals of polymer chemistry will be introduced.

B. Outline of the course

Sr.No	Title of Unit	Approximate No of Hours
1	Basic concepts of Polymer Chemistry	5
2	Chemistry of Polymerization	8
3	Kinetics of polymerization	8
4	Molecular weight and size	9

Total Hours (Theory): 30

C. Detailed syllabus:

Sr. No	Title of Unit	Approximate No of Hours
1.	**Basic concepts of Polymer Chemistry** Introduction to polymers, How are polymers made, Classification of polymers.	5
2.	**Chemistry of Polymerization** Chain polymerization, Step polymerization, Miscellaneous polymerization reactions, Polymerization techniques.	8
3.	**Kinetics of polymerization** i). Free – Radical chain polymerization. ii). Cationic & anionic polymerization. iii). Polycondensation	8
4.	**Molecular weight and size** Number – Average molecular weight. Viscosity – Average molecular weight. Polydispersity and molecular weight. Significance of polymer molecular weight. Size of polymer molecules	9

D. Instrumental Methods and Pedagogy:

Topics will be taught in interactive class room sessions using black-board and if required power-point presentations will also be employed. Special interactive problem solving sessions will be conducted. Course materials will be provided from various sources of information. Students will be trained to measure molecular weight of polymers using

appropriate instrument(s). Unit test will be taken regularly as a part of continuous evaluation and suggestions will be given to the students in order to do better in their performance.

E. Student Learning Outcomes/Objective:

- The programme aims at providing the basic concepts in polymer science.
- Ensuring that students acquire skills for further research in this area.

F. References:

1. A First Course in Polymer Chemistry by A. Strepikheyev , V.Derevitskaya and G.Slonimsky ; MIR Publishers, Moscow
2. Polymer Science by V.R.Gowariker , N.V.Viswanathan and Jayadev Sreedhar, New Age International Publishers.
3. Polymer Science and Technology of Plastics and Rubbers by Premamoy Ghosh, Tata McGraw-Hill Publishing Company Ltd. New Delhi.

MB651: SOFTWARE BASED STATISTICAL ANALYSIS

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Course Objectives

The objectives of this course are:

- To enable the students to understand importance of research and statistical techniques.
- To provide hands on training of statistical software like SPSS, SYSTAT, MATLAB and other open source software like R , WEKA, for research.

B. Course Outline

Module No.	Title/Topic	Classroom Contact Sessions
1	**Introduction to Statistics** • Research and Innovation • Introduction to Statistics • Quantitative Techniques in Research	06
2	**Software # 1 - Use of Software in Research** • Introduction to the Software • Creating Variables • Data and its Types • Importing Data from MS-Excel • Transformation of Variables • Visual Benning • Determining Validity and Reliability of Scale using CFA - Cronbach's (alpha) : a coefficient of internal consistency • Estimation & Hypothesis Testing: • Parametric Tests o Z Test o t – Test o Cross Tabulation and Chi – square o One-Way & Two-Way Analysis of Variance (ANOVA) o Pearson's Correlation Analysis o Regression Analysis	12

Module No.	Title/Topic	Classroom Contact Sessions
	○ Simple & Multiple Linear Regression Analysis ○ Measures of Model Fit (R and R-square Statistics) • Non-Parametric Tests ○ Mann-Whitney U Test ○ Wilcoxon Signed Rank Test ○ Run test ○ Krushal-Wallis Test ○ Spearman Correlation Analysis	
3	**Statistical Analysis Using Open Source software** • Introduction to Software • Programming Language Basics – including creating, sub-setting and analyzing • Managing your files and workspace • Controlling functions (procedures or commands) • Data Acquisition – Reading files • Data Transformations • Selecting variables and observations • Writing functions (macros) • Graphics	10
4	**Article / Research Papers Reviews**	02
	Total	30

C. Pedagogy

The course will emphasise self-learning and active classroom interaction based on students' prior preparation. The course instructor is expected to prepare a detailed session-wise schedule, showing the topics to be covered, the reading material and case material for every session. Wherever the material for any session is drawn from sources beyond the prescribed text-book, reference books, journals and magazines in the library, or from websites and other resources not accessible to the students, the course instructor should make the material available to the students well in advance, so that the students can come prepared for the classes. The pedagogical mix will be as follows:

- Classroom / Practical Contact Sessions ... About 28 Sessions
- Research Paper Discussions / Feedback ... About 02 Sessions

The exact division among the above components will be announced by the instructor at the beginning of the semester as a part of detailed session-wise schedule.

D. Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks	Percentage of total internal evaluation
1	Quizzes	3	10	30	10
2	Assignment / Project work	1	150	150	50
3	Internal Tests	2	45	90	30
4	Attendance and Class Participation			30	10
			Total	**300**	**100**

The total marks will be divided by 10 and declared as Institute-level evaluation marks for the course. The Institute-level evaluation will constitute 30% of the total marks f or the course.

E. External Evaluation

The University examination will be for 70 marks and will be based on practical computer-based tests and a viva-voce.

F. Learning Outcomes

At the end of the course, the student should have developed:

- Skills related to use of statistical techniques for analysis using software
- Rational decision making skills for typical business / other decisions
- Inputs for reviewing articles / research papers especially related to use of statistical techniques and analysis based on software

G. Reference Material

❖ **Text-book**

1. Latest Manuals of Software

❖ **Reference Books**

1. David .M. Levine, Krehbiel, Berenson, P.K. Viswanathan, (Latest Edition), Business Statistics – A First Course, (Latest Edition), Pearson Education

MA 772: DESIGN OF EXPERIMENTS

Credits and Hours:

Teaching Scheme	Theory	Practical/Tutorial	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

The course is designed for Engineers, Physicists, Chemists, Mathematician. This course covers basics of Statistics and Experimental Design.

The objectives of the course are to:

1. Understand basics of Statistical Techniques of Design of Experiment
2. Understand the applications of experimental design in practice

B. Outline of the course:

Sr No.	Title of the unit	Minimum number of hours
1.	Principles of Experimental Design	06
2.	Statistical Concepts	06
3.	Single Factor Experiments	08
4.	Factorial Experiments	10

Total hours (Theory): 30

C. **Detailed Syllabus:**

1	**Principles of Experimental Design**	**06 Hours**	**20%**
1.1	Basic Terminologies: Types of Investigations and Experiments		
1.2	Confirmatory and Exploratory Experiments		
1.3	Modeling and selecting Response		
1.4	Minimizing Bias and Variability		
2	**Statistical Concepts**	**06 Hours**	**20%**
2.1	Descriptive Statistics and Graphical Presentation		
2.2	Probability Distributions, Hypothesis Tests and Confidence Intervals		
2.3	Power and Sample size calculation		
2.4	Experiments for Two Treatments		
2.5	Linear Regression: Simple and Multiple		
3.	**Single Factor Experiments**	**08 Hours**	**30%**
3.1	Completely Randomized Designs		
3.1	Concepts of Multiple comparison		
3.2	Pairwise Comparisons		
3.3	Comparisons with a Control		
3.4	General Contrast		
4.	**Factorial Experiments**	**10Hours**	**30%**
4.1	Inference from Factorial Experiments		
4.2	Two-Level Factorial Experiments		
4.3	Definition and Estimation of Main Effects and Interactions		
4.4	Statistical Analysis		
4.5	Two-Level Fractional Factorial Experiments: Introduction		

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures/laboratory which carries a 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weighting of 5%.
- Two Quizzes (surprise test) will be conducted which carries 5% component of the overall evaluation.

E. Student Learning Outcomes:

- At the end of the course the students will be able to understand the basic concepts of Design of Experiment.
- Student will be able to apply concepts of these course in their study of specialization

F. Recommended Study Material:

❖ **Text Books:**

1. Tamhane, Ajit C. Statistical analysis of designed experiments: theory and applications. Vol. 609. John Wiley & Sons, 2009.
2. Hinkelmann, Klaus, and Oscar Kempthorne. Design and Analysis of Experiments, Introduction to Experimental Design. Vol. 1. John Wiley & Sons, 2008.
3. Lorenzen, Thomas, and Virgil Anderson, eds. *Design of experiments: a no-name approach*. CRC Press, 1993.

❖ **Reference Books:**

1. Cox, David Roxbee, and Nancy Reid. *The theory of the design of experiments*. CRC Press, 2000.
2. Goupy, Jacques L. *Methods for experimental design: principles and applications for physicists and chemists*. Vol. 12. Elsevier, 1993.

PH826: INTELLECTUAL PROPERTY RIGHTS

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objectives of the course:

- To acquaint the students with the basic concepts of Intellectual Property Rights;
- To develop expertise in IPR related issues,
- To sensitize the students with the emerging issues in IPR and the rationale for the protection of IPR, and;
- To explore practical aspects repeated to patenting.

B. Outline of the course:

Sr. No.	Title of Unit	No. of Contact Hours.
1	Intellectual Property Concepts	5
2	IPR and Research	5
3	Practical aspect of patenting	10
4	IPR related treaties	5
5	Case Study	5

Total Hours (Theory): 30

C. Syllabus Topics:

Sr. No.	Title of Unit	Topics
1	Intellectual Property Concepts	• Concept of property, conventional property vs. Intellectual Property • Basic aspect of the 8 different IPR mechanism Viz. Patents, Copyright, trademark, industrial design, layout design of integrated circuits, geographical indicators, plant varieties & trade secrets.
2	IPR and Research	• Benefits of IPRs to improve the quality of research work • Strategies for avoiding research duplications, infringements
3	Practical aspect of patenting	• Indian patent act and its recent amendment with respect to following aspect: Patentable and non-patentable inventions, Essential criteria for filing a patent, Filling a patent in India and abroad, Drafting of patent application • Patent Filling and Commercialization: Procedure for patent obtaining in India, National and International Patent Search, Patent Analysis, Patent Drafting and Filling Procedure in India, Patent Specification and Claims, How to right a Claim of Patent, Pre/Post Grant Issues in Patenting, Opposition of Patent Granting, Infringement Analysis, Ground of Defense, Intellectual Property Appellation Board (IPAB), International Filing: PCT System • Patent and Biodiversity Act • Introduction to World Intellectual Property Organization. (WIPO) • Commercialization of patent: Need for Commercialization of research and role of IPRs in research Commercialization. • Benefit/Disadvantages of patenting to the society • Latest Amendment/Emerging Issues in Patenting
4	IPR related treaties	• Patent co-operative treaty • Budapest treaty
5	Case Study	

D. Instructional Methods and Pedagogy:

The course employs in interactive classroom session using chalk and talk teaching to power point presentations. It also includes presentation by students on a specific topic assigned to them by the faculty and case study discussion with various litigation, infringement and patent rejection cases. Unit test will be conducted regularly as a part of continuous evaluation and suggestion will be given to student in order to improve their performance.

E. Students Learning Outcomes/Objectives:

- At the end of the course, the student will be able to understand the fundamental concepts of Intellectual Property Rights which further will be helpful in understanding other advanced aspects of Patent and Trademark applications in various scientific research and innovation.
- At the end student would gain experience in filling and drafting procedure of Patent.

F. Recommended Study material

1. Intellectual Property Right basic Concept, by M. M. S. Khatri, Atlantic Publisher and Distributors Pvt. Ltd., New Delhi.
2. Epstein on Intellectual Property: 5th Edition by Michael M. Epstein, Wolters Kulwer India Pvt. Ltd. Gurgaon, India.
3. Intellectual Property Right and Human Development in India by Shabana Talwar, First Edition, Serials Publications, New Delhi, India.
4. IPR Handbook for Pharma Students and Researchers, Parikshit Bansal, Pharma Book Syndicate, Hyderabad, India.
5. Patents, N. R. Subbaram, Pharma Book Syndicate, Hyderabad.
6. Intellectual Property Right by Nikolaus Thumm, Springer-Verlag Publications, Germany.
7. Intellectual Property - Patents, Copyright, TradeMarks and Allied Rights by Cornish, Aplin and Llewelyn, Sweet and Maxwell – Thomson Publishers, New Delhi, India
8. The Enforcement of Intellectual Property Rights: A Case Book by Louis Tc. Harms, WIPO Publishing House, Geneva.
9. Intellectual Property: From Creation to Commercialization - A Practical Guide for Innovators & Researchers by John P., MC Manus, Oak Tree Press, Ireland.

PG PROGRAMMES

Semester 1

UNIVERSITY ELECTIVES

MA771: RELIABILITY AND RISK ANALYSIS-I

Credits and Hours:

Teaching Scheme	Theory	Practical/Tutorial	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

The course is designed for Engineers, Mathematician, and Industrial Managers. This course covers basics of Probability and Statistics for prediction of failures in system and quantification of risk

The objectives of the course are to:

1. Understand basics of Probability and Probability distributions
2. Define the system to be analyzed.
3. Identify the system performance measures (Measuring Reliability and Risk)

B. Outline of the course:

Sr No.	Title of the unit	Minimum number of hours
1.	Introduction to Probability and Statistics	06
2.	Characteristics of Reliability	06
3.	Reliability of Simple Systems	06
4.	Concept of Safety and Risk Analysis	06
5.	Reliability Modeling	06

C. Total Hours (Theory): 30

D. Detailed Syllabus:

1	**Introduction to Probability and Statistics**	**06 Hours**	**20%**
1.1	Random Event.		
1.2	Basic formula of Probability.		
1.3	Random Variable and Probability Distribution Functions.		
1.4	descriptive statistics		
2	**Characteristics of Reliability**	**06 Hours**	**20%**
2.1	Reliability of a Unit Functioning until First Failure		
2.2	System Reliability		
2.3	Testing for Reliability		
2.4	Exponential Law and Evaluation of parameter		
3.	**Reliability of Simple Systems**	**06 Hours**	**20%**
3.1	Series System		
3.2	Parallel System		
3.3	K out of N systems		
4.	**Concept of Safety and Risk Analysis**	**06 Hours**	**20%**
4.1	Qualitative definition of Risk		
4.2	Quantitative definition of Risk		
4.3	Failure Model and Effect Analysis(FMEA)		
4.4	Hazard and operability analysis(HAZOP)		
4.5	Fault Tree Analysis		
5.	**Reliability Modeling**	**06 Hours**	**20%**
5.1	Software Reliability Analysis		
5.2	Human Reliability		
5.3	Stress-Strength Analysis		

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures/laboratory which carries a 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weighting of 5%.

- Two Quizzes (surprise test) will be conducted which carries 5% component of the overall evaluation.

E. Student Learning Outcomes:

- At the end of the course the students will be able to understand the basic concepts of Reliability and Risk Analysis.
- Student will be able to apply concepts of these course in their study of specialization

F. Recommended Study Material:

❖ **Text Books:**

1. Mathematical Methods of Reliability Theory. B. V. Gnedenko, Yu. K. Belyayev, and A. D. Solovyev ,Academic Press 1969
2. An Introduction to Basics of Reliability and Risk Analysis. Enric Zio, World Scientific Publishing Co.Pte. Ltd.2007
3. Reliability and Risk Analysis. Terje Aven, Elsevier Publicaion,1992

❖ **Reference Books/Articles:**

1. On The Quantitative Definition of Risk, Stanley Kaplan and B. John Garrick, Risk Analysis, Vol. I, No. I , 1981
2. Probability concepts in engineering planning and design. Volume II – decision, risk and reliability. Ang, A.H.-S. and Tang, W.H John Wiley & Sons, Inc., New York (1984)
3. M. Modarres, Reliability and Risk Analysis, Marcel Dekker (1993).
4. N.J. McCormick, Reliability and Risk Analysis, Academic Press (1981).

EE781: OPTIMIZATION TECHNIQUES

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the course:

Optimization techniques, having reached a degree of maturity in recent years, are being used in a wide spectrum of industries, including aerospace, automotive, chemical, electrical, construction, and manufacturing industries. Optimization methods, coupled with modern tools of computer-aided design, are also being used to enhance the creative process of conceptual and detailed design of systems.

The objectives of the course are:

1. To provide an overview of state-of-the-art optimization algorithms and the theoretical principles that underpin them
2. To prepare the students with the modelling skills necessary to describe and formulate optimization problems
3. To introduce methods of optimization to students, including linear programming, network flow algorithms, integer programming, interior point methods, quadratic programming, nonlinear programming, and heuristic methods.
4. To make the students familiar with the applications of various classical and AI methods in solving various complex real-world optimization problems.
5. To introduce the students with software tool to solve optimization problem

B. Outline of the Course:

Sr. No.	Title of Unit	Min. no of hours
1	Fundamentals of Optimization	01
2	Linear Programming	05
3	Unconstrained Optimization	04
4	Nonlinear Programming	05
5	Fundamentals of Artificial Intelligence methods	01
6	Particle Swarm Optimization and Cuckoo Search Algorithm	08
7	MATLAB programming and Optimization Toolbox	06

Total Hours (Theory): 30

C. Detailed Syllabus

1	Fundamentals of Optimization	01 Hours	3.33%

Introduction, Feasibility and optimality, Convexity, constraints, Rates of convergence

2	Linear programming	05 Hours	16.66%

Introduction, Formulation of Linear programming problem, Graphical method, Simplex method, Basic solution, Basic feasible solution, Simplex algorithm, Two phase method.

3	Unconstrained Optimization	04 Hours	13.33%

Introduction, Optimality conditions, Newton's method for minimization, Line search methods, Steepest-Descent method, Quasi-Newton method, Modified newton's method

4	Nonlinear Programming	05 Hours	16.66%

Optimality conditions for constrained problems, Kuhn-Tucker conditions, Penalty function method, Barrier method, The Lagrange multipliers and the Lagrangian function, Sensitivity analysis, Computing the Lagrange multipliers, Sequential quadratic programming, Interior point method

5	Fundamentals of Artificial Intelligence methods	01 Hours	3.33%

To understand importance of AI methods and their comparison with various classical methods using various criteria.

6	Particle Swarm Optimization and Cuckoo Search Algorithm	08 Hours	26.66%

Introduction to PSO, Unconstrained and constrained optimization using PSO, Effects of various coefficients on convergence, Cuckoo Search (CS) Algorithm, Comparison between PSO and CS

7	MATLAB programming and Optimization Toolbox	06 Hours	20%

MATLAB programming of various classical and AI methods. Use of MATLAB optimization toolbox to solve various optimization problems.

D. Instructional Methods and Pedagogy

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Attendance is compulsory in lectures which carries a component of the overall evaluation.
- Minimum two internal exams will be conducted and will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students for each unit/topic and will be evaluated at regular interval and its weightage may be reflected in the overall evaluation.

E. Student Learning Outcomes:

A. The students will be able to get awareness about the optimization problems. They can differentiate the class of classical optimization methods and AI methods

B. The student will learn to handle, solve and analyzing problems using linear programming and other mathematical programming algorithms

C. The students will also be able to learn different techniques to solve Non- Linear Programming Problems. They can also use search techniques methods, which are based on iterative methods, to find optimal solutions of Non-Linear Programming Problems.

D. Ability to develop codes for evolutionary optimization techniques and to solve wide range of optimization problem.

E. The students will be able to solve optimization methods using software tools such as MATLAB and be prepared for developing case studies and simulation examples

F. Recommended Study Material:

Books:

1. "Optimization Methods for Engineers", N.V.S. Raju, PHI, 2014.
2. "Artificial intelligence and intelligent systems", N.P. Padhy, Oxford University Press, 2005
3. "Engineering Optimization: Theory and Practice", S. Rao, 4th Edition, John Wiley & Sons, Inc., 2009

ME781: OCCUPATIONAL HEALTH & SAFETY

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

- To raise awareness of key health and safety issues in the workplace.
- To provide knowledge of occupational health and safety, emergency planning and environmental management.
- To ingrain the consciousness in students related to occupational health, occupational hygiene, ergonomics, safety and risk management, research methods, and legal studies.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to occupational health and safety	02
2	Occupational safety and management standards, and regulations for health, safety and environment	04
3	Identifying safety and health hazards, and risk analysis	04
4	Occupational physiology and psychosocial factors, and work organization	04
5	Ergonomic workplace design and musculoskeletal diseases	04
6	Control of workplace hazards	04
7	E-waste management	04
8	Work practices in industries and global strategy on occupational safety and health	04

Total Hours (Theory): 30

C. Detailed Syllabus:

1	**Introduction to occupational health and safety**	**02 Hours**	**9%**
	Definition and history of occupational health & safety, workplace hazards.		
2	**Occupational safety & management standards and regulations for health, safety and environment**	**04 Hours**	**13%**
2.1	Factories act and rules; Workmen compensation act. Indian explosive act - Gas cylinder rules - SMPV Act - Indian petroleum act and rules.		
2.2	Environmental pollution act. Manufacturing, storage and import of Hazardous Chemical rules 1989, Indian Electricity act and rules. Overview of OHSAS 18000 and ISO 14000 National legislation and public organizations.		
3	**Identifying safety and health hazards, and risk analysis**	**04 Hours**	**13%**
3.1	Hazard, risk issues and hazard assessment, Introduction to hazard, hazard monitoring-risk issue.		
3.2	Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminary hazard analysis (PHA), hazard operability studies (HAZOP).		
3.3	Computer aided risk analysis, Fault tree analysis & Event tree analysis, Logic symbols, methodology, minimal cut set ranking - fire explosion and toxicity index (FETI), various indices – Hazard analysis (HAZAN).		
3.4	Failure Mode and Effect Analysis (FMEA), Basic concepts of software on risk analysis, CISCON, FETI, ALOHA.		
4	**Occupational physiology, Psychosocial factors and Work organization**	**04 Hours**	**13%**
4.1	Man as system component – allocation of functions – efficiency.		
4.2	Occupational work capacity aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job heaviness		
4.3	Work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene.		
5	**Ergonomic workplace design and Musculoskeletal diseases**	**04 Hours**	**13%**
5.1	Meaning of Ergonomic		
5.2	Meaning of Workplace Design.		

5.3	Musculoskeletal Diseases causes and prevention		
6	**Control of workplace hazards**	**04 Hours**	**13%**
6.1	Workplace hazards and risk control, Transport hazards and risk control, Musculoskeletal hazards and risk control, Work equipment hazards and risk control		
6.2	Electrical safety, Fire safety, Chemical and biological health hazards and risk control, Physical and psychological health hazards and risk control, Health and safety practical application		
7	**E-waste management**	**04 Hours**	**13%**
7.1	Waste characteristics, generation, collection, transport and disposal		
8	**Work practices in industries and global strategy on occupational safety and health**	**04 Hours**	**14%**
8.1	Work practices in industries in manufacturing industries		
8.2	Work practices in industries in service industries		

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of Multi-Media projector, Black Board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- Tutorials related to course content will be given to students.
- In the lectures discipline and behavior will be observed strictly.
- Industrial visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of the assignment.

E. Students Learning Outcomes:

- Students will be able to make models for safety at work.
- Students will be able to select safety methods.
- Students will be able to understand how hazardous the process is at work.
- Students will be able to understand proneness of accidents.

F. Recommended Study Material:

❖ **Text Books:**

1. Grimaldi and Simonds , Safety Management, AITBS Publishers , New Delhi (2001)
2. Industrial safety and health, David L. Goetsch, Macmillan Publishing Company, 1993.
3. R.K.Jain and Sunil S.Rao , Industrial Safety, Health and Environment Management Systems, Khanna publishers , New Delhi (2006)
4. Salvendy, G. (2012). Handbook of human factors and ergonomics. John Wiley & Sons.

❖ **Reference Books:**

1. Arezes, P., Baptista, J. S., Barroso, M. P., Carneiro, P., Cordeiro, P., Costa, N., & Perestrelo, G. (Eds.). (2013). Occupational Safety and Hygiene. CRC Press.
2. Chaturvedi, P. (2005). Managing Safety Challanges Ahead. Concept Publishing Company.
3. Healey, B. J., & Walker, K. T. (2009). Introduction to occupational health in public health practice (Vol. 13). John Wiley & Sons.
4. Hester, R. E., & Harrison, R. M. (2009). Electronic waste management (Vol. 27). Royal Society of Chemistry.
5. Karwowski, W., Soares, M. M., & Stanton, N. A. (Eds.). (2011). Human Factors and Ergonomics in Consumer Product Design: Uses and Applications. CRC Press.
6. Khan, B. H. (Ed.). (1997). Web-based instruction. Educational Technology.
7. Roughton, J., & Crutchfield, N. (2011). Job hazard analysis: A guide for voluntary compliance and beyond. Butterworth-Heinemann.
8. Salvendy, G. (Ed.). (2001). Handbook of industrial engineering: technology and operations management. John Wiley & Sons.
9. Smedley, J., Dick, F., & Sadhra, S. (Eds.). (2013). Oxford handbook of occupational health. Oxford University Press.
10. Tillman, C. (2006). Principles of occupational health and hygiene: an introduction. Allen & Unwin.

❖ **Web Material:**

1. International Labour Organization (ILO) http://www.ilo.org/public/english/
2. Occupational Safety & Health Administration United States Department of Laborhttps://www.osha.gov/about.html

❖ **Other Material:**

1. International Journal of Labour Research http://www.ilo.org/actrav/info/pubs/WCMS_158769/lang--en/index.htm
2. International journal of occupational safety And ergonomics (http://archiwum .ciop.pl/757).
3. Journal of Safety and Health at Work (http://www.journals.elsevier.com/safety-and-health-at-work/)

CE772: RESEARCH METHODOLOGY

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

Quite frequently these days' people talk of research, both in academic institutions and outside. Several research studies are undertaken and accomplished year after year. But in most cases very little attention is paid to an important dimension that of research methodology. A great deal of research tends to be futile. It may be noted, in the context of planning and development that the significance of research lies in its quality and not in quantity.

- To introduce the basic methods of conducting research, explore ideas in formulating research objectives and hypotheses and sample framework for taking up research studies in a structured manner.
- To facilitate for the development of an insight into different statistical tools for data analysis, interpretation and presentation of reports in different areas of research.
- To enable researchers, irrespective of their discipline, in developing the most appropriate methodology for their research.
- To pay due attention to designing and adhering to the appropriate methodology throughout for improving the quality of research
- To impact higher education in basic areas as well as interdisciplinary areas and to provide researchers a platform to carry out quality research and relevant research.
- To prepare the literature in chronological pattern and logically analyze the concerns.
- To help researchers to use tools, techniques, concepts and world's best practices to present a unique research.
- To frame the research problems to enhance the scale of understanding.
- To give guidance and support to initiate and carry out quality research with a focus on awareness of areas of potential research, guidelines to carry out literature survey in the areas of interest, selection of research area, selection of problem for research and formulation of title, justification of title in current context of research, anticipated

research outcome and its relevance, research methodology to undertake the research, month wise plan for the research work to be carried out, six monthly review of research work of Doctoral Committee with eminent well experience Guides constituted by University etc.

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	General introduction to Research	02
2	Research problem Formulation	03
3	Research Design	08
4	Research Publication & Presentation	08
5	Research Ethics and Morals	05
7	Quality indices of research publication	04

Total hours: 30

C. Detailed Syllabus:

1 General introduction to Research **02 Hours 06%**

General Introduction:

Importance of Research, Role of Research, Aims & Objectives, Research Process, Phases of Research. Introduction to Research Methodology: Meaning of Research, Objectives of Research, Motivations in Research, Types of Research, Research Approaches, Significance of Research, Research Methods v/s Methodology, Research and Scientific Methods, Research Process, Criteria of Good Research.

2. Research problem Formulation: **03 Hours 09%**

Review of Research Literature:

Defining the Research Problem: What is Research Problem, Selecting the Problem, Necessity of and Techniques in defining the problem. Purpose and use of literature review, locating relevant information, use of library & electronic databases, preparation & presentation of literature review, research article reviews, theoretical models and frame work. Identification of gaps in research, formulation of research problem, definition of research objectives.

3. Research Design: **08 Hours 27%**

Research Design: Meaning, Need, Features of Good Design, Concepts, Types. Basic Principles of Experimental Design, Developing a Research Plan.

Qualitative Methods: Types of hypothesis and characterization. *Quantitative Methods:* Statistical methods for testing and evaluation.

Characterization of experiments: Accuracy, reliability, reproducibility, sensitivity, Documentation of ongoing research.

Sample Design: Implication, Steps. Criteria for selecting a sample procedure, Characteristics of Good sampling Procedure, Types of Sample Design, Selecting Random Samples, Complex random sampling Design.

Measurement and Scaling Techniques: Measurement in Research, Measurement Scales, Sources of Errors in measurement, Tests of Second measurement, Technique of developing Measurement Tools, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques.

Methods of Data Collection: Collection of Primary Data, Observation Method, Interview method, Collection of Data through questionnaire and Schedules, Other methods. Collection of Secondary Data, Selection of appropriate method for data collection, Case Study Method, Guidelines for developing questionnaire, successful interviewing. Survey v/s Experiment.

Processing and Analysis of Data : Processing Operations (Meaning, Problems), Data Analysis (Elements), Statistics in Research, Measures of Central Tendency, Dispersion, Asymmetry, Relationship. Regression Analysis, Multiple correlation and Regression, Partial Correlation, Association in case of Attributes.

Sampling Fundamentals: Definition, Need, Important sampling Distribution, Central limit theorem Sampling Theory, Sandler's A-test, Concept of Standard Error, Estimation, Estimating population mean, proportion. Sample size and its determination, Determination of sample size.

Analysis of Variance and Covariance: Basic Principles, techniques, applications, Assumptions, limitations.

Analysis of Non-parametric or distribution-free Tests : Sign Test, Fisher-Irwin Test, McNemer Test, Wilcoxon Matched pair Test (Signed Rank Test).

Sum Tests : a) Wilcoxon-Mann-Whitney Test b)Kruskal-Wallis Test, One

sample Runs Test, Multivariate Analysis Techniques: Characteristics, Application, Classification, Variables, Techniques, Factor Analysis (Methods, Rotation), Path Analysis.

4. **Research Publication & Presentation:** **08 Hours** **27%**

Thesis, Research paper, Organization of thesis and reports, formatting issues, citation methods, references, effective oral presentation of research, Documentation of ongoing research.

5. **Research Ethics and Morals:** **05 Hours** **19%**

Issues related to plagiarism and ethics. Intellectual Property Rights: Copy rights, Patents, Industrial Designs, Trademarks.

6. **Quality indices of research publication:** **04 Hours** **12%**

Impact factor, Immediacy factor.

D. **Instructional Method and Pedagogy:**

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of Multi-Media projector, Black Board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- Tutorials related to course content will be given to students.
- In the lectures discipline and behaviour will be observed strictly.
- Industrial visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of the assignment.

E. **Student Learning Outcomes:**

- Research Methodology as a subject should help researchers to prepare the literature in chronological pattern and should logically analyse the concerns.
- This subject should help in framing the research problems to enhance the scale of understanding.
- In this world of global village, research papers are available in abundance; one thesis submitted by a scholar, in no way should be a repetition of a work already done.

- This subject should help researchers to use tools, techniques, concepts and world's best practices to present a unique research.

F. Recommended Study Material:

❖ **Text Books:**

1. Research Methodology, Methods & Techniques, C.R. Kothari, Viswa Prakashan, 2nd Edition, 2009.
2. Research Methods- A Process of Inquiry, Graziano, A.M., Raulin, M.L, Pearson Publications, 7th Edition, 2009.
3. How to Write a Thesis:, Murray, R. Tata McGraw Hill, 2nd Edition, 2010.
4. Writing For Academic Journals, Murray, R., McGraw Hill International, 2009.
5. Writing for Publication, Henson, K.T., Allyn &Bacon, 2005.

❖ **Reference Books:**

1. What is this thing called Science, Chalmers, A.F., Queensland University Press, 1999.
2. Methods &Techniques of Social Research, Bhandarkar & Wilkinson, Himalaya publications, 2009.
3. Doing your Research project, Bell J., Open University Press, Berkshire, 4thEdition, 2005
4. A Handbook of Academic Writing, Murray, R. and Moore, S., Tata McGraw Hill International, 2006.

CA730: INTERNET AND WEB DESIGNING

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

- The objective of the course is to provide basic understanding of designing professional web page templates with Markup language. This syllabus also provides the knowledge about publishing website.

Methodology & Pedagogy: During the sessions, topics related to web designing technologies will be covered with suitable examples and students will be required to design and develop entire web sites using several web designing technologies and editors.

Learning Outcome: Upon successful completion of the course, students will understand basic concepts of internet and web page architecture and will be able to develop and host web site by using markup languages and advanced technologies, including HTML and CSS. On completion, student will be able to design and create an advanced website and will be equipped to undertake complex internet projects.

B. Outline of the Course:

Sr. No.	Content
1.	Overview of Internet and WWW, Basic elements of the Internet, Internet services, Internet Browsers and Servers, Hardware and Software requirements to connect to the internet, Internet Service Provider (ISP), Introduction to Internet Protocols
2.	Introduction to Web Page, Web Site, Web Browser, Overview of HTML, Structure of HTML Documents
3.	HTML Basics Tags and HTML elements
4.	List, Marquee & Hyperlink in HTML
5.	Images and Tables in HTML
6.	Forms in HTML
7.	Media Element in HTML5
8.	Introduction to Cascading Style Sheet (CSS), Ways to embed CSS in HTML
9.	CSS selectors & Layout
10.	CSS Properties
11.	Creation of Menu with CSS
12.	Introduction to Web Publishing or Hosting : Domain Name, Web Server, Website Parking, Publishing Website through FTP

E. Total Hours (Theory): 30

❖ **Text Books:**

1. Harley Hahn: The Internet Complete Reference, 2nd Edition, Tata McGraw-HILL Edition.
2. Matthew MacDonald: HTML5: The Missing Manual, O'Reilly Media, August 2011.
3. Peter Gasston: The Book of CSS3: A Developer's Guide to the Future of Web Design, No Starch Press, April 2011.
4. Richard York: Beginning CSS: Cascading Style sheets for Web Design, Wrox Press (Wiley Publishing), 2005.

❖ **Reference Books**:

1. Ivan Bayross: Web Enabled Commercial Application Development using HTML, JavaScript, DHTML and PHP, 4th revised edition, BPB Publication.
2. Adrian Farrel: The Internet and its Protocol – A comparative approach, Morgan Kaufmann Publishers.
3. David Mc Farland: CSS: The Missing Manual, O'Reilly, 2006.

❖ **Reference Links**:

1. http://www.w3schools.com [lecture notes]
2. http://www.whatwg.org/specs/web-apps/current-work/multipage/#auto-toc-4 [HTML Materials]
3. http://people.cs.pitt.edu/~mehmud/cs134-2084/lectures.html [CSS notes]

PT795: HEALTH & PHYSICAL ACTIVITY

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objectives of the course:

This course will make the student to understand health and physical activity and the impact inactivity have on his/her health. Health and physical activity constitute major components of a healthy lifestyle and general health promotion and protection. The knowledge and experience gained from health and physical activity course will enable students to make informed decisions about their health as it relates to quality of life and longevity.

Upon completion of this course, the student should be able to:

1. Understand the health-related benefits of physical activity and risks associated with physical inactivity
2. Comprehend the principles specific to attaining and maintaining good health and fitness throughout the lifespan
3. Realize the areas of nutrition, cardiovascular health, diseases related to physical activity, stress management, substance use and abuse, and sexually transmitted diseases.

B. Outline of the course:

S. No.	Title of the unit	Minimum number of hours
1.	Introduction to health	10
2.	Physical Activity	10
3.	Introduction to Yoga	10

Total Hours (Theory): 30

C. Detailed Syllabus:

1	**Introduction to Health**	**10 hours**
1.1	What is health?	
1.2	Healthcare delivery system: Developing Countries, Developed Countries	
1.3	Human anatomy, physiology & physical fitness	
1.4	Basics of Nutrition	
1.5	Life style disorders – obesity & diabetes	
2	**Physical Activity**	**10 hours**
2.1	What is Physical activity, exercise, physical fitness, epidemiology?	
2.2	Measurement of Physical Activity in individuals	
2.3	Physical Activity – Theoretical Perspective: Self-determination, trans theoretical	
2.4	Physical Activity and mental health – Body image, depression, problem with exercise	
2.5	Barriers & Facilitators of Physical Activity	
3	**Introduction to Yoga**	**10 hours**
3.1	What is yoga?	
3.2	Types of yoga	
3.3	Benefits of yoga to various body systems	
3.4	Asanas, Pranayam	
3.5	Yoga therapy for various back pain, asthma, stress, hypertension, diabetes	

D. Instructional Method and Pedagogy:

- Interactive classroom sessions using black-board and audio-visual aids.
- Using the available technology and resources for e-learning.
- Students will be encouraged towards self-learning and under direct interaction with course faculty.
- Students will be enabled for continuous evaluation.
- Case study, didactic mode of group discussions

E. Student Learning Outcomes:

Upon completion of the course, the student should be able to:

- Appraise the importance of exercise in maintenance of health and fitness.
- Objectively define health and physical activity in realistic environment.

F. Recommended Study Material:

- **Textbooks:**
  1. ACSM"s "Health Related Physical Fitness Assessment Manual Lippincott Williams and Walkins USA, 2005.
  2. Nilima Patel (2008) Yoga and Rehabilitation, Jaypee Publication, India
- **Reference books:**
  1. Biddle, S. J. H., & Mutrie, N. (2008). Psychology of physical activity. London: Routledge
  2. B.C. Rai. Health Education and Hygiene Published by Prakashan Kendra
  3. Puri. K. Chandra. S.S. (2005). Health and Physical Education. New Delhi: Surjeet Publications

NR751: WOMEN'S HEALTH

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Course Objectives:

Upon completing the course, students will be able to

- Understand and describe the sociocultural, behavioral, and policy issues that contribute to and affect women's health at National and International Level.
- Describe the seven domains of health and their impact on women.
- Understand the value and limitations of various tools that are used to measure and monitor women's health.
- Identify major demographic, behavioral and environmental factors that are associated with women's health and how such factors may be incorporated into public health interventions, programs, and policies.
- Identify trends in major health conditions that affect women.
- Identify the interplay between health services delivery and policy issues as they impact and are impacted by health issues.

B. Outline of the Course:

Unit No.	Title of Unit	Prescribed Hours
I.	**Overview of Women Health in India**: • Women's health nationally and locally. • Women's health and the seven domains of health. • Policy initiatives related to women's health issues, as related to cost, monitoring, measures of success and impact on other policy initiatives.	3
II.	**Female Anatomy & Physiology**: • Female anatomy and physiology from the perspective of their effects on women's health, including differences from men's health • Menstrual and menopause	5
III.	**Women and relationships**: Family, social networks and exposure to intrapersonal violence: • Social meaning for women's lives • Social policies relating to women in the INDIA • Health policies relating to women • violence that affect women's lives & medical issues	5

IV.	**Non Communicable Diseases** : • Introduction of Non Communicable diseases in relation to women health • Cardiovascular Diseases: ➢ Women's risk factors for cardiovascular disease ➢ Gender differences in prognosis for and treatment of cardiovascular disease in women. ➢ Interactions between knowledge, risk, and outcomes of cardiovascular disease in women • Cancer: ➢ Most common cancers in women (excluding minor skin cancers) in terms of diagnoses as well as deaths. ➢ Levels of cancer prevention. ➢ Public health approach to screening for cancer	10
V.	Mental Health/ Substance use	2
VI.	Act & Laws : Indian legislations and law regarding Women protection (Human Rights)	5
	Total	**30 Hours**

C. Instruction Method and Pedagogy

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, microteaching, task-based learning, assignments and various interpersonal activities like case studies, critical reading, group work, independent and collaborative research, presentations etc.

D. Evaluation: The students will be evaluated continuously in the form of internal as well as external examinations. The evaluation (Theory) is schemed as 25 marks for internal evaluation and 75 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Assignments	1	8	8
2	Internal Test/ Model Exam	1	12	12
3	Attendance and Class Participation	Minimum 80% attendance		10
			Total	**30**

External Evaluation

The University Theory examination will be of 75 marks and will test the logic and critical thinking skills of the students by asking them theoretical as well as application based questions. The examination will avoid, as far as possible, grammatical errors and will focus on applications.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

E. Learning Outcomes: At the end of the course, learners will be able to:

- Understand the sociocultural, behavioral, and policy issues that contribute to and affect women's health at National and International Level.
- Understand the seven domains of health and their impact on women.
- Understand the value and limitations of various tools that are used to measure and monitor women's health.
- Understand trends in major health conditions that affect women.
- Understand the health services delivery and policy issues which impact on women's health.

RD701: INTRODUCTION TO ANALYTICAL TECHNIQUES

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the course.

- The objective of the course is to introduce students to different types of experimental techniques available.
- This course will expose student to state of art equipments and their utility.
- The emphasis is given more on analyzing of the data and operating skills.
- To explore the basics of Chromatography

B. Outline of the Course

Sr. No.	Title of Unit	No. of hrs.
1.	HPLC	08
2.	TGA-DSC	09
3.	DLS	05
4.	PCR	08

Total Hours (Theory): 30

C. Syllabus Topics:

Sr. No.	Title of Unit	Topics
1.	High Performance Liquid Chromatography (HPLC)	Introduction to HPLC, Basic Principle of HPLC, Instrumentation for HPLC, Types of Detector used in HPLC, Column efficiency in liquid chromatography
2.	TGA-DSC	General Discussion, Thermogravemetry Analysis, Instruments available for Thermogravimetric analysis, Detailed Discussion, Principle and Applications in various fields of Science and Engineering. Data Analysis
3.	DLS	Concept of Dynamic light scattering and basics of Particle size analyzer, Data Analysis and applications of DLS

4.	PCR	Introduction and principle of Polymerase Chain Reaction (PCR), Principle of PCR, Primer designing, Detailed methodology of PCR, Modifications of PCR, Applications of PCR

D. Instructional Methods and Pedagogy:

The topics will be discussed in interactive class room sessions using classical black-board teaching to power-point presentations. Unit tests will be conducted regularly as a part of continuous evaluation and suggestions will be given to student in order to improve their performance.

E. Student Learning Outcomes / objectives:

- The Programme aims at providing students with the methodological concepts and tools needed to acquire top-level skills in the field of some selected instrumentation
- At the end students would gain experience in using these tools and analyzing the data.

F. Recommended Study Material:

❖ **Text books/Reference books**

1. Instrumental methods of analysis by Williard Merritt Dean Settle, 7th Ed. CBS publishers and distributors Pvt. Ltd.,
2. Instrumental methods of analysis by Williard Merritt Dean Settle, 7 th Ed. CBS publishers and distributors Pvt. Ltd.,
3. Principles of Gene Manipulation and Genomics by Sandy B. Primrose, Richard Twyman 7 th Ed. Wiley-Blackwell
4. Molecular Cloning: A Laboratory Manual by Joseph Sambrook, David William Russell 3 rd Ed.CSHL Press
5. Principles and Techniques of Biochemistry and Molecular Biology by Wilson and Walker 7 th Ed. Cambridge University Press
6. Principles of Instrumental Analysis by Douglas A. Skoog, F.James Holler and Timothy A.Nieman. Publisher: Saunders College Publishing.

RD 702: INTRODUCTION TO NANOSCIENCE & TECHNOLOGY

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the course:

The objective of the course is to introduce the students:

- To provide a general and broad introduction to the multi-disciplinary field of nanoscience and nanotechnology
- During the course the students will acquire the basic knowledge of why and how the physicochemical properties change at the nanoscale.
- The students will become familiar with the typical techniques that allow the observation, characterization and manipulation of matter at the atomic, molecular and supramolecular level.
- The recent scientific and technology work in the nano world will be presented to demonstrate the potential of nanoscience and nanotechnology in diverse areas such as medicine, biotechnology, chemical industry, information and communication technology, production and storage of energy, synthesis and manufacture of new materials, etc.
- It is also attempted that the student becomes aware of the ethical, social and economic implications that can lead this new discipline.
- To cultivate interest in the research and development of nanotechnology for future advancement of the career.

B. Outline of the Course:

Sr No.	Title of Unit	Minimum No. of Hrs
1.	Nanotechnology – development history & Implications of nanotechnology	6
2.	Overview on characterization and synthesis of nanostructure materials	10
3.	Overview of nanostructures & Nano devices	10
4.	New fields of nanotechnology	4

Total Hours (Theory): 30

C. Syllabus Topics:

1. Nanotechnology – development history & Implications of nanotechnology
   Concept of nanoscience and nanotechnology, Nanotechnology in the history and in nature. Impact of the nanotechnology in the society: Ethical, social, economic and environmental implications. the nanoscale. Size dependent physical and chemical properties. Surface effects. Importance of the surface at nanoscale. The surface/volume ratio. Size dependent properties
2. Overview on synthesis and characterization of nanostructure materials.
   Physical, chemical and biological methods of synthesis of nanostructures, Electron microscopy, scanning probe microscopy, non-imaging techniques
3. Overview of nanostructures & Nano devices
   zero dimensional, one dimensional and two dimensional nanostructures , Electronic devices, magnetic devices, photonic devices, mechanical devices, fluidics devices and biomedical devices
4. New fields of nanotechnology
   quantum computing, spintronics, nanomedicines, energy, etc.

D. Instructional Methods and Pedagogy:

The topics will be discussed in interactive class room sessions using classical black-board teaching to power-point presentations. Students will be exposed to practical operations, and lab visit and experimental demonstrations of some of the equipment facilities for Nano fabrication & characterization available in UNI. Students will produce a technical report on the experiences.

E. Student Learning Outcomes / objectives:

Nanotechnology promises to be the technology of the future benefitting the humanity in a number of ways. This course is aimed at preparing students for further industrial or academic work in the field of nano-characterization techniques.

F. Recommended Study Material:

- **Text Books / Reference Books:**
  1. Essentials of nanotechnology by Jeremy Ramsden [JR], 2009, Jeremy Ramsden & Ventus Publishing ApS,
  2. Introduction to Nanoscience, S.M.Lindsay, Oxford ISBN 978-019-954421-9 (2010).
  3. Guozhong Cao (2004). *Nanostructures and Nanomaterials: Synthesis, Properties & Applications*, 448 pages, Imperial College Press, ISBN-10: 1860944159.
  4. NANO: The Essentials Understanding Nanoscience and Nanotechnology, T. Pradeep, Tata McGraw-Hill Publishing Co. Ltd., 2007.
  5. Nanoscience and Nanotechnology, B K Parthsarathy, ISHA Books, New Delhi, 2007.
  6. Nanotechnology: Principles and practices, Sulabha K Kulkarni, Capital publishing company, 2007.

MB650: CREATIVE LEADERSHIP

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Course Objectives

The objectives of this course are:

- To create awareness about traits, types, approaches /theories and contemporary issues of leadership.
- To nurture qualities of creative leadership to meet the 21st century challenges in students.

B. Outline of the Course:

Module No.	Title/Topic	Classroom Contact Sessions
1	**Introduction to Leadership** • What are Leadership Skills? • Ways of Conceptualizing Leadership • Definition and Components • A Born Leader • Traits of Successful Leader • Why Leadership? o Managerial Roles • Importance of Leadership **Leading Vs Managing** • Roles and Relationships • Developing Personality for Effective Leading Roles • Authority Vs. Responsibility • Leading the Team • Leadership–Styles, Models and Philosophy	05
2	**Leadership Approach** • Trait Approach • Skills Approach • Style Approach • Situational Approach • Psychodynamic Approach **Leadership Theories** • Contingency Theory	05

Module No.	Title/Topic	Classroom Contact Sessions
	• Path-Goal Theory • Leader-Member Exchange Theory	
3	**Leadership Processes** • Transactional Leadership • Transformational Leadership • Authentic Leadership • Team Leadership • Integrative Leadership • Liquid Leadership	**05**
4	**Women and Leadership** • Gender and Leadership Styles • Gender and Leadership Effectiveness • Glass Ceiling Turned Labyrinth • Strengths of Women Leadership • Criticism and Application	**05**
5	**Culture and Leadership** • Dimensions of Culture • Clusters of World Cultures • Leadership Behavior and Culture Clusters • Universally Desirable and Undesirable Leadership Attributes • Criticism and Application • Leadership for High Performing Organisations • General Principles for Creative Culture • Nurturing Personal Creativity	**05**
6	**Contemporary Issues in Leadership** • Power and Politics in Leadership • Ethics in Leadership • Cases in Leadership	**05**
	Total	**30**

C. **Pedagogy**

The course will emphasise self-learning and active classroom interaction based on students' prior preparation. The course instructor is expected to prepare a detailed session-wise schedule, showing the topics to be covered, the reading material and case material for every session. Wherever the material for any session is drawn from sources beyond the prescribed text-book, reference books, journals and magazines in the library, or from websites and other resources not accessible to the students, the course instructor should make the material available to the students well in advance, so that the students can come prepared for the classes. The pedagogical mix will be as follows:

- Classroom Contact Sessions ... About 20 Sessions
- Case Discussions ... About 03 Sessions

- Presentation ... About 03 Sessions
- Management Exercise/ Stimulations/Game ... About 02 Sessions
- Feedback ... About 02 Sessions

The exact division among the above components will be announced by the instructor at the beginning of the semester as a part of detailed session-wise schedule.

D. Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks	Percentage of total internal evaluation
1	Quizzes	3	10	30	10
2	Case Analysis and Presentation	2	45	90	30
3	Assignment / Project work	1	60	60	20
4	Internal Tests	2	45	90	30
5	Attendance and Class Participation			30	10
			Total	**300**	**100**

The total marks will be divided by 10 and declared as Institute-level evaluation marks for the course. The Institute-level evaluation will constitute 30% of the total marks for the course.

E. External Evaluation

The University examination will be based on oral presentation, review of students' reports and a viva-voce and will carry 70% marks for the course evaluation.

F. Learning Outcomes

At the end of the course, the student should have developed:

- Appreciation for types, traits, approaches and leadership models/theories.
- Motivation for leadership roles and responsibilities.
- Qualities of creative leadership skills.

G. Reference Material

❖ **Text-book:**

1. Leadership – Theory and Practices , Peter G. Northouse, Sage Publications India Pvt. Ltd., Latest Edition

❖ **Reference Books:**

1. Liquid Leadership by Brad Szollose, Prolibris Publishing Media, Latest Edition
2. Effective Leadership by Lussier/ Achua , Cengage Learning Publications, Latest Edition

3. Integrative Leadership by Hatala & Hatala, Pearson Power Publication, Latest Edition
4. Cases in Leadership by Rowe and Guerrero, Sage Publications India Pvt. Ltd., Latest Edition

❖ **Journals / Magazines / Newspapers:**

1. HBR Issues on Building Leadership Skills
2. International Journal of Innovation, Creativity and Change
3. Economic Times
4. Business Standard

PH825: COMMUNITY PHARMACY OWNERSHIP

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course

Community pharmacy is concerned with promoting the safe and appropriate use of drugs and common medical devices.
Ownership concept in Community Pharmacy is required to create for the effective delivery of pharmacy services in an regulated environment in which the nature of pharmacy is clearly evolving from the supply of goods (pharmaceuticals under prescription, pharmacist and pharmacy only medicines, and other goods) to the supply of services designed to support the optimal use of medication as part of a wider health care strategy.

B. Outline of course:

Sr. No.	Title of Unit	No. of Contact Hours
1	Introduction to Community pharmacy	10
2	Community Pharmacy Management	10
3	Pharmacy Business Plan	10
	Total	30

C. Detailed Syllabus:

Sr no	Title of Unit	Topics
1	Introduction to Community pharmacy	Roles & Responsibility, relationship with other health care providers, Prescribed medication order interpretation including OTC medicines, Safe use of medical devices.
2	Community Pharmacy Management	Role, process and scope of Community Pharmacy Management, modern technologies, financial, material, staff management and Drug store management, Code of ethics for Pharmacy.
3	Pharmacy Business Plan	Creating a Successful Pharmacy Business Plan, Business Owner Roles, Responsibilities, and Management Styles, Legal, Financial and Accounting Advice for the Beginning Owner, Marketing of Pharmacy Practice.

D. Instructional Methods and Pedagogy:

The content of the syllabus would be transmitted through different pedagogy tools like interactive class room sessions using classical chalk - board teaching to Power point presentations. Class room teaching would also be supplemented with group discussions, seminars, assignments and case studies.

E. Student Learning Outcomes / Objectives

At the end of the course, the student will be able to understand

- The concept of Community Pharmacy Ownership and its scope
- Students understand the role of the pharmacist in community and development
- Able to learn skill require to set Pharmacy store & its management

F. Recommended Study Material

❖ **Text / Reference Books:**

1. Mohd. Aquil, Practice of Hospital, clinical & Community Pharmacy Elsevier
2. Paul Rutter, Community Pharmacy E-Book, Symptoms, Diagnosis and Treatment, 3rd Edition
3. A Textbook of Clinical Pharmacy Practice: G. Parthasarathi, Karin Nyfort-Hansen and Milap Nahata, Universities Press.
4. Research articles as per the assignment

Semester 2
University Electives

EE782: ENERGY AUDITING & MANAGEMENT

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objectives of the Course:

Energy auditing and management is a course where a student will deal with various types of energy conservation schemes employed in industries, power stations, domestic and commercial areas. Also they will familiar with energy auditing and management procedures. The objectives of the course are:

- To learn practical and theoretical elements of energy auditing and management
- To be able to assess the benefits and drivers of an energy audit and have knowledge of the Energy Audit Process
- To understand how to plan and carry out an energy audit and be confident with the process of reviewing energy data in the energy audit process
- To Have knowledge of the equipment and key considerations required when carrying out an energy audit
- To be aware about the energy efficient technology and energy storage system

B. Outline of the Course:

Sr. No.	Title of Unit	Min. No. of Hrs
1	**Electrical Energy Conservation**	3
2	**Electrical Energy Management**	10
3	**Financial Management**	4
4	**Energy Management & Audit**	5
5	**Energy Efficient Technologies In Electrical Systems**	3
6	**Energy Storage Systems**	3
7	**Case Studies.**	2

Total hours (Theory): 30

C. **Detailed Syllabus:**

1 Electrical Energy Conservation 3 Hours 11.33%

1.1 **Energy Scenario:** Introduction to energy science and energy technology, various forms of energy. Law of conservation of energy. Energy scenario of India, Introduction to global energy scenario. Carbon credit, Energy Sector Reforms, Energy Strategy for the Future, Energy Conservation Act 2001 and its features.

1.2 **Measures for energy conservation:**
Potential energy conservation opportunities in: HVAC System, Lighting systems, Motors and Transformers.

2 Electrical Energy Management 10 Hours 29.12%

2.1 Concept of energy management, Design of Energy management programmes, energy cost, Energy planning, Energy staffing, Energy Organization, Energy Requirement, Energy Costing, Energy Budgeting, Energy Monitoring, Energy consciousness, Energy Management Professionals, Environment pollution due to energy use. Need of energy planning, steps for energy planning, Energy management in industry, Energy management cell function and objective, Energy management cell roles and responsibilities, Role of energy manager, benchmarking, Social and economic cost benefits. Seven principals of energy management.

2.2 **Electrical System Optimization**
Electricity rate tariff, key to reduction in electrical energy Consumption, Methods to improve plant power factor, load management, conduction loss, switching loss, magnetic loss, harmonic Compensation, Motor control, Lighting energy saving.

2.3 **Cogeneration**
Definition, Need, Application, Advantages, Classification, Saving potentials

3 Financial Management 4 Hours 11.11%

Investment-need, Appraisal and criteria, Financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Role of ESCOs.

4. Energy Management & Audit 5 Hours 12.89%

Introduction, Definition, Energy audit- needs, types and walkthrough energy audit. Energy audit at unit level, Industrial Audit approaches. Procedure for energy audit and equipments required. Comprehensive Energy audit Site testing Measurement & Analysis of Electrical System like Induction Motors. Transformers, Illumination system, Problems on Energy Management.

5. Energy Efficient Technologies In Electrical Systems 3 Hours 11.11%

Load Management and Maximum demand control. Electrical distribution system. Maximum demand controllers, Automatic power factor controllers, Energy efficient motors, Soft starters with energy saver, Variable speed drives, Energy efficient transformers, Electronic ballast, Occupancy sensors, Energy efficient lighting controls.

6. **Energy Storage Systems** **3 Hours** **13.33%**

Introduction, Demand for energy storage, Energy storage systems: heat storage- hot water, hot solids, phase change materials; Potential energy storage: spring, compressed gas. Pumped hydro: Flywheels. Rolling mills, Electrical and magnetic energy storage systems.

7. **Case Studies.** **2 Hours** **11.11%**

D. Instructional Methods and Pedagogy

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures which carries a component of the overall evaluation.
- Minimum two internal exams will be conducted and will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students for each unit/topic and will be evaluated at regular interval and its weightage may be reflected in the overall evaluation.

E. Student Learning Outcomes:

After the completion of the course the students will be able to:

1. Analyze about energy scenario nationwide and worldwide
2. Decide about energy management in more effective way.
3. To propose the effective way for energy conservation
4. Carry out financial management.
5. Can design energy efficient technologies and provide alternative solutions for energy storage

F. Recommended Study Material:

❖ **Text Book:**

1. Amlan Chakrabarti, Energy engineering and management, PHI Learning Private Limited.
2. K. Nagabhusan Raju, Industrial Energy Conservation Techniques, Atlantic Publishers & Distributors (P) Ltd.

❖ **Reference Book:**

1. Renewable energy sources and conservation technology By- N.K.Bansal, Kleemann and Meliss
2. Non – conventional energy sources by G.D. Rai
3. Energy technology by S.Rao.
4. A guide to energy management by Barney L Capehart, William J Kennedy, Wayne C Turner.

❖ **Web Material:**

1. www.energymanagertraining.com
2. www.bee-india.gov.in

CE771: PROJECT MANAGEMENT

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

The course aims to provide and understanding management issues process during project management.

- To develop an awareness of the need for project planning and management
- To apply professional attitudes and techniques to managing a project
- Provide students with a basic understanding of project management principles and practices.
- Increase the student's ability to function effectively on a project team.
- Increase the student's ability to function effectively as a project manager.

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Overview of Project Management	03
2	Project Management Concepts and Techniques	03
3	Project Cost Estimation	04
4	Project Planning and Scheduling	05
5	Project Monitoring and Control	05
6	Material Management in Project	04
7	Management of Special Projects and Project	06

Total hours (Theory): 30

C. **Detailed Syllabus:**

1.	**Overview of Project Management** Introduction to Project Management Overview of Project Planning, Project Estimation, Project Scheduling, Organization and Team Structure, Risk Analysis and Management, Resource Allocation Project Management Process and Role of Project Manager	**03 Hours**	**10 %**
2.	**Project Management Concepts and Techniques** Project Screening and Selection Techniques Structuring Concepts and Tools (WBS,ORS,LRC) Project Planning Tools (Bar Chart, LOB, CPM and PERT) Risk Analysis and Management	**03 Hours**	**10 %**
3.	**Project Cost Estimation** Types of Estimates and Estimating Methods Project Budgeting	**04 Hours**	**13 %**
4.	**Project Planning and Scheduling** Dynamic Project Planning and Scheduling Project Scheduling with Resource Constraints	**05 Hours**	**17 %**
5.	**Project Monitoring and Control** Monitoring Techniques and Time control system Project Cost Control and Time cost tradeoff	**05 Hours**	**17 %**
6.	**Material Management in Project** Project Procurement and Material Management	**04 Hours**	**13 %**
7.	**Management of Special Projects and Project Management Software Tools** Management of SE/NPD/R&D/Hi-Tech and Mega Projects Software tools for Project Management: MS Project, Primavera, Turbo Project, Riski Project.	**06 Hours**	**20 %**

D. **Instructional Method and Pedagogy:**

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.

- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

E. Student Learning Outcomes:

Upon successful completion of this course, students will be able to understand project management process and different aspect of development process necessary for the management of the project which includes various activities, resources, quality, cost and system configuration etc.

F. Recommended Study Material:

❖ **Text Books:**

1. Project management: engineering, technology, and implementation by Shtub, Avraham, Jonathan F. Bard, and Shlomo Globerson, Prentice-Hall, Inc., 1994.
2. Project Management Handbook by Lock, Gower.
3. VNR Project Management Handbook by Cleland and King.
4. Management guide to PERT/CPM by Wiest and Levy, PHI.
5. Project Management: A Systemic Approach to Planning, Scheduling and Controlling by Horald Kerzner, CBS Publishers, 2002.
6. Project Scheduling and Monitoring in Practice by S. Choudhury,
7. Total Project Management: The Indian Context by P. K. Joy, Macmillan India Ltd.

❖ **Reference Books:**

1. Project Management for Business and Technology: Principles and Practice by John M Nicholas, Prentice Hall of India, 2002.
2. Project Management, by N. J. Smith (Ed), Blackwell Publishing, 2002.
3. Effective Project Management by Robert K. Wysocki, Robert Back Jr. and David B. Crane, John Wiley, 2002.
4. Project Management: A Managerial Approach, by Jack R Meredith and Samuel J Mantel, John Wiley, 4th Edition, 2000.

IT771: CYBER SECURITY & LAWS

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	02	00	02	02
Marks	100	-	100	

A. Objective of the Course:

The main objectives for offering the course Cyber Security are

- To under the concepts of Cybercrimes and cyber security
- To create the awareness of how to avoid becoming victims of cybercrimes.
- To provides the content which will help the students who wish to seek career in cyber security or independent study and research in the field of cyber security.

B. Outline of the Course:

Sr No.	Title of the unit	Minimum number of hours
1.	Computer and Cyber Security Basics	06
2.	Security Threats	09
3.	Provisions in Indian Laws in dealing with Cyber Crimes	07
4.	Case Studies	08

Total hours (Theory): 30

C. Detailed Syllabus:

1. **Computer and Cyber Security Basics** **06 hours** **20 %**

   Introduction to Computers, Computer History, Software, Hardware, Classification, Computer Input-Output Devices, Windows, DOS Prompt Commands, Basic Computer Terminology, Internet, Networking, Computer Storage, Computer Ethics and Application Programs, Security : Security trends – Goal, Attacks, Services and Mechanism

2. **Security Threats** **09 hours** **30 %**

   Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e-Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.

3. **Provisions in Indian Laws in dealing with Cyber Crimes** **07 hours** **23 %**

   Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law.

4. **Case Studies** **08 hours** **27 %**

   Identity Management, Cyber Security and Terrorism: Case Studies, The DigiNotar case, Deutsche Telekom, The disruption at the IT service provider Tieto, Web Based Attacks by Symantec, Password Security

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.

- **Assignments** based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of **5 Marks** as a part of internal theory evaluation.
- Surprise Tests/Quizzes/Seminar/**Case Study** will be conducted which carries **10 Marks** as a part of internal theory evaluation.

E. Student Learning Outcome:

Learning outcomes of the course are:

- Students will able to do classification of cybercrime, methods used to perform crime, apply cyber security, and know the detailing of Information Technology Acts against offences.
- Students will understand and appreciate the legal and ethical environment impacting individuals as well as business organizations and have an understanding of the ethical implications of IT legal decisions.
- Students will have a fundamental knowledge of Information Technologies which affect organizational processes and decision-making.

F. Recommended Study Material:

❖ **Reference Books:**

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security", Pearson Education India.
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla,"Introduction to Information Security and Cyber Law" Willey Dreamtech Press.
4. Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill.
5. CHANDER, HARISH," Cyber Laws And It Protection " , PHI Learning Private Limited ,Delhi ,India

CA 842: MOBILE APPLICATION DEVELOPMENT

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. **Objective:** Develop skills to describe mobile technologies, mobile environment and todevelop Android application for mobile device using Android SDK, android application resource, application component, and Android APIs.

Prerequisites: Object Oriented Programming.

Methodology & Pedagogy: This course focuses on providing hands-on experience in designing and development of mobile application with emphasis on the real world application and techniques that enable smart phone based application development. Student shall also develop applications dealing with data storage, documents sharing among applications and application based on Google maps and integration of web service with mobile application.

Learning Outcomes:

- Describe the different mobile technologies, mobile development platform and mobile GUI.
- Comprehend how Android applications works, their life cycle, Intents, fragments and resources.
- Design and develop useful Android applications with compelling user interfaces by using View, ViewGroup, menu, and dialog elements.
- Use Android's APIs for data storage, retrieval, user preferences, files, databases, and content providers.
- Utilize the power of background services, notifications, and broadcast receiver.
- Use Android's communication APIs for SMS, telephony and location based application.

B. Outline of the Course:

Week No	Practical	Description
1	Brief about mobile technologies and challenges in mobile application development and architectural overview of an Android platform.	Different mobile application development platform overview and Android architecture overview and basic components of Android application development overview.
2	Development of first Android based mobile	Working of Android Studio IDE, Android project directory structure, Dalvik Virtual Machine Overview,

	application and overview of necessary components required for development.	Android Software development kit explanation, Virtual device creation and execution of first application on virtual as well as actual device
3	Fundamentals of User Interface designing.	XML based user interface designing using different available layouts like Relative Layout, Linear Layout, Table Layout etc.
4	User Interface Widgets-1	Hands-on demonstration of basic widgets like- TextView, EditText, Button, ToggleButton, RadioButton, RadioGroup, CheckBox, RatingBar, SeekBar etc.
5	User Interface Widgets-2	Hands-on demonstration of composite widgets like- ListView, Spinner and AutoCompleteTextView and customization of the composite controls.
6	Activity, Activity navigation and Intents.	Activity life cycle, Linking Activity using Intents:startActivity(), StartActivityForResult(). Calling built-in applications: ACTION_MAIN, ACTION_VIEW, ACTION_DIAL, ACTION_SEND
7	Android Resources, Styles and Themes.	Usage and implementation of different resources like drawable, string, color, dimes, raw and animation. Creating and Applying simple Style, Inheriting built-inStyle and User defined style, Using Styles as themes.
8	Dialogs & Menus.	Hands-on demonstration of different dialogs and menus available in Android.
9	Data Persistence Techniques.	User Preferences and Database management through SQLite
10	Broadcast Actions and Services implementation.	Service: life cycle, create and destroy service, Alarm Manager and SMS Manager. Standard Broadcast Actions.
11	PHP based web service implementation in Android	Creation and consumption of PHP based web service.
12	Simple Google Map incorporation with Android application.	Google Developer console usage, SHA-1 certificate creation and API-KEY creation and incorporation in Android application.

Total hours (Theory): 30

❖ **Text Books:**

1. Wei-Meng Lee: Beginning Android 4 Application Development, Wiley India Pvt Ltd.
2. Mark L. Murphy: The Busy Coder's Guide to Android Development

Reference Books:

1. Jonathan Simon: Head First Android Development, O'REILLY publication
2. Mark L Murphy: Beginning Android, Wiley India Pvt. Ltd.

Web References:

1. https://developer.android.com [Detail Android Development Guide]
2. https://www.youtube.com/watch?v=SUOWNXGRc6g&list=PL2F07DBCDCC01493A [200 android development tutorials]
3. www.androidhive.info/ [Advance application development with Android]

PT796: FITNESS AND NUTRITION

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objectives of the course:

This course is intended to introduce the student with the basic concepts of health and fitness and appraise the relative contribution of leading a physically active lifestyle. This shall familiarize the student with different perspectives on maintaining general health and fitness behavior and understand the nutritional information to suit individual needs and preferences.

Upon completion of this course, the student should be able to:

1. To provide general concepts of physical education, nutrition and fitness.
2. To promote and understanding of the value of sports for life skill development.
3. Introduce nutritional principles and application to improve overall health.

B. Outline of the course:

S. No.	Title of the unit	Minimum number of hours
1.	Physical Education and Physical Fitness	10
2.	Nutrition and Health	10
3.	Sports and Life Skills Education	10

Total hours (Theory): 30

C. Detailed syllabus:

1 PHYSICAL EDUCATION AND PHYSICAL FITNESS 10 hours

1.1. Concept of Physical Education, Meaning, Definition, Aims and Objectives of Physical Education, Need and Importance of Physical Education

1.2 Physical Education and its Relevance in Inter Disciplinary Context

1.3 Physical Fitness Components: Type of Fitness, Health Related Physical Fitness, Performance Related Physical Fitness

2 NUTRITION AND HEALTH 10 hours

2.1 Concept of Food and Nutrition, Balanced Diet, Food Pyramid Index

2.2 Macro and Micronutrients: Types, functions and classification system

2.3 Carbohydrates : Types, RDA data, Glycemic index, Sources of Fats, saturated, unsaturated fats, recommended intake, importance of fat in diet, fats in health and disease

2.4 Protein: Types EAA, function, assessing quality of proteins, selecting incomplete proteins, RDA sources.

2.5 Vitamins And Minerals: Types, functions, sources, and minerals - calcium, Phosphorus, iron, magnesium, sodium, potassium, and chloride. Trace elements - sources and functions.

2.6 Determining Caloric Intake and Expenditure, Obesity, Causes and Preventing Measures – Role of Diet and Exercise, Importance of hydration in exercise

3 SPORTS AND LIFE SKILLS EDUCATION 10 hours

3.1 Sports and Socialization

3.2 Physical Activity and Sport – Emotional Adjustment and Wellbeing

3.3 Substance Abuse among Youth – Preventive Measures and Remediation

3.4 Yoga, Meditation and Relaxation

3.5 Sports and Character Building

3.6 Values in Sports

3.7 Sports for World Peace and International Understanding

D. Instructional Method And Pedagogy:

- Interactive classroom sessions using black-board and audio-visual aids.
- Using the available technology and resources for e-learning.
- Students will be encouraged towards self-learning and under direct interaction with course faculty.
- Students will be enabled for continuous evaluation.
- Case study, didactic mode of group discussions

E. Student Learning Outcomes:

Upon completion of the course, the student should be able to :

- Appraise the importance of exercise in maintenance of health and fitness.

- Objectively define health and fitness in realistic environment and inculcate habits of physical activity, nutrition and sports as a behavior change and overall health promotion

F. Recommended Study Material:

❖ **Textbooks:**

1. ACSM"s "Health Related Physical Fitness Assessment Manual Lippincott Williams and Walkins USA, 2005.
2. Siedentop.D,(1994) Introduction to Physical Education and Sports (2nd ed.), California: Mayfield Publishing Company.
3. Corbin.Charles Beetal. C.A., (2004) Concepts of Fitness and Welfare Boston McGraw Hill.

NR 752: EPIDEMIOLOGY & COMMUNITY HEALTH

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. **Course Objectives:**

Upon completing the course, students will be able to

- Familiar with epidemiologic terminology, outcome measures, and study designs; to appreciate application of epidemiology to subfields (e.g., infectious diseases, reproductive health, genetics); and to apply epidemiologic methods to current public health issues.

B. **Outline of the Course:**

UnitNo.	Title of Unit	Prescribed Hours
1	**Introduction:** • Concept, scope, definition, trends, History and development of modern Epidemiology • Contribution of epidemiology • Implications	5
2	**Health Statistics:** • Morbidity & Mortality	2
3	**Epidemiological approaches:** • Study of disease causatives (Cause & Risk) • Health promotion • Levels of prevention	4
4	**Epidemiology of** • Communicable diseases • Non-communicable diseases	10
5	**Disaster:** • Disaster preparedness, • Disaster management	3
6	**Health Organizations:** • Voluntary health organizations • International health agencies –WHO, World health assembly, UNICEF, UNFPA, SIDA, US AID, DANIDA, DFID. AusAID etc	6
	Total	**30 Hours**

C. Instruction Method and Pedagogy

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, microteaching, task-based learning, assignments, field visit and various interpersonal activities like group work, independent and collaborative research, presentations etc.

D. Evaluation:

The students will be evaluated continuously in the form of internal as well as external examinations. The evaluation (Theory) is schemed as 25 marks for internal evaluation and 75 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Assignments	1	8	8
2	Internal Test/ Model Exam	1	12	12
3	Attendance and Class Participation	Minimum 80% attendance		10
			Total	**30**

External Evaluation

The University Theory examination will be of 75 marks and will test the logic and critical thinking skills of the students by asking them theoretical as well as application based questions. The examination will avoid, as far as possible, grammatical errors and will focus on applications.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

E. Learning Outcomes: At the end of the course, learners will be able to:

- Understand the epidemiologic terminology,
- Understand the health statistic
- Understand the various methods of epidemiology
- Understand the role and functions of various health agencies
- Understand the epidemiological trends in communicable and non-communicable diseases.

OC733: INTRODUCTION TO POLYMER SCIENCE

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the course

Fundamentals of polymer chemistry will be introduced.

B. Outline of the course

Sr.No	Title of Unit	Approximate No of Hours
1	Basic concepts of Polymer Chemistry	5
2	Chemistry of Polymerization	8
3	Kinetics of polymerization	8
4	Molecular weight and size	9

Total Hours (Theory): 30

C. Detailed syllabus:

Sr. No	Title of Unit	Approximate No of Hours
1.	**Basic concepts of Polymer Chemistry** Introduction to polymers, How are polymers made, Classification of polymers.	5
2.	**Chemistry of Polymerization** Chain polymerization, Step polymerization, Miscellaneous polymerization reactions, Polymerization techniques.	8
3.	**Kinetics of polymerization** i). Free – Radical chain polymerization. ii). Cationic & anionic polymerization. iii). Polycondensation	8
4.	**Molecular weight and size** Number – Average molecular weight. Viscosity – Average molecular weight. Polydispersity and molecular weight. Significance of polymer molecular weight. Size of polymer molecules	9

D. Instrumental Methods and Pedagogy:

Topics will be taught in interactive class room sessions using black-board and if required power-point presentations will also be employed. Special interactive problem solving sessions will be conducted. Course materials will be provided from various sources of information. Students will be trained to measure molecular weight of polymers using

appropriate instrument(s). Unit test will be taken regularly as a part of continuous evaluation and suggestions will be given to the students in order to do better in their performance.

E. Student Learning Outcomes/Objective:

- The programme aims at providing the basic concepts in polymer science.
- Ensuring that students acquire skills for further research in this area.

F. References:

1. A First Course in Polymer Chemistry by A. Strepikheyev , V.Derevitskaya and G.Slonimsky ; MIR Publishers, Moscow
2. Polymer Science by V.R.Gowariker , N.V.Viswanathan and Jayadev Sreedhar, New Age International Publishers.
3. Polymer Science and Technology of Plastics and Rubbers by Premamoy Ghosh, Tata McGraw-Hill Publishing Company Ltd. New Delhi.

MB651: SOFTWARE BASED STATISTICAL ANALYSIS

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Course Objectives

The objectives of this course are:

- To enable the students to understand importance of research and statistical techniques.
- To provide hands on training of statistical software like SPSS, SYSTAT, MATLAB and other open source software like R , WEKA, for research.

B. Course Outline

Module No.	Title/Topic	Classroom Contact Sessions
1	**Introduction to Statistics** • Research and Innovation • Introduction to Statistics • Quantitative Techniques in Research	06
2	**Software # 1 - Use of Software in Research** • Introduction to the Software • Creating Variables • Data and its Types • Importing Data from MS-Excel • Transformation of Variables • Visual Benning • Determining Validity and Reliability of Scale using CFA - Cronbach's (alpha) : a coefficient of internal consistency • Estimation & Hypothesis Testing: • Parametric Tests o Z Test o t – Test o Cross Tabulation and Chi – square o One-Way & Two-Way Analysis of Variance (ANOVA) o Pearson's Correlation Analysis o Regression Analysis	12

Module No.	Title/Topic	Classroom Contact Sessions
	○ Simple & Multiple Linear Regression Analysis ○ Measures of Model Fit (R and R-square Statistics) • Non-Parametric Tests ○ Mann-Whitney U Test ○ Wilcoxon Signed Rank Test ○ Run test ○ Krushal-Wallis Test ○ Spearman Correlation Analysis	
3	**Statistical Analysis Using Open Source software** • Introduction to Software • Programming Language Basics – including creating, sub-setting and analyzing • Managing your files and workspace • Controlling functions (procedures or commands) • Data Acquisition – Reading files • Data Transformations • Selecting variables and observations • Writing functions (macros) • Graphics	10
4	**Article / Research Papers Reviews**	02
	Total	30

C. Pedagogy

The course will emphasise self-learning and active classroom interaction based on students' prior preparation. The course instructor is expected to prepare a detailed session-wise schedule, showing the topics to be covered, the reading material and case material for every session. Wherever the material for any session is drawn from sources beyond the prescribed text-book, reference books, journals and magazines in the library, or from websites and other resources not accessible to the students, the course instructor should make the material available to the students well in advance, so that the students can come prepared for the classes. The pedagogical mix will be as follows:

- Classroom / Practical Contact Sessions ... About 28 Sessions
- Research Paper Discussions / Feedback ... About 02 Sessions

The exact division among the above components will be announced by the instructor at the beginning of the semester as a part of detailed session-wise schedule.

D. Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks	Percentage of total internal evaluation
1	Quizzes	3	10	30	10
2	Assignment / Project work	1	150	150	50
3	Internal Tests	2	45	90	30
4	Attendance and Class Participation			30	10
			Total	**300**	**100**

The total marks will be divided by 10 and declared as Institute-level evaluation marks for the course. The Institute-level evaluation will constitute 30% of the total marks f or the course.

E. External Evaluation

The University examination will be for 70 marks and will be based on practical computer-based tests and a viva-voce.

F. Learning Outcomes

At the end of the course, the student should have developed:

- Skills related to use of statistical techniques for analysis using software
- Rational decision making skills for typical business / other decisions
- Inputs for reviewing articles / research papers especially related to use of statistical techniques and analysis based on software

G. Reference Material

❖ **Text-book**

1. Latest Manuals of Software

❖ **Reference Books**

1. David .M. Levine, Krehbiel, Berenson, P.K. Viswanathan, (Latest Edition), Business Statistics – A First Course, (Latest Edition), Pearson Education

MA 772: DESIGN OF EXPERIMENTS

Credits and Hours:

Teaching Scheme	Theory	Practical/Tutorial	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objective of the Course:

The course is designed for Engineers, Physicists, Chemists, Mathematician. This course covers basics of Statistics and Experimental Design.

The objectives of the course are to:

1. Understand basics of Statistical Techniques of Design of Experiment
2. Understand the applications of experimental design in practice

B. Outline of the course:

Sr No.	Title of the unit	Minimum number of hours
1.	Principles of Experimental Design	06
2.	Statistical Concepts	06
3.	Single Factor Experiments	08
4.	Factorial Experiments	10

Total hours (Theory): 30

C. **Detailed Syllabus:**

1	**Principles of Experimental Design**	**06 Hours**	**20%**
1.1	Basic Terminologies: Types of Investigations and Experiments		
1.2	Confirmatory and Exploratory Experiments		
1.3	Modeling and selecting Response		
1.4	Minimizing Bias and Variability		
2	**Statistical Concepts**	**06 Hours**	**20%**
2.1	Descriptive Statistics and Graphical Presentation		
2.2	Probability Distributions, Hypothesis Tests and Confidence Intervals		
2.3	Power and Sample size calculation		
2.4	Experiments for Two Treatments		
2.5	Linear Regression: Simple and Multiple		
3.	**Single Factor Experiments**	**08 Hours**	**30%**
3.1	Completely Randomized Designs		
3.1	Concepts of Multiple comparison		
3.2	Pairwise Comparisons		
3.3	Comparisons with a Control		
3.4	General Contrast		
4.	**Factorial Experiments**	**10Hours**	**30%**
4.1	Inference from Factorial Experiments		
4.2	Two-Level Factorial Experiments		
4.3	Definition and Estimation of Main Effects and Interactions		
4.4	Statistical Analysis		
4.5	Two-Level Fractional Factorial Experiments: Introduction		

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures/laboratory which carries a 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weighting of 5%.
- Two Quizzes (surprise test) will be conducted which carries 5% component of the overall evaluation.

E. Student Learning Outcomes:

- At the end of the course the students will be able to understand the basic concepts of Design of Experiment.
- Student will be able to apply concepts of these course in their study of specialization

F. Recommended Study Material:

❖ **Text Books:**

1. Tamhane, Ajit C. Statistical analysis of designed experiments: theory and applications. Vol. 609. John Wiley & Sons, 2009.
2. Hinkelmann, Klaus, and Oscar Kempthorne. Design and Analysis of Experiments, Introduction to Experimental Design. Vol. 1. John Wiley & Sons, 2008.
3. Lorenzen, Thomas, and Virgil Anderson, eds. *Design of experiments: a no-name approach*. CRC Press, 1993.

❖ **Reference Books:**

1. Cox, David Roxbee, and Nancy Reid. *The theory of the design of experiments*. CRC Press, 2000.
2. Goupy, Jacques L. *Methods for experimental design: principles and applications for physicists and chemists*. Vol. 12. Elsevier, 1993.

PH826: INTELLECTUAL PROPERTY RIGHTS

Credits and Hours:

Teaching scheme	Theory	Practical	Total	Credit
Hours/week	2	-	2	2
Marks	100	-	100	

A. Objectives of the course:

- To acquaint the students with the basic concepts of Intellectual Property Rights;
- To develop expertise in IPR related issues,
- To sensitize the students with the emerging issues in IPR and the rationale for the protection of IPR, and;
- To explore practical aspects repeated to patenting.

B. Outline of the course:

Sr. No.	Title of Unit	No. of Contact Hours.
1	Intellectual Property Concepts	5
2	IPR and Research	5
3	Practical aspect of patenting	10
4	IPR related treaties	5
5	Case Study	5

Total Hours (Theory): 30

C. Syllabus Topics:

Sr. No.	Title of Unit	Topics
1	Intellectual Property Concepts	• Concept of property, conventional property vs. Intellectual Property • Basic aspect of the 8 different IPR mechanism Viz. Patents, Copyright, trademark, industrial design, layout design of integrated circuits, geographical indicators, plant varieties & trade secrets.
2	IPR and Research	• Benefits of IPRs to improve the quality of research work • Strategies for avoiding research duplications, infringements
3	Practical aspect of patenting	• Indian patent act and its recent amendment with respect to following aspect: Patentable and non-patentable inventions, Essential criteria for filing a patent, Filling a patent in India and abroad, Drafting of patent application • Patent Filling and Commercialization: Procedure for patent obtaining in India, National and International Patent Search, Patent Analysis, Patent Drafting and Filling Procedure in India, Patent Specification and Claims, How to right a Claim of Patent, Pre/Post Grant Issues in Patenting, Opposition of Patent Granting, Infringement Analysis, Ground of Defense, Intellectual Property Appellation Board (IPAB), International Filing: PCT System • Patent and Biodiversity Act • Introduction to World Intellectual Property Organization. (WIPO) • Commercialization of patent: Need for Commercialization of research and role of IPRs in research Commercialization. • Benefit/Disadvantages of patenting to the society • Latest Amendment/Emerging Issues in Patenting
4	IPR related treaties	• Patent co-operative treaty • Budapest treaty
5	Case Study	

D. Instructional Methods and Pedagogy:

The course employs in interactive classroom session using chalk and talk teaching to power point presentations. It also includes presentation by students on a specific topic assigned to them by the faculty and case study discussion with various litigation, infringement and patent rejection cases. Unit test will be conducted regularly as a part of continuous evaluation and suggestion will be given to student in order to improve their performance.

E. Students Learning Outcomes/Objectives:

- At the end of the course, the student will be able to understand the fundamental concepts of Intellectual Property Rights which further will be helpful in understanding other advanced aspects of Patent and Trademark applications in various scientific research and innovation.
- At the end student would gain experience in filling and drafting procedure of Patent.

F. Recommended Study material

1. Intellectual Property Right basic Concept, by M. M. S. Khatri, Atlantic Publisher and Distributors Pvt. Ltd., New Delhi.
2. Epstein on Intellectual Property: 5th Edition by Michael M. Epstein, Wolters Kulwer India Pvt. Ltd. Gurgaon, India.
3. Intellectual Property Right and Human Development in India by Shabana Talwar, First Edition, Serials Publications, New Delhi, India.
4. IPR Handbook for Pharma Students and Researchers, Parikshit Bansal, Pharma Book Syndicate, Hyderabad, India.
5. Patents, N. R. Subbaram, Pharma Book Syndicate, Hyderabad.
6. Intellectual Property Right by Nikolaus Thumm, Springer-Verlag Publications, Germany.
7. Intellectual Property - Patents, Copyright, TradeMarks and Allied Rights by Cornish, Aplin and Llewelyn, Sweet and Maxwell – Thomson Publishers, New Delhi, India
8. The Enforcement of Intellectual Property Rights: A Case Book by Louis Tc. Harms, WIPO Publishing House, Geneva.
9. Intellectual Property: From Creation to Commercialization - A Practical Guide for Innovators & Researchers by John P., MC Manus, Oak Tree Press, Ireland.