INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure and Syllabus for B.Arch.

(2018-19 Admission Batch)

First Semester				Second Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
AR101	Introduction to Architecture	3-0-0	3	AR201	Environmental Psychology	3-0-0	3
AR102	English	3-0-0	3	AR202	History of Architecture-I (Buddhist, Jain, Hindu)	3-0-0	3
AR103	Building Materials-I	3-0-0	3				
AR104	Mechanics-I	3-0-0	3	AR203	Mechanics-II	3-0-0	3
	Total (Theory)	**12**	**12**		**Total (Theory)**	**9**	**9**
Practical/ Sessional				**Practical/ Sessional**			
AR105	Descriptive Geometry-I	0-0-6	3	AR204	Building Construction-I	0-0-6	3
AR106	Architectural Presentation -I (Free Hand Drawing)	0-0-3	2	AR205	Descriptive Geometry-II	0-0-6	3
				AR206	Architectural Presentation-II (with Paint Brush and similar Software)	0-0-3	2
AR107	Workshop-I (Metal And Wood Work)	0-0-6	2				
AR108	Basic Design-I	0-0-6	6	AR207	Workshop-II (Arch. Model Making)	0-0-3	1
				AR208	Basic Design-II	0-0-6	6
Total (Practical/ Sessional)		**21**	**13**	**Total (Practical/ Sessional)**		**24**	**15**
TOTAL		**33**	**25**	**TOTAL**		**33**	**24**
TOTAL SEMESTER CREDITS: 25				TOTAL SEMESTER CREDITS: 24			
TOTAL CUMULATIVE CREDITS: 25				TOTAL CUMULATIVE CREDITS: 49			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure and Syllabus for B.Arch.

(2018-19 Admission Batch)

Third Semester				Fourth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods / Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods / Week)**	**Credits**
AR301	Climatology	3-0-0	3	AR401	History of Architecture-III (Western)	3-0-0	3
AR302	History of Architecture-II (Islamic, Asia Pacific)	3-0-0	3	AR402	Acoustics	3-0-0	3
AR303	Strength of Materials	3-0-0	3	AR403	Specification and Quantities	3-0-0	3
				AR404	Structural Analysis	3-0-0	3
				AR405	Water Supply and Sanitation	3-0-0	3
Total (Theory)		**9**	**9**	**Total (Theory)**		**15**	**15**
Practical/ Sessional				**Practical/ Sessional**			
AR304	Building Construction - II	0-0-6	3	AR406	Building Construction-III	0-0-6	3
AR305	Descriptive Geometry-III (Sciography and Perspective)	0-0-6	3	AR407	Computers in Architecture-II (Auto Cad and Arch. Cad)	0-0-3	2
AR306	Computers in Architecture-I	0-0-3	2	AR408	Architectural Design-II	0-0-6	6
AR307	Surveying and Levelling	0-0-3	2	AR409	Interior Design	0-0-3	3
AR308	Architectural Design-I	0-0-6	6				
Total (Practical/ Sessional)		**24**	**16**	**Total (Practical/ Sessional)**		**18**	**14**
TOTAL		**33**	**25**	**TOTAL**		**33**	**29**
TOTAL SEMESTER CREDITS: 25				TOTAL SEMESTER CREDITS: 29			
TOTAL CUMULATIVE CREDITS: 74				TOTAL CUMULATIVE CREDITS: 103			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure and Syllabus for B.Arch.

(2018-19 Admission Batch)

Fifth Semester				Sixth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
AR501	Theory of Design	3-0-0	3	AR601	Contemporary Architecture	3-0-0	3
AR502	Sociology	3-0-0	3	AR602	Illumination and Elect. Services	3-0-0	3
AR503	Estimating And Costing	3-0-0	3	AR603	Landscape Architecture	3-0-0	3
AR504	Design of RCC Structures	3-0-0	3	AR604	Design of Steel Structures	3-0-0	3
AR505	Village Planning And Tribal Architecture.	3-0-0	3				
	Total (Theory)	**15**	**15**		**Total (Theory)**	**12**	**12**
	Practical/ Sessional				**Practical/ Sessional**		
AR506	Architectural Design-III	0-0-9	9	AR605	Architectural Design-IV	0-0-9	9
AR507	Building Construction - IV	0-0-6	3	AR606	Working Drawing-I (Load Bearing Structures)	0-0-6	3
	Elective-I (Any One)	0-0-3	3	AR607	Building Construction – V (Architectural Detailing)	0-0-3	2
AR508	Sustainable Architecture				**Elective-II (Any One)**	0-0-3	3
AR509	Disaster Resistant Architecture			AR608	Prefab and Modular Co-Ordination		
AR510	Architectural Photography			AR609	Project Management		
				AR610	Industrial Architecture		
Total (Practical/ Sessional)		**18**	**15**	**Total (Practical/ Sessional)**		**21**	**17**
	TOTAL	**33**	**30**		**TOTAL**	**33**	**29**
TOTAL SEMESTER CREDITS: 30				TOTAL SEMESTER CREDITS: 29			
TOTAL CUMULATIVE CREDITS: 133				TOTAL CUMULATIVE CREDITS: 162			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG
Course Structure and Syllabus for B.Arch.
(2018-19 Admission Batch)

Seventh Semester				Eighth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods / Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods / Week)**	**Credits**
AR701	Urban Design	3-0-0	3	AR801	Principles of Town Planning	3-0-0	3
AR702	Housing	3-0-0	3	AR802	Research Methods in Architecture	3-0-0	3
AR703	Architectural Conservation	3-0-0	3	AR803	Tendering and Tender Documents	3-0-0	3
AR704	Air-conditioning and Ventilation	3-0-0	3	AR804	Building Bye-Laws	3-0-0	3
	Total (Theory)	**12**	**12**		**Total (Theory)**	**12**	**12**
	Practical/ Sessional				**Practical/ Sessional**		
AR705	Architectural Design-V	0-0-9	9	AR805	Architectural Design-VI	0-0-12	12
AR706	Building Construction-VI (Structural Drawing And Detail)	0-0-3	2	AR806	Seminar	0-0-3	2
AR707	Working Drawing-II (Framed Structures)	0-0-6	3		**Elective- IV(Any One)**	0-0-3	3
	Elective-III(Any One)	0-0-3	3	AR807	Architectural Journalism		
AR708	Barrier Free Environment			AR808	Transportation Planning		
AR709	Building Economics			AR809	Facility Planning		
AR710	Intelligent Buildings			AR810	GPS Technology		
AR711	Heritage Document						
Total (Practical/ Sessional)		**21**	**17**	**Total (Practical/ Sessional)**		**18**	**17**
	TOTAL	**33**	**29**		**TOTAL**	**30**	**29**
TOTAL SEMESTER CREDITS: 29				TOTAL SEMESTER CREDITS: 29			
TOTAL CUMULATIVE CREDITS: 191				TOTAL CUMULATIVE CREDITS: 220			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure and Syllabus for B.Arch.

(2018-19 Admission Batch)

Ninth Semester				Tenth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods / Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods / Week)**	**Credits**
				AR001	Professional Practice	3-0-0	3
				AR002	Real Estate Management	3-0-0	3
Total (Theory)		-	-	**Total (Theory)**		**6**	**6**
Practical/ Sessional				**Practical/ Sessional**			
AR901	Architectural Office Training	-	4	AR003	Project (Thesis)	0-0-24	15
AR902	Site Supervision Training	-	3				
AR903	Field Observations	-	3				
AR904	Critical Appraisal of Buildings	-	2				
AR905	Field Documentation and Architectural Details	-	3				
Total (Practical/ Sessional)		-	**15**	**Total (Practical/ Sessional)**		**24**	**15**
TOTAL		-	**15**	**TOTAL**		**30**	**21**
TOTAL SEMESTER CREDITS: 15				TOTAL SEMESTER CREDITS: 21			
TOTAL CUMULATIVE CREDITS: 235				TOTAL CUMULATIVE CREDITS: 256			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year (2018-19 Admission Batch) B.Arch programme

1st Semester

AR101	INTRODUCTION TO ARCHITECTURE	3-0-0	Credit 3

Course Objectives:

1. To understand the Architectural design of built structure.
2. To be aware how socio cultural and technology affect architecture.
3. To know the old and new architecture projects in India and abroad.
4. To be familiarize with interest and bent of mind towards designing.

MODULE-I(12 Hours)

Architecture is the study which deals with planning and designing of building and structures. Architects blend their vision and dreams with materials to erect milestones which leave a powerful imprint on human mankind.
Definition and concept of Architecture and Architects experienced through the ages.
Philosophy of architecture propagated by some leading architects.

MODULE-II (10 Hours)

Factors influencing architecture such as climate, materials, socio cultural and technological influences.
Subjects to be learned by a student of architecture, such as the arts, the sciences, the soft sciences, the technologies and others.
The types of projects that an architect deals with.
Mandatory professional codes and guidelines to be followed by an architect.

MODULE-III (12 Hours)

Introduction to some old and new architecture projects in India and abroad.
Opportunities for architects to work after completion of their course are: practicing alone, in organizations, as interior designers, as teachers as well as in a team.
Some of the government organizations such as Public Works Department, the Archaeological Department, Ministry of Defence, Departments of Railways, Development Authorities, Housing Boards, Local Bodies which are responsible for construction works recruit architects.
Opportunities of Higher studies for architecture students: Master of Architecture, Master of City Planning, Master of Architecture (with specialization in Urban Design, Urban Planning, Conservation, Transportation, Construction Management, Product Design ,et al)

MODULE-IV (8 Hours)

Personality requirement of a student in the field of architecture:
One should be a creative artist with an interest and bent of mind towards designing. Ability to sketch, free hand plan though not of utmost importance, is helpful while explaining to the clients the very intricate details of the structure. One needs to have an imaginative and perspective outlook. Awareness of social and environmental factors, observant attitude adds to the advantage while designing. Apart from being technically sound, good mathematical ability is essential as the work involves complex designing problems, building economics and cost estimations. Often architects deal with legal procedures and documents making it necessary for them to have clarity of thought to understand the legal language.

Reference Books*:*

1. James Snider Catmese, Introduction to Architecture.

Course Outcomes:

At the end of the course students will be able to understand

1) The basic aesthetic principles involved in architectural design.
2) The scale and composition of design elements.
3) The student will know about architectural practice and evolution of design concept.

AR102	ENGLISH	3-0-0	Credit 3

Course Objectives:

1) Improve their ability for communication and speaking in English.
2) Presentation skill in group discussion and office correspondence.

There are lectures tutorials, labs and assignments in English which will give them adequate powers of comprehension and expression, for meeting not only the needs of ordinary day-to-day situations of life but also the demands of their own professional fields. The program also aims at providing opportunities to the students, by means of suitable English literary works for the healthy development of their emotional and aesthetic life.

MODULE I **(21 Hours)**

Vocabulary, sentence structure, Grammar and usage. Comprehension, Composition, Scientific and Technical Report Written, Drafting Notes, Using Reference Books, English sounds, stress Rhythm, Intonation.

MODULE II **(21 Hours)**

Listening Comprehension, Note-taking, Lessons in Spoken English in the Language, Laboratory Classes, Selected Poems, Essays Plays and Short stories with a view to enriching the student's intellectual, emotionally and aesthetic life.
Reference Books:

Reference Books:

1. Aiyer and Desai, English for technical students, the popular book store, Surat.
2. E.F.Candling, An English for technical students, University of London Press, London.

Course Outcomes:

At the end of the course, students will be able to

1) Know reading, writing, understanding and speaking English.
2) Improve the presentation skill in group discussion and office communication.

AR103	BUILDING MATERIALS-I	3-0-0	Credit 3

Course Objectives:

1. Fundamental of Building materials..
2. To enhance knowledge about different use of building materials.

MODULE-1 **(14 Hours)**

General introduction to building materials.

Soils: Formation – characteristics, Identification, Local names, Classification, Sources and uses of sand.
Bricks: Types and their qualities and their manufacture.
Lime: Fat and Hydraulic lime, their uses and properties, manufacture of lime, preparation of lime mortar, functions and requirements of good mortar, mix proportions of various works.

MODULE-1I **(14 Hours)**

Stones: Types and their qualities and their methods of quarrying.
Cement: Type, properties, composition and manufacturing process and setting of cement composition of cement mortar. Plastering.
Timber: Uses and characteristics of timber, cutting, seasoning, and preservation of timber.
Types of Timber and defects in timber. Protection from termites.

MODULE-1II **(14 Hours)**

Iron and Steel: cast iron, Steel and wrought iron with properties, brief idea of manufacturing process and use of iron work in buildings.
Paints and Varnishes: Composition, manufacture and properties and uses of ordinary paints, Varnishes and wood preservatives, method of distempering wall surfaces, and painting of timber and iron work.
Glass: Types of glass like plate, decorative, tinted, heat absorbing etc. structural glass bricks and glasscrete, fiber glass, wool etc.

Reference Books:

1. S.C. Rangwala, Engineering Materials , Charotar publishing house, Anand, 1982
2. S.C. Rangwala, Building Construction ,Charotar publishing house, Anand.

Course Outcomes:

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

1) Know the physical and chemical characteristics of building materials.
2) Manage different kind building materials for design.
3) Know the building component and their function.

AR104	MECHANICS-I	3-0-0	Credit 3

Course Objectives:

1. Fundamentals of building engineering.
2. Analyze and design different components of building.
3. Do design analysis for safety of built structure.

MODULE-1 **(14 Hours)**

Forces – definitions and review of theories relating to coplanar force systems – problems relating to coplanar force systems.
Simple plane frames – analytical methods of analysis of determinate frames only.

MODULE-II **(14 Hours)**

Beams – Simply supported, cantilever and overhanging beams – significance of different types of supports and loads – calculations of reactions.

MODULE-III **(14 Hours)**

Shear force and bending moment relations between them analytical methods of sketching shear force and bending moment diagram.

Reference Books:

1. Fundamentals of Engineering Mechanics, Second Edition, Publisher: Vikas Publishing House Pvt. Ltd. by S. Rajashekharan and G.
2. SankaraSubhramanian. Engineering Mechanics,
3. K. L. Kumar, TMH
4. Elements *of Strength of Materials by Tuinoshenko& Young*

Course Outcomes:

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

1) Know the engineering aspect of building materials.
2) Analyse different kind of forces affecting to buildingdesign component.
3) Know the building component and their functional use.

AR105	DESCRIPTIVE GEOMETRY-I	0-0-6	Credit 3

Course Objectives:

1 To be familiar with Geometry of built form.
2 To gain knowledge of different types of projections of built form.
3 To have knowledge over composition of different shapes of built form.

MODULE-1 **(14 Hours)**

Lines and angles, proportional, triangles, quadrilaterals, circles and tangents. Circles touching lines, regular, polygons, arches, plane curves. ellipse, parabola and hyperbola.

MODULE-II **(14 Hours)**

Concept of Orthographic Projection, First-Angle Projection, Projections of Points, Projections of Straight Lines, Projections of Planes, Projections of Solids, Intersection of Surfaces.

Development of Surfaces.

MODULE-III **(14 Hours)**

Geometry of lines and planes, Geometrical shapes (two dimensional)-polygons volutes. Study of solid geometrical forms in various positions including group of forms. Simple Projections and projections of solids, Polyhedron, solids of revolution, solids in simple position, Axis
Perpendicular to a plane, Axis parallel to both the plane, Axis parallel to one plane and inclined to other. Axis inclined to both the planes, spheres.
Section of solids-Section planes, True shapes of section, sections-of prisms, sections of pyramids, cylinders, cones etc.

Reference Books:

1. Engineering Drawing by N.D. Bhatt & V.M. Panchal, Charotar Publishing House, Anand
2. N.D.Bhatt, Elementary Engineering drawing, Chartor publishing house.
3. A.C.Parkinson, London, Sir Issac Pitman and sons. A First year Engg. Drawing.
4. Earl D.Black. Engg. and Technical Drawing.
5. S.C.Sharma, Engg. Drawing, S.Chand& Company, New Delhi.

Course Outcomes:

At the end of the course, student will be able to
1) Know the uses of instruments in architectural drafting, dimensioning. Plan and proportional scales.
2) Geometrical interpretation of building forms.
3) Visualize the different components of building for design.

AR106	ARCHITECTURAL PRESENTATION-I (Free Hand Drawing)	0-0-3	Credit 2

Course Objectives:

1. Visualize the three dimensions of an object by sketching.
2. Familiar with use of pencils with tonal value and stroke.
3. Create and draw 3D-view of an ambience.
4. To learn better presentation ability.

MODULE-I **(6 Hours)**

Role and meaning of art, various types of arts - fine arts, performing arts, commercial arts, industrial arts, folk arts, abstract art, visual arts, spatial arts, temporal arts, pop art, etc.,

MODULE-II **(6Hours)**

Study of colors and colour schemes. Composition with primary, secondary & tertiary colors, Composition with complementary, split and analogous colours.Study of light and shade effects on simple objects.

MODULE-III **(8 Hours)**

Sketching of simple natural / manmade forms in combination with trees, human figures etc.using pencil.
Rendering buildings and other manmade forms in combination with natural elements using pen and ink, charcoal, water colours etc.

MODULE-IV **(8 Hours)**

To study and practice through lettering exercises and graphical presentations techniques.
Measured drawings of different furniture types, small house, park pavilion, bus shelter etc.

Reference books:

1. James Richards, Free hand drawing and Discovery.
2. Architectural Graphics, by Francis D.K.Ching.

Course Outcomes:

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

1) Understand the use of colours and rendering techniques to prepare 2D and 3D dimensional presentations.
2) Enhance the skills in visual perceptions of design.
3) Relationship of architecture with other arts like painting and Sculpture.

AR107	WORKSHOP-I (Metal and Wood Work)	0-0-6	Credit 2

Course Objective:

1. To provide an introduction of techniques for creating an object.
2. To nurture the skills for creation of innovative 3D physical objects.
3. To understand applications of machine tool and carpentry tools etc.

MODULE -I **(10 Hours)**

Fitting (One job) :
Fitting tools like – files, vice, chisels, scriber, hammers, surface plate, try square, calipers,, etc. Fitting operations such as filing, grinding, sawing, marking, drilling, tapping, safety precaution, demonstration of various operations, and preparation of male – female joints.

MODULE -II **(10 Hours)**

Carpentry (two joint job) :
Carpentry tools like – saw, planer, chisels, hammers, pallet, marking gauge, vice, tee square, rule, etc., carpentry operations such as marking, sawing, planning, chiseling, grooving, boring, joining, type of woods, and carpentry hardware, safety precaution, demonstration of various operations by using hardware.

MODULE- III **(8 Hours)**

Welding (one job) :
Electric arc welding, welding machines different types of electrodes, screen fixers, hand gloves, demonstration of welding operation.

Reference Books :
1)Work familiarization : E. Wilkinson

2)Workshop technology : A.K. Hajrachaudhuri& S.K. Hajrachaudhuri
3) ITB Handbook : Engineering Industry Training Board
4)Workshop Technology : Gupta &Kaushik Vol. I & II

Course Outcomes:

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

1) Know the mechanism of assembling of different components to form an object.
2) Different methods used for different kind of material and object as a whole.
3) Know how technology,material and skill is blend to form an object.

AR108	BASIC DESIGN-I	0-0-6	Credit 6

Course Objectives:

1. Familiarise with processing techniques and application of skill for creating design scheme.
2. Understand the design principles.
3. Identify and explain relation of art and aesthetic to basics of design.
4. Have an appreciation of future trends in design.

MODULE- I **(20 Hours)**

Perception: Visual, Audio, Smell, Tactile and Taste. Exercise to recognize these. Understanding its association to Architecture and design.

MODULE- II **(20 Hours)**

Study, analyse and document the shelter of Birds, Animals and Insects.
Transformation/ understanding of point, line, planes, volumes, and forms.

MODULE -III **(24 Hours)**

To familiarize the student with shape, size, colour, texture, lighting, which are all attributes of form. Exercises on composition in all the above attributes should be carried out.

MODULE- IV(20 Hours)

Understanding the various organizing principles such as: Axis, Symmetry, Rhythm, Harmony, Contrast, Balance, Hierarchy, Monotony etc. Followed by exercises based on these principles.

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Reference Books:

1. V.S.Parmar, Design fundamentals in Architecture, Somaiya publications private limited, New Delhi.
2. Francis D.K.Ching, Architecture-Form, space and order, Van, Nostrand Reinhold company, NewYork.

Course Outcomes:

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

1) Enhance the vocabulary in basic design principles.
2) Develop the ability to systematically arrive at “Architectural Design” solutions.
3) Visualize and create different built forms which are functional in nature.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year (2018-19 Admission Batch) B.Arch programme

2nd Semester

AR201	ENVIRONMENTAL PSYCHOLOGY	3-0-0	Credit 3

Course Objective:

1. Knowledge of technologies and fundamentals of environment.
2. To provide ideas on environmental ambience affects the psychology.
3. To understand the need of better environment for healthy society

MODULE- I **(10 Hours)**

Define the term environment, encompassing natural environments, social settings, built environments, learning environments, and informational environment.

Human beings are in constant interaction with the environment. With the growth of civilization, men are making more and more artificial environments, and architects and planners play a significant role in this process.

MODULE- II **(10 Hours)**

Measurement of environmental stimuli from psychological aspect. Behavioural effects of Environmental conditions.

a. Physical - Noise, Temperature and air pollution
b. Social- Overcrowding and isolation.
c. Extra ordinary- Catastrophe.

Perceptual factors of environment- perception of distance. Size and movement. Meaning of colour and form. Social and Cultural influences on environmental perception.

MODULE- III **(12 Hours)**

Personal space- individual and situational as determinants of personal space. Consequences of too much or too little of Personal space. Personal space and environmental space as implications for design aspects.

Psychological aesthetics - Measurement of communication through art; determination of pleasantness and unpleasantness as psychological factors in environmental design. Place identity, place attachment, space-over-time orientation.

MODULE- IV **(10 Hours)**

Adaptation to environment - Behavioural aspects of adaptation to familiar and unfamiliar environment.

Reference Books:

1. Oscar Newman, Defensible space.
2. Wicius Wong, Principles of colour composition
3. Bell, P.A Fisher, J.D. Leomis, R.J- Environmental psychology
4. Munn, N.C. Psychology, Fundamentals of Human adjustment.

Course Outcomes:

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

1) Enhance the knowledge about environment and its impact on human beings.
2) Know how to protect environment and conserve it.
3) Visualize and create different environment suitable built forms which are functional in nature.

AR202	HISTORY OF ARCHITECTURE-I (Buddhist, Jain, Hindu)	3-0-0	Credit 3

Course Objectives:

1. To introduce ancient monuments and its architecture.
2. To introduce the concepts of space arrangement, socio-economic issues and geography of ages.
3. To introduce a significance of built forms of different ages.
4. To understand collective and continuous progression of built forms.

MODULE -I(10 Hours)

The origins of Architecture. Study of houses, temples and tombs and appreciation of Indian history.

MODULE- II **(10 Hours)**

Budhist Period- Chaitya, Vihara and Stupas, influence of timber construction and forms. Rock cut and Builtup.

MODULE- III **(12 Hours)**

Jain Period- General planning, setting and decorative treatment of temples. Examples of Dilwara temple groups in Mount Abu and Raunakpur temples.

MODULE –IV **(10 Hours)**

Hindu Period- Development of Dravidian, Chalukyan and Indo-Aryan temples,(rock cut and builtup) in India.

Reference books:

1. Bannister Fletcher, A History of Architecture.
2. Satish Grover, Architecture in India.
3. Percy Brown, The History of Indian Architecture.
4. G.K. Hiraskar. World History of Architecture. Dhanpat Raj and Sons.

Course Outcomes:

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

1) Enhance the knowledge about history of architecture of different ages.
2) The character and construction techniques of different type of buildings.
3) Know the social, economic, geographical etc. condition of respective civilization.

AR203	MECHANICS –II	3-0-0	Credit 3

Course Objectives:

1. Fundamentals of building engineering.
2. Analyze and design different components of building.
3. Do design analysis for safety of built structure.

MODULE- I **(10 Hours)**

Statics

Virtual Work:

Principles of virtual work: Equilibrium of Ideal Systems, Efficiency of simple mechanics, Stable and unstable equilibrium.

MODULE- II **(10 Hours)**

Dynamics
Kinematics:
Kinematics of Curvilinear motion, Motion of Projectile, Moment of Momentum, Work & Energy in curvilinear motion.
Kinematics of Rotation, Rotation under the action of a constant moment, The compound pendulum,

MODULE -III **(12 Hours)**

Moment of Inertia

Moments of Inertia of Plane Figures with respect to an axis in it's plane, with respect to an axis perpendicular to the plane, Parallel axis theorem, Product of inertia, Principal axes and Principal moments 1of inertia.

MODULE -IV **(10 Hours)**

Solid Mechanics
Concepts of Stress & Strain:
Concepts of Stress and Strain, Normal stress, Sheer stress, normal strain, shear strain, Hooke's law, Poisson's ratio, Principal stresses, Principal strains, Mohr's Circle for stress and strain.

Reference Books:

1. Engineering Mechanics by: S. Tuimoshenko, D.H. Young, Mc-Graw Hill International Edition Chapters: 1, 2, 3& 6.
2. Fundamentals of Engineering Mechanics, Second Edition, Publisher: Vikas Publishing House Pvt. Ltd. by S. Rajashekharan and G. SankaraSubhramanian.
3. Engineering Mechanics, K. L. Kumar, TMH
4. Elements of Strength of Materials by Timoshenko & Young

Course Outcomes:

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

1) Know the engineering aspect of building materials.
2) Analyse different kind force affecting to building design component.
3) Know the building component and their functional use.

AR204	BUILDING CONSTRUCTION-I	0-0-6	Credit 3

Course Objectives:

1. To expose the students to the basics of building components and methods for design.
2. To classify the building materials and know its use.
3. Necessity of safety,economy,procedure of construction.

MODULE-I **(14 Hours)**

Brick masonry: Masonry tools and equipment, binding and its principle, headers, stretchers, king and queen closers, English and Flemish bonds for corner, tee and cross junctions in 35 cms, 23 cms and 11 cms brick walls and buttress and pilasters and piers of 45cms, 35cms and 23 cms size, section of a compound wall.

MODULE-II **(14Hours)**

Stone masonry: Various types of stone dressing, plain bevelled and rebated joints, dowels and cramps, quoins, headers and bond. Rubble, and Ashlar masonry walls, walls with stone facing and brick backing.

MODULE-III **(14 Hours)**

Simple foundations: Simple foundation for masonry load bearing walls and piers.

Sessional work based on above topics.

Reference Books:

1. W.B. McKay. Building construction. Vol-I, Vol-IV
2. R .Barry. The Construction of Buildings. VoI.1-Vol-IV, The English Language book society, Crospy Lockwood staples, London.

Course Outcomes:

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

1) Know the engineering aspect of building construction and use of building materials.
2) Develop different kind of techniques to building design component and structure.
3) Know how to construct the building component and analyze functional use.

AR205	DESCRIPTIVE GEOMETRY-II	0-0-6	Credit 3

Course Objectives:

1 To be familiar with Geometry of built form.
2 To gain knowledge of different types of projections of built form .
3 To have knowledge on composition of different shapes of built form.

MODULE-I **(21 Hours)**

Interpenetration of solids and representation in two-dimension. Analysis of complex forms (moldings, vaults etc.) at different intersections. Surface development of simple solid forms leading to complex forms including interpenetration.
Isometric and Axonometric projections.

MODULE-II **(21 Hours)**

Perspective - parallel, angular and three points. Exercise from simple solid geometrical shapes leading to perspective of building forms, simple rendering of perspectives. Free hand perspectives Different drawings mediums. Measuring point Method, Three point Perspectives. Perspective of Buildings, and Interior, Rendering of Perspectives.

References books:

1. Engineering Drawing by N.D. Bhatt & V.M. Panchal, Charotar Publishing House, Anand Ch - 8, 9, 10, 12, 13, 15, 16 & 17
2. N.D.Bhatt, Elementary Engineering drawing, Chartor publishing house.
3. A.C.Parkinson, London, Sir Issac Pitman and sons. A First year Engg. Drawing.
4. Earl D.Black. Engg. and Technical Drawing.
5. S.C.Sharma, Engg. Drawing, S.Chand & Company, New Delhi.

Course Outcomes:

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

1) Know the uses of instruments in architectural drafting, dimensioning. Plan and proportional scales.
2) Geometrical interpretation of building forms.
3)Visualize the different components of building for design.

AR206	ARCHITECTURAL PRESENTATION-II (with Paint Brush and similar Software)	0-0-3	Credit 2

Course Objectives:

1. Visualize the three dimensions of an object by digital graphic techniques.
2. Familiar with use of various softwares.
3. Create and draw 3D-view of an ambience.
4. To learn better presentation ability.

MODULE-I **(6 Hours)**

Study of colours and colour schemes. Composition with primary, secondary & tertiary colours. Composition with complementary, split and analogous colours.

Study of light and shade effects on simple objects.

MODULE-II **(6 Hours)**

Exercises in 2D &3D dimensional compositions with effects of light and shade. Study of scales and

proportions with perspectives of simple geometric forms. Three dimensional composition on convex-concave and curvilinear forms

MODULE-III **(8 Hours)**

Sketching of simple natural / manmade built forms in combination with

trees , human figures etc using pencil rendering buildings

MODULE-IV **(8 Hours)**

Manmade built forms in combination with natural elements using pen and ink, charcoal, water colour. Two dimensional compositions on straight linear form.

Reference books:

1. Architectural Graphics, by Francis D.K.Ching and Books on AutoCAD.Revit Architecture.

Course Outcomes:

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

1) Understand the use of colours and rendering techniques to prepare two and three dimensional presentations.
2) Enhance the skills in visual perceptions of design.
3) Relationship of architecture with other arts like painting and Sculpture.
4) Enhance the skills in Visual perceptions of design theories.

AR207	WORKSHOP-II (Arch. Model Making)	0-0-3	Credit 1

Course Objectives:

1. To provide an introduction of techniques for creating an object.
2. To nurture the skills for creation of innovative 3D physical objects.
3. To understand application of machine tool and carpentry tools etc.

MODULE-I **(4 Hours)**

Instructions on the use of tools such as craft knives, hot wire cutter, small bench drill, fretsaw, glue gun, and materials such as Clay, Thermocol, Paper and Softwood etc. for making architectural models.

MODULE-II **(4 Hours)**

(One object)
To create objects by using Plaster of Paris (POP).

MODULE-III **(6 Hours)**

(One object)
To create objects by using Fibre reinforced plastic (FRP).

Reference Books :

1. Work familiarization : E. Wilkinson
2. Workshop technology : A.K. Hajrachaudhuri & S.K. Hajrachaudhuri
3. ITB Handbook : Engineering Industry Training Board
4. Workshop Technology : Gupta & Kaushik Vol. I & II

Course Outcomes: At the end of the course, student will be able to

1) Mechanism of assembling of different components to form an object.
2) Different methods used for different kind of material and object as a whole.

AR208	BASIC DESIGN-II	0-0-6	Credit 6

Course Objectives:

1. Familiarise with processing techniques and application of skill for creating design scheme.
2. Understand the design principles.
3. Identify and explain relation of art and aesthetic to basics of design.
4. Have an appreciation of future trends in design.

MODULE-I **(20 Hours)**

Anthropometric studies.
Area and space calculations for simple understandable spaces such as bed rooms, dining, living, kitchen, toilet, veranda, etc.

MODULE-II **(20 Hours)**

Preliminary ideas of circulation and flow aspects of simple habitations starting with a house, with the use of bubble diagrams.

MODULE-III **(20 Hours)**

Simple considerations of engineering aspects such as stability, and others.
Some social aspects of family and community may be highlighted for the students understanding.
Making and breaking spaces with vertical planes.
Making and breaking spaces with Horizontal Planes.
Making and breaking with inclined and curvilinear planes.
Making and breaking spaces with a combination of planes.

MODULE-IV **(24 Hours)**

Assigning Utility to space. (Assigning of utility to space may be that of a house, memorial, bus shelter, park pavilion etc.)

Ranging the spaces according to aesthetics, anthropometrics, social and engineering aspects.
Feed back and design integration.
Producing a final design in the form of sketch plans, sections, perspective and Model.

Reference Books :

1. V.S.Parmar, Design fundamentals in Architecture, Somaiya {publications private limited, New Delhi.
2. Francis D.K.Ching, Architecture-Form, space and order, Van, Nostrand Reinhold company, New York.

Course Outcomes:

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

1) Enhance the vocabulary in basic design principles.
2) Develop the ability to systematically arrive at "Architectural Design" solutions.
3) Visualize and create different built forms which are functional in nature.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure for 1st Year (2018-19 Admission Batch) B.Tech programme

(Common to all Branches)

First Semester				Second Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
BSMA1101	Mathematics-I	3-1-0	3	BSMA1106	Mathematics-II	3-1-0	3
BSPY1102/ BSCY1103	Physics/ Chemistry	3-0-0	3	ESME2113	Engineering Mechanics	3-1-0	3
ESEE2101/ ESEC2102	Basic Electrical Engineering /Basic Electronics Engineering	2-0-0	2	BSCY1103/ BSPY1102/	Chemistry/ Physics	3-0-0	3
ESCE2103/ ESME2104	Basic Civil Engineering / Basic Mechanical Engineering	2-0-0	2	ESEC2102/ ESEE2101	Basic Electronics Engineering / Basic Electrical Engineering	2-0-0	2
HSHM3101/ ESCS2105	Communicative English/ Programming Language using C	3-0-0	3	ESME2104/ ESCE2103	Basic Mechanical Engineering / Basic Civil Engineering	2-0-0	2
				ESCS2105/ HSHM3101	Programming Language using C/ Communicative English	3-0-0	3
Total (Theory)		**14**	**13**	**Total (Theory)**		**18**	**16**
Practical/ Sessional					**Practical/ Sessional**		
BSPY7104/ BSCY7105	Physics Lab/ Chemistry Lab	0-0-3	2	BSCY7105/ BSPY7104/	Chemistry Lab/ Physics Lab	0-0-3	2
ESEE7106/ ESEC7107	Basic Electrical Engg. Lab/ Basic Electronics Engg. Lab	0-0-3	1	ESEC7107/ ESEE7106	Basic Electronics Engg. Lab/ Basic Electrical Engg. Lab	0-0-3	1
ESCE7108/ ESME7109	Basic Civil Engg. Lab/ Basic Mechanical Engg. Lab	0-0-3	1	ESME7109/ ESCE7108	Basic Mechanical Engg. Lab/ Basic Civil Engg. Lab	0-0-3	1
HSHM7102/ ESCS7110	Communicative English Lab/ Programming Language using C Lab	0-0-3	1	ESCS7110/ HSHM7102	Programming Language using C Lab/ Communicative English Lab	0-0-3	1
ESCE7111/ ESME7112	Engineering Graphics & Design Lab/ Workshop Practice	0-0-3	2	ESME7112/ ESCE7111	Workshop Practice/ Engineering Graphics & Design Lab/	0-0-3	2
MCGN9101	Induction Training (21 Days)	-	0	MCGN9102	NCC/NSS/Yoga/Professional Ethics	-	0
Total (Practical/ Sessional)		**15**	**7**	**Total (Practical/ Sessional)**		**15**	**7**
TOTAL		**29**	**20**	**TOTAL**		**33**	**23**
TOTAL SEMESTER CREDITS: 20				TOTAL SEMESTER CREDITS: 23			
TOTAL CUMULATIVE CREDITS: 20				TOTAL CUMULATIVE CREDITS: 43			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year (2018-19 Admission Batch) B.Tech programme

(Common to all Branches)

BSMA1101	Mathematics-I	3-1-0	Credit 3

Module I: Calculus (4 + 1 hours)

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties;

Module II: Calculus (6 + 2 hours)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module III: Matrices (6 + 2 hours)

Matrices, vector addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination.

Module IV: Vector spaces (6 + 2 hours)

Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity.

Module V: Vector spaces (4 + 1 hours)

Eigen values, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. Diagonalization;

Module VI: vector calculus (14 = 5 hours)

Limit continuity and partial derivatives, directional derivatives, Gradient, curl and divergence. Multiple Integration: line, double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes.

Textbooks:

1. Ramana B.V., *Higher Engineering Mathematics*, Tata McGraw Hill New Delhi, 11th Reprint, 2010.Chapter 6.6, 11(11.1, 11.2), 2(2.4-2.9), 4(4.1, 4.2), 13(13.1-13.6), 15(15.1-15.4), 16(16.1-16.7)
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, **8th** Edition, John Wiley & Sons, 2006. Chapter 6.8, 7(7.1-7.5)

References:

1. Thomas G.B. and Finney R.L., *Calculus and Analytic geometry*, **9th** Edition, Pearson, Reprint, 2002.
2. Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers, **35th** Edition, 2000.
3. Peter V.O'Neil, *Advanced Engineering Mathematics*, Thomson Publisher, India edition.

BSPY1102	Physics	3-0-0	Credit 3

Module-I (10 Classes)

Vector Calculus: Gradient of scalar field, divergence and curl of vector fields, Gauss divergence theorem and Stoke's theorem (Statement and physical significance only).

Force: Forces in Nature; Newton's laws of motion; constrained and unconstrained motion, Free body diagrams, Forces in space, Newton's equations of motion in polar, cylindrical and spherical coordinates; Equilibrium of a particle in space, Constraints, degrees of freedom, D' Alembert's principle (Brief ideas, simple applications of formulae, no derivation).

Potential energy function: Force and motion from potential energy curve, Oscillations about a stable point, Force from the potential energy function, conservative and non-conservative forces; impact, coefficient of restitution.

Oscillation: Simple Harmonic Oscillation, Damped oscillation, Forced oscillation, Resonance, Coupled oscillation.

Waves: Concepts of waves: wave equation, two beam superposition in one dimension, coherent and incoherent superposition.

Module-II (11 Classes)

Optics: Interference in thin films, Newton's ring, determination of wavelength of light. Fresnel and Fraunhoffer diffraction, zone plate, Fraunhoffer diffraction through single slit, plane diffraction grating, resolving power of grating. Polarization, polarization by reflection, Brewster's law.

Electromagnetism: Gauss Law of electrostatics, electric displacement, magnetic monopole, magnetic induction, Ampere's circuital law, displacement current, Faradays' law of electromagnetic induction (only statements, no derivation), non conservative electric field and continuity equation for current density.

Maxwell's electromagnetic equations in differential and integral form, Electromagnetic wave equation in vacuum and in conducting media, Poynting vector and its average value, Poynting theorem (statement, no proof).

Module-III (11 Classes)

Quantum Mechanics: Needs for Quantum physics- Elementary ideas on blackbody radiation, photoelectric effect, Compton effect, pair production (No derivations). Wave particle duality- Matter waves, de-Broglie hypothesis, Davisson-Germer experiment. Heisenberg's uncertainty principle and its applications: absence of electron in nucleus and ground state energy of Hydrogen atom

Wave function: Wave function and its characteristics, Born interpretation, probability density, normalization, operators, Eigen value, Eigen function, Expectation value, boundary conditions, stationary states, superposition, Schrodinger's equations (Time dependent and time independent).

Applications: Free particle, potential step, finite well, particle in one dimensional potential box, tunnelling.

Module- IV (10 Classes)

Quantum Statistics: Statistical distribution, Maxwell-Boltzmann, Fermi-Dirac and Bose- Einstein distribution

functions, density of states (Only statement and formulae, no derivation), quantum theory of free electrons in metals.

Optoelectronic Devices: LASER, spontaneous and stimulated emission, Principle and working of LASER, Population inversion and pumping, Different types of LASER: Ruby LASER, Helium- Neon LASER, semiconductor LASER, Applications of LASER.

Fibre Optics: Introduction, structure and types of optical fibre, step and graded index fibres, total internal reflection, Acceptance angle, Acceptance cone, Numerical aperature, attenuation, Applications of optical fibre.

BOOKS:

1. Principles of Engineering Physics (Vol-I, II) , Md. N. Khan, S. Panigrahi, Cambridge Univ.Press.
2. Engineering Physics, D. R. Joshi, Tata Mc Graw Hill.
3. Engineering Physics, D.K. Bhattacharya and P. Tandon, Oxford University Press.
4. Concepts of Physics, A. Beiser, Mc Graw Hill.

BSCY1103	Chemistry	3-0-0	Credit 3

Course Objectives:

The prospective engineers should

1. Memorize the principle of interaction of electromagnetic radiation with matter.
2. Understand the basic concepts of organometallic compounds and different phases of matter.
3. Understand the Basics of fuels and corrosion chemistry.
4. Understand the concept of Nano-technology and apply the same to design engineering materials.

Module I: (12 hrs)

Quantum Chemistry and Spectroscopy: Basic concepts and postulates of quantum mechanics. Introduction to Schrödinger Wave Equation. Particle in a box: Energy levels, quantum numbers and selection rule.

Spectroscopy: Lambert Beer's Law, Principles and applications of UV-Visible Molecular Absorption Spectroscopy; Chromophores, applications to colorimetry. Effect of conjugation on chromophores, Absorption by aromatic systems, Introductory idea on Rotational and Vibrational Spectroscopy-Principles and application to diatomic molecules.

Module II: (12 hrs)

The phase rule: Statement of Gibb's phase rule and explanation of the terms involved, Phase diagram of one component system – water and sulfur system, Condensed phase rule, Phase diagram of two component system – Eutectic Bi-Cd system.

Organometallics: Introduction to organometallics, EAN rule; classification, nomenclature and characteristics of organometallic compounds. Applications of organometallic compounds and catalyst in alkene isomerization hydrogenation and hydroformylation (detail mechanisms are to be excluded).

Module III: (10 hrs)

Fuels: Classification of fuels, calorific value. (Determination by Dulong's formula), G.C.V. and N.C.V. Cracking, Knocking and anti knocking, cetane and octane numbers. Combustion calculation.

Corrosion: Electrochemical theory of corrosion, galvanic series, Types of corrosion; Differential metal corrosion, Differntial aeration corrosion (Pitting and water line corrosion), Stress corrosion (caustic embrittlement in boilers).

Module IV: (6 hrs)

Nano Chemistry: Introduction to nano chemistry, nanotechnology applications, material self-assembly, self-assembled monolayers, processes of nanotechnology (top down, bottom up approach), Fullerene, nanocrystals.

Course Outcomes

The prospective engineers should develop the:

1. Ability of optimal use of energy
2. Production and application of nano-materials

Text Books:

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publiation.
2. Text Book in Applied Chemistry by A. N. Acharya and B. Samantaray, Pearson India.
3. Introductory to Quantum Chemistry by A. K. Chandra. , 4th Edition, Mcgraw Hill Education.
4. Fundamentals of Molecular & Spectroscopy by Banwell, Tata McGraw Hill Education.
5. Physical Chemistry by Gordon M. Barrow, McGraw-Hill
6. Engineering Chemistry, 12th Edition, Author: Wiley India Editorial Team Publishers Wiley.
7. Engineering Chemistry: Fundamentals and Applications. Shikha Agarwal. Cambridge University Press.

Reference Books:

1. Inorganic Chemistry by Donald A. Tarr, Gary Miessler, Pearson India, Third Edition.
2. Quantum Chemistry by Ira N. Levine, Pearson 7th Edition.
3. Molecular Spectroscopy, Ira N. Levine, John Wiley and Sons
4. Modern Spectroscopy – A Molecular Approach, by Donald McQuarrie and John Simon, published by University Science Books.
5. Inorganic Chemistry by W. Overton, Rounk and Armstrong, Oxford Univesity Press, 6th edition.

ESEC2102	Basic Electronics Engineering	2-0-0	Credit 2

Course Objective:

1. To analyze different types of elementary signals.
2. Understanding the Characteristics of an Ideal Op-Amp.
3. To gain knowledge about semiconductors devices.
4. Provides comprehensive idea about working principle, operation and characteristics of electronic

devices.

5. Develop analysis capability in BJT.
6. To develop basic idea on MOSFETs.

MODULE I (08 Hours)

Introduction to Signals

Signals, Frequency and Time Domain analysis of signals, Elementary signals (impulse, step and ramp), Analog and digital signals, Discrete signals, Amplifiers, Digital logic inverter.

Operational Amplifiers

The Ideal Op Amp, Different stages of Op-Amp, Virtual Ground Concept Inverting and Non - Inverting configurations, Equivalent Circuit model, Op amp application in Integration, Differentiation and Summing Circuits.

Semiconductor Diodes

Introduction (Intrinsic, Extrinsic semiconductors and their energy level diagrams), P-N junction with open circuit, P-N junction with an applied voltage, Ideal diode, Characteristics of p-n Junction diodes, Rectifier circuits.

Special diodes- Zener diode and Light emitting diode. Display devices- Liquid Crystal Display, Seven Segment Display.

MODULE II (10 Hours)

Bipolar Junction Transistors (BJTs)

Simplified structure and physical operation of n-p-n and p-n-p transistors in the active region, Current-voltage characteristics of BJT (Common-Emitter, Common-Base and Common-Collector configurations).BJT as an amplifier and as a switch.

BJT Circuits at DC, Biasing in BJT amplifier circuits, Small Signal Operation of BJT:re-model, Simplified hybrid-π model and its application to single stage BJT amplifiers (Common- Emitter, Common-Base and Common-Collector configurations).A comparison on CB,CE and CC configuration.

Metal Oxide Semiconductor Field - Effect Transistors (MOSFETs)

Structure and Principle of operation of the Enhancement - Type and Depletion - Type MOSFETS. V - I Characteristics, DC - Biasing, Load – line and operating point.

MODULE III (10 Hours)

Digital Electronic Principles

Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic.

Logic Gates and Boolean Algebra

The inverter, The AND, OR, NAND, NOR, Exclusive-OR and Exclusive-NOR gate, Boolean operations and expressions, Laws and Rules of Boolean algebra, DeMorgan's theorem, Boolean analysis of logic circuits, Standard forms of Boolean expressions, Boolean expression and truth table.

Text Books:

1. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits", Oxford University Press, 7th Edition, 2014.
2. Thomas L. Floyd and R.P. Jain, "Digital Fundamentals", Pearson Education, 8th Edition, 2009.

Reference Books:

1. Thomas L. Floyd, Pearson Education, "Electronic Devices", Pearson Education, 7th Edition, 2005.
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 11th Edition,2013.
3. Albert Malvono and David J. Bates, "Electronics Principles", Tata McGraw-Hill Publishing Company Limited, 7th Edition,2007.

Course Outcomes:

1. Understand the application of diode in rectifiers.
2. Explains the basic knowledge on Op-Amp.
3. Will be able to understand different configuration, V-I Characteristics, applications and different biasing scheme in BJT.
4. Describes Structure and Operation of MOSFETs,
5. Acquire knowledge on Number systems, Logic gates and Boolean algebra.

ESEE2101	Basic Electrical Engineering	2-0-0	Credit 2

Course Outcomes:

At the end of this course, students will demonstrate the ability

1. To understand and analyze basic electric and magnetic circuits.
2. To study the working principles of electrical machines and power converters.
3. To introduce the components of low-voltage electrical installations.

Module I: DC Circuits (6 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

Module II: AC Circuits (6 hours)

Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

Module III: Electrical Machines (8 hours)

Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer.

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Loss components and efficiency. Construction, working, torque-speed characteristic and speed control of separately excited dc motor.

Module IV: Electrical Installations (4 hours)

Components of LT Switch gear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Text / References:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India,1989

ESME2104	Basic Mechanical Engineering	2-0-0	Credit 2

PURPOSE

To familiarize the students with the basics of Mechanical Engineering.

INSTRUCTIONAL OBJECTIVES

1. To familiarize with the basic machine elements
2. To familiarize with the Sources of Energy and Power Generation
3. To familiarize with the various manufacturing processes

Module I MACHINE ELEMENTS (10 hrs)

Springs: Helical and leaf springs – Springs in series and parallel.

Cams: Types of cams and followers – Cam profile.

Power Transmission: Gears (terminology, spur, helical and bevel gears, gear trains). Belt drives (types). Chain drives. **Simple Problems.**

Module II ENERGY(10)

Sources: Renewable and non-renewable (various types, characteristics, advantages/disadvantages). **Power Generation:** External and internal combustion engines – Hydro, thermal and nuclear power plants (layouts, element/component description, advantages, disadvantages, applications). **Simple Problems.**

Module III MANUFACTURING PROCESSES (10)

Sheet Metal Work: Introduction – Equipments – Tools and accessories – Various processes

(Applications, advantages / disadvantages). **Welding:** Types – Equipments – Tools and accessories – Techniques employed -applications, advantages / disadvantages – Gas cutting – Brazing and soldering. **Lathe Practice:**

Types - Description of main components – Cutting tools – Work holding devices – Basic operations. **Simple Problems**. **Drilling Practice:** Introduction – Types – Description – Tools. S**imple Problems**.

Reference Books:

1. Kumar, T., Leenus Jesu Martin and Murali, G., *Basic Mechanical Engineering*, Suma Publications, Chennai,2007.
2. Prabhu, T. J., Jai Ganesh, V. and Jebaraj, S., *Basic Mechanical Engineering*, Scitech Publications, Chennai, 2000.
3. Hajra Choudhary, S.K. and Hajra Choudhary, A. K., *Elements of Workshop Technology Vols. I & II*, Indian Book Distributing Company Calcutta, 2007.
4. Nag, P.K., *Power Plant Engineering*, Tata McGraw-Hill, New Delhi, 2008.
5. Rattan, S.S., *Theory of Machines*, Tata McGraw-Hill, New Delhi, 2010.

ESCE2103	Basic Civil Engineering	2-0-0	Credit 2

Module-I (10 classes)

Mechanics: Concurrent forces on a plane – Composition and resolution of forces and equilibrium of concurrent coplanar forces, Method of projections, Methods of moment, Friction. Parallel forces in a plane- Two parallel forces, General case of parallel forces, Center of parallel forces in a plane and center of gravity- centroids of composite plane figure and curves, Distributed parallel forces in a plane. General case of forces in a plane- composition of forces in a plane and equilibrium of forces in a plane.

Module-II (10 classes)

Plane trusses- method of joints and method of sections. Moments of Inertia- Plane figure with respect to an axis in its plane and perpendicular to the plane- parallel axis theorem, Moment of Inertia of material bodies.

Rectilinear Translation- Kinematics- Principles of Dynamics- D'Alemberts Principles, Momentum and impulse, Work and Energy- impact.

Module-III (8 classes)

Building Material and Building Construction: Bricks: Brick as a construction material and its importance, qualities of a good brick, Stone: classification, composition and characteristics, Cement: Classification, tests for cement, uses of cement, types of cement, Concrete: Quality of mixing water, Workability, vibration of concrete, concrete mix design, Grade and strength of Concrete. Building Components and their basic requirements, Foundation: Types of foundation, spread foundations, pile foundations, Mortar, Stone masonry, brick masonry, roof, floors, building services: air conditioning, fire protection, ventilation.

Module-IV (8 classes)

Surveying: Linear measurement and chain survey: Use of chains and tapes for measurement of correct length of lines, direct and indirect ranging, Compass surveying: Use of prismatic compass, bearing of a line. Local

attraction, Introduction to modern surveying instruments EDM and Total Station.

Transport, Traffic and Urban Engineering: Introduction to planning and design aspects of transportation engineering, different modes of transport, highway engineering, rail engineering, airport engineering, traffic engineering, urban engineering.

Text Books:

1. Engineering Mechanics by S Timoshenko, D.H Young and J.V.Rao, McGraw Hill
2. Basic Civil Engineering, S. Gopi, Pearson
3. Building Construction, Sushil Kumar, Standard Publishers Distributors
4. Surveying and Levelling by R. Subramanian, Oxford University Press

Reference Books:

1. Engineering Mechanics by K.L.Kumar, McGraw Hill
2. Engineering Materials, S.C. Rangwala, Charotar Publishing House
3. Building Material and Construction, G C Sahu, Joygopal Jena, McGrow Hill
4. Surveying Vol-1 by R Agor, Khanna Publishers 5. Basic Civil Engineering, M.S. Palanichamy, McGraw Hill

BSPY7104	Physics Lab	0-0-3	Credit 2

A Student is expected to perform **ten** experiments from the list given below.

1. Determination of Young's modulus by Searle's methods.
2. Determination of Rigidity modulus by static methods.
3. Determination of surface tension by capillary rise method.
4. Determination of acceleration due to gravity by Bar / Kater's pendulum.
5. Determination of thermal conductivity by Lee's method.
6. Determination of wave length of light of light by Newton's ring apparatus.
7. Determination of grating element of a diffraction grating.
8. Determination of wave length of light of light by Biprism.
9. Plotting of characteristic curves of a PN junction diode.
10. Plotting of characteristic curves of BJT.
11. Verification of laws of verification of strings using sonometer.
12. Determination of wavelength of laser source by diffraction rating methods.
13. Study of Hall effect.
14. Study of RC circuit.
15. Study of a power source- output impedance.

BSCY7105	Chemistry Lab	0-0-3	Credit 2

1. Determination of amount of sodium hydroxide and sodium carbonate in a mixture.
2. Standardization of $KMnO_4$ using sodium oxalate.
3. Determination of ferrous iron in Mohr's salt by potassium permanganate.
4. Estimation of calcium in calcium in limestone.
5. Determination of total hardness of water by EDTA method.
6. Determination of percentage of available chlorine in a sample of bleaching powder.
7. Determination of dissolved oxygen in a sample of water.
8. Determination of partition coefficients of iodine between benzene and water.
9. Preparation of buffer solution and determination of pH of a buffer solution.
10. Determination of Viscosity of lubricating oil by Red Wood viscometer II.
11. Determination of Flash point of given oil by Pensky-Marten's flash point approach.

Reference:

Laboratory Manual for Engineering Chemistry, B. B. Patra, Pearson Education, 1st edition, 2010

ESEE7106	Basic Electrical Engineering Lab	0-0-3	Credit 1

List of Laboratory Experiments/Demonstrations: (any six)

1. Study of different electrical equipments.
2. Power factor improvement using capacitor for fluorescent lamp.
3. Verification of Superposition and Thevenin's theorem.
4. Polarity test of transformer.
5. Power measurement using 2-wattmeter method.
6. Calculation of current, voltage and power in series R-L-C circuit excited by single- phase AC supply and calculation of power factor.
7. Measurement of the armature & field resistance of D.C. Machine by volt-amp method & Starting and speed control of a D.C. shunt motor.
8. Study of BH Curve

ESEC7107	Basic Electronics Engineering Lab	0-0-3	Credit 1

1. Familiarization of electronic components and devices (Testing of semiconductor diodes and transistors using digital multimeter)
2. Familiarization with use of Oscilloscope, signal generator to view waveforms and measure amplitude and frequency of a given waveform.
3. Application of Op-Amp as Differentiator and Integrator.

4. Verification of V-I characteristics of semiconductor diode and determining its DC and AC resistance.
5. Studies on half-wave and full-wave rectifier circuits without and with capacitor filter; recording of the waveforms and measurement of average and rms values of the rectifier output.
6. Plot the Input and Output V-I Characteristics of N-P-N Transistor in CE Configuration.
7. Determine the frequency response of a BJT common-emitter RC coupled amplifier.
8. Design a Low pass and High pass filter and verify its performance.
9. Verify truth table of Logic gates.
10. Simplify a Boolean expression and implement the function using Logic gates. Modify the circuit for implementation with NAND Gatesor NOR Gates only.

ESCE7108	Basic Civil Engineering Lab	0-0-3	Credit 1

List of Experiment are

1. Shape and Size Test of Brick
2. Compressive Strength of Brick
3. Specific Gravity of Cement
4. Testing of Chain and Measurement of Correct Length of the Line.
5. Bearing of a Line
6. Study of Total Station
7. Support Reactions of a Beam
8. Calculate the force in the Member of a simple Truss
9. Turbidity of Water
10. pH of Water

ESME7109	Basic Mechanical Engineering Lab	0-0-3	Credit 1

1. To study the working and construction details of Cochran and Babcock & Wilcox Boiler
2. To study the working and function of mountings and accessories in boilers
3. To study Two stroke & Four stroke Diesel Engines
4. To study Two-stroke & Four-stroke Petrol Engines
5. To study the vapour compression Refrigeration System and determination of its C.O.P
6. To study the functioning of Window Room Air Conditioner
7. To study the Constructional features and working of Pelton Wheel Turbine, Francis Turbine and Kaplan Turbine
8. To study the construction & working of centrifugal pump
9. To study the working of single plate clutch
10. To study different type of gears used for power transmission.

HSHM7102	Communicative English Lab	0-0-3	Credit 1

Lab sessions will be devoted to practice activities based on all three modules of theory.

A. Phonemic Transcription **5 hours**

Students will be trained to find out the correct pronunciation of words with the help of a dictionary, to enable them to monitor and correct their own pronunciation.

i. Transcription of words and short sentences in normal English orthography (writing) into their IPA equivalents;

ii. Transcription of words presented orally;

iii. Conversion of words presented through IPA symbols into normal orthography

iv. syllable division and stress marking (in words presented in IPA form)

B. Listening **10 hours**

i. Listening with a focus on pronunciation (ear-training) : segmental sounds, stress, weak forms, intonation

(Students should be exposed, if possible, to the following varieties of English during listening practice: Standard Indian, British and American.)

C. Speaking **15 hours**

i. Pronunciation practice (for accent neutralization), particularly of problem sounds, in isolated words as well as sentences

ii. Practising word stress, rhythm in sentences, weak forms, intonation

iii. Reading aloud of dialogues, poems, excerpts from plays speeches etc. for practice in pronunciation

D. Managerial Writing **6 hours**

Business letters, Advertisement, Preparing Press Releases, Press Notes, Writing theme speeches, Speeches of thanks.

Course Outcome:

1. Demonstrate preparation and research skills for oral presentations
2. Develop proper listening skills
3. Articulate and enunciate words and sentences clearly and efficiently
4. Show confidence and clarity in public speaking projects
5. Demonstrate ability to gather information and apply it to persuade or articulate one's own point of view
6. Understand the rules of spelling and grammar
7. Read and analyze text and be able to summarize ideas in writing
8. Organize thoughts in a manner that emphasizes flow and paragraph development
9. Understand different writing techniques

ESCS7110	Programming Language using C Lab	0-0-3	Credit 1

At least five C programs from each of the following category

1. Tokens, data types, operators and expressions.
2. Non-formatted and formatted IO.
3. if, nested if-else, switch.
4. while, do-while and for.
5. continue, break, goto.
6. One-dimensional and two-dimensional operations.
7. Pointers and pointer arithmetic, pointers to arrays, pointers to pointers.
8. Functions, recursion, pointers to functions.
9. Structures, unions and enumerations, pointers to structures and unions.
10. Files and command line arguments.
11. Dynamic memory allocation.

ESCE7111	Engineering Graphics & Design Lab	0-0-3	Credit 2

Introduction: Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning line Conventions

AUTO CAD, layout of the software, standard tool bar/menus and description of most commonly used toolbars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.

2 – Sheets

Orthographic Projections: Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections ofpoints in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only),True and apparent lengths, True and apparent inclinations to reference planes

2 – Sheets

Orthographic Projections of Plane Surfaces (First Angle Projection Only): Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only

1-Sheets

Projections of Solids (First Angle Projection Only): Introduction, Definitions – Projections of right regular

tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions.

2-Sheets

Sections and Development of Lateral Surfaces of Solids: Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP.

2 – Sheets

Isometric Projection (Using Isometric Scale Only): Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cutspheres.

2-Sheets

Text Books:

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, Charotar Publishing House, Gujarat.
2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K. International Publishing House Pvt. Ltd., New Delhi
3. Engineering Drawing by N.S. Parthasarathy and Vela Murali Oxford University Press

Reference Books:

1. Engineering Graphics - K.R. Gopalakrishna, Subash Publishers Bangalore.
2. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Computer Aided Engineering drawing, Prof. M. H. Annaiah, New Age International Publisher, New Delhi

ESME7112	Workshop Practice	0-0-3	Credit 2

List of Experiments are:

1. Machine shop
2. Fitting shop
3. Carpentry
4. Welding shop
5. Casting
6. Smithy
7. Plastic moulding & Glass Cutting

BSMA1106	Mathematics-II	3-1-0	Credit 3

Module 1: Basic Probability (14 + 4 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Module 2: Continuous Probability Distributions (5 + 2 hours)

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Module 3: Bivariate Distributions (5 + 2 hours)

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Module 4: First order ordinary differential equations (8 + 3 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 5: Ordinary differential equations of higher orders (10 + 3 hours)

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Textbooks:

1. Ramana B.V., *Higher Engineering Mathematics*, Tata McGraw Hill New Delhi, 11th Reprint, 2010. Ch-8(8.7-8.12), 9(9.1-9.3, 9.6, 9.7), 10(10.1, 10.2), 11(11.3-11.5), 26(26.3-26.5), 27(27.1-27.9, 27.12, 27.13), 30.9,31.1.

References:

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, **8th** Edition, John Wiley & Sons, 2006.
2. Thomas G.B. and FinneyR.L., *Calculus and Analytic geometry*, **9th** Edition, Pearson, Reprint, 2002.
3. Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers, **35th** Edition, 2000.
4. Peter V.O'Neil, *Advanced Engineering Mathematics*, Thomson Publisher, India edition.

ESCS2105	Programming Language using C	3-0-0	Credit 3

Course Objective:

This course aims at providing a concrete knowledge of the C programming language to the undergraduate students. They will be able to develop logics for different computational problems and implement them through C. By learning the basic programming constructs the students can switch over to any other language in future.

Course Outcomes:

CO1: Understand the programming paradigms and structure programming concept.

CO2: Develop flowcharts and algorithms to solve problems and implement them through C.

CO2: Use basic programming constructs like operators, control statements and arrays to write C programs.

CO3: Exercise pointers, user-defined functions and data types to write C programs.

CO5: Use files and associated operations for a given application.

Module I (8hours)

Preliminaries: Introduction to digital computers, Binary arithmetic, Binary conversion,

Programming Classifications, Structured Programming Concept, Algorithms, Flowcharts, Developing Programs In C, Structure of a C Program, Tokens in C, Data Types, Operators and Expressions, Lvalues and Rvalues, Type Conversions.

Console IO: Non-formatted and Formatted IO

Module II (10 hours)

Control Statements: Decision Making - If, Nested if-else and Switch, Iterations- While, Do-While and For, Jumps - Continue, Break and Goto.

*Arrays and Strings:*Declaration, Initializing, Accessing Array Elements in One Dimensional and Multidimensional Arrays, Primitive Operations on Them, Applications of Arrays, Concept of Strings, Array of Strings.

Module III (12 hours)

Functions: Concept of Functions, Defining, Declaring and Calling Functions, Call by Value, Passing Arrays to Functions, Scope and Extent, Storage Classes, Inline Functions, Recursion.

Pointers: Pointer Variable and its Importance, Declaring and Initializing Pointers, Dereferencing, Arrays and Pointers, Pointers and Strings, Pointer Arithmetic, Pointers to Pointers, Array of Pointers, Pointers to an Array, Arrays, Pointers to Functions, Dynamic Memory Allocation.

Module IV (10 hours)

User Defined Data types: Structures, Unions and Enumerations.

Files: Concept of Files, Defining and Declaring a File, Opening and Closing a File, Input/output Operations in

Files, Random Access to Files, Error Handling.

Advanced Features: Command Line Arguments, Working with Pre-Processor Directives.

Text Books:

1. Pradip Dey, Manas Ghosh, "Programming in C", Second Edition, Oxford University Press, 2011. (Module 1: Chapters 1-3, Module 2: Chapters 4-5, Module 3: Chapters 6-7, Module 4: Chapters8-9,11)
2. R.Thareja, "Introduction to C programming, July 2015, Oxford University Press.

Reference Books:

1. Brian W. Kernighan, Dennis Ritchie, "The C Programming Language" (2nd Edition), 1988, Prentice Hall.
2. E. Balagurusamy, "Programming in ANSI C", 4th edition, 2007, McGraw-Hill Publication, New Delhi.
3. K.R. Venugopal, S.R. Prasad, "Mastering C", McGraw-Hill Education India
4. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

HSHM3101	Communicative English	3-0-0	Credit 3

Objectives:

1. To develop the communication skills of the students
2. To improve students' pronunciation in English
3. To enhance the ability to use targeted grammatical structures meaningfully and appropriately in oral and written production
4. To improve their general English knowledge that can assist them towards achieving their goal of effectively communicating in English
5. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills

Module-I (8 hours)

1. The Basics of Communication

Types of communication, The process of communication and factors of communication: sender, receiver, channel, code, topic, message, context, feedback, 'noise', filters and barriers, The importance of audience and purpose, The information gap principle: given and new information; information overload, Verbal and non-verbal communication: body language , Paralinguistic of features, Comparing general communication and business communication

Module-II (12 hours)

2. The sounds of English

Vowels, diphthongs, consonants, consonant clusters, Problem sounds, The International Phonetic Alphabet (IPA); phonemic transcription, , Syllabic division and word stress, Sentence rhythm and weak forms, Contrastive stress in sentences , Intonation: falling, rising and fall-rise tones, Varieties of Spoken English:

Standard Indian, American and British

Module-III (12 hours)

Reading and Writing

Comparing reading and writing

3.1. Reading: Sub -skills of reading

Reading for comprehension, Comprehending the text, Skimming, Scanning, Getting the meanings of unfamiliar words , Note making, Summarising.

3.2. Mechanics of Writing

Process of writing, Paragraph writing, Business and Official Letters (Good news, bad news, Neutral messages), Report and Proposal writing, Notice, Circular and Memo writing, Résumé (CV) Writing.

.

Module-IV (8 hours)

Grammar in Context

Time, Tense and Aspects, Use of Modal Verbs, Passive and Active Voice, Conditionals Reported Speech, Elimination of Common Errors.

Recommended Books:

1. Das, B.K. et al. An Introduction to Professional English and Soft Skills: Cambridge University.
2. Kumar, Sanjay & PuspLata. Communication Skill: Oxford University Press.
3. Conner, J.D.O. Better English Pronunciations : Cambridge University Press.
4. Leech, G.N. and Jan Svartik. A Communicative Grammar of English: OUP.

Reference Books:

1. Raman, Meenakshi. & Sangeeta Sharma .Technical Communication, Principle and Practice: Oxford University Press.
2. Chaturvedi & Chaturvedi. Business Communication- Concepts, Cases & Applications: Pearson.
3. Rai,Urmila. and S M Rai. Communication for Management: HPH.

ESME2113	Engineering Mechanics	3-1-0	Credit 3

Couse Objective:

A working knowledge of statics with emphasis on force equilibrium free body diagrams. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions.

Module 1: **(6)**

Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

Module 2: **(4)**

Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Module 3: **(4)**

Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;

Module 4: **(8)**

Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Module 5: **(6)**

Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Module 6: **(6)**

Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Module 7: **(6)**

Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Text/Reference Books:

1. S. Timoshenko, D.H. Young, J.V. Rao (2017), Engineering Mechanics, 5th Edition, McGraw Hill
2. S.S. Bhavikatti (2016), Engineering Mechanics, New Age International Publishers
3. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
4. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
5. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
6. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University

Press
7. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
8. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
9. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
10. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
11. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
12. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

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

- Use scalar and vector analytical techniques for analyzing forces in statically determinate structures
- Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
- Apply basic knowledge of mathematics and physics to solve real-world problems
- Understand measurement error, and propagation of error in processed data
- Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
- Understand basic dynamics concepts – force, momentum, work and energy;
- Understand and be able to apply Newton's laws of motion;
- Understand and be able to apply other basic dynamics concepts - the Work-Energy principle, Impulse-Momentum principle and the coefficient of restitution;
- Extend all of concepts of linear kinetics to systems in general plane motion (applying Euler's Equation and considering energy of a system in general plane motion, and the work of couples and moments of forces)
- Learn to solve dynamics problems. Appraise given information and determine which concepts apply, and choose an appropriate solution strategy; and
- Attain an introduction to basic machine parts such as pulleys and mass-spring systems.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure and Syllabus for MCA

(2018-19 Admission Batch)

First Semester				Second Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
CAC101	Programming in C	3-0-0	3	CAC201	Data Structures	3-0-0	3
CAC102	Computer Organization and Architecture	3-0-0	3	CAC202	OOPs using C++	3-0-0	3
CAS101	Discrete Mathematics	3-0-0	3	CAC203	Microprocessor & Assembly level language programming	3-0-0	3
CAH101	Management Information System	3-0-0	3				
CAH102	Business Communications	3-0-0	3	CAC204	Operating Systems	3-0-0	3
				CAC205	Computational Mathematics & Numerical Methods	3-0-0	3
				CAH201	Engineering Economics & Costing	3-0-0	3
	Total (Theory)	**15**	**15**		**Total (Theory)**	**18**	**18**
Practical/ Sessional				**Practical/ Sessional**			
CAC103	Extra- Curricular activities & Social Work	0-0-2	2	CAC206	Data Structures Lab	0-0-3	3
				CAC207	OOPs using C++ Lab	0-0-3	3
CAC104	Programming in C Lab	0-0-3	3	CAC208	Microprocessor & Assembly level language programming Lab	0-0-3	3
CAH103	Business Communications Lab	0-0-3	3				
				CAC209	Operating Systems Lab	0-0-3	2
	Total (Practical/ Sessional)	**8**	**8**		**Total (Practical/ Sessional)**	**12**	**11**
	TOTAL	**23**	**23**		**TOTAL**	**30**	**29**
TOTAL SEMESTER CREDITS: 23				TOTAL SEMESTER CREDITS: 29			
TOTAL CUMULATIVE CREDITS: 23				TOTAL CUMULATIVE CREDITS: 52			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure and Syllabus for MCA

(2018-19 Admission Batch)

Third Semester				Fourth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
CAC301	Design & Analysis of Algorithms	3-0-0	3	CAC401	Python Programming	3-0-0	3
CAC302	OOPs using Java (Core)	3-0-0	3	CAC402	Compiler Design	3-0-0	3
CAC303	Formal Language & Automata Theory	3-0-0	3	CAC403	Software Engineering	3-0-0	3
CAC304	Database Management System	3-0-0	3	CAS401	Quantitative Techniques	3-0-0	3
CAC305	Computer Networks & Security	3-0-0	3		**Programme Elective-I (Any one)**	3-0-0	3
CAS301	Applied Probability & Statistics	2-0-0	2	CAE401	Embedded Systems/		
				CAE402	Parallel and Distributed Systems /		
				CAE403	Real Time Systems/		
				CAE404	Machine Learning		
					Programme Elective-II (Any One)	3-0-0	3
				CAE405	Data Mining & Data Warehousing /		
				CAE406	Distributed Database/		
				CAE407	Soft Computing		
	Total (Theory)	**17**	**17**		**Total (Theory)**	**18**	**18**
	Practical/ Sessional				**Practical/ Sessional**		
CAJ301	Internship Evaluation	0-0-2	2	CAC405	Python Programming Lab	0-0-3	3
CAC306	Design & Analysis of Algorithms Lab	0-0-3	3	CAC406	Software Engineering Lab	0-0-3	3
CAC307	OOPs using Java (Core) Lab	0-0-3	3	CAJ401	Seminar	0-0-3	3
CAC308	Database Management System Lab	0-0-3	3				
CAC309	Computer Networks & Security Lab	0-0-3	2				
	Total (Practical/ Sessional)	**14**	**13**		**Total (Practical/ Sessional)**	**9**	**9**
	TOTAL	**31**	**30**		**TOTAL**	**27**	**27**
TOTAL SEMESTER CREDITS: 30				TOTAL SEMESTER CREDITS: 27			
TOTAL CUMULATIVE CREDITS: 82				TOTAL CUMULATIVE CREDITS: 109			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure and Syllabus for MCA

(2018-19 Admission Batch)

Fifth Semester				Sixth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
CAC501	Computer Graphics	3-0-0	3	CAH601	Entrepreneurship Development	2-0-0	2
CAC502	Artificial Intelligence	3-0-0	3				
CAH503	Personality & Soft Skill Development	3-0-0	3	CAH602	Accounting Information System	3-0-0	3
	Programme Elective-III (Any One)	3-0-0	3				
CAE501	PHP & SQL Programming/						
CAE502	Android Programming/						
CAE503	Advance Java Programming						
	Open Elective-I (Any One)	3-0-0	3				
CAO501	Cloud Computing/						
CAO502	IOT & Big Data/						
CAO503	Wireless Sensor Networks						
	Total (Theory)	**15**	**15**		**Total (Theory)**	**5**	**5**
	Practical/ Sessional				**Practical/ Sessional**		
CAC504	Computer Graphics	0-0-3	3	CAJ601	Project	0-0-20	18
	Programme Elective-III Lab (Any One Corresponding Lab)	0-0-3	3				
CAE504	PHP & SQL Programming Lab/						
CAE505	Android Programming Lab/						
CAE506	Advance Java Programming Lab						
CAJ501	Internship Evaluation	0-0-3	2				
Total (Practical/ Sessional)		**9**	**8**	**Total (Practical/ Sessional)**		**20**	**18**
	TOTAL	**24**	**23**		**TOTAL**	**25**	**23**
TOTAL SEMESTER CREDITS: 23				TOTAL SEMESTER CREDITS: 23			
TOTAL CUMULATIVE CREDITS: 132				TOTAL CUMULATIVE CREDITS: 155			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year MCA (2018-19 Admission Batch)

1st Semester

CAC101	Programming in C	3-0-0	Credit 3

Course Objectives:

The course is designed to provide a complete knowledge of C language. Students shall be able to develop logic which will help them to create programs, applications in C. Also, by learning the basic programming constructs they can easily switch over to any other language in future.

MODULE I **(10 Hours)**

Introduction to Computers:
Basic Organization of a Computer, Number System, Conversion, 1's and 2's complements Fixed-point and Floating-point representations.

Introduction to C Programming:
Algorithms and Flowcharts, Evolution of Programming form Machine-level to High-level, Structured Programming Approach, Structure of a C Program, Compiling, Linking and Executing Programs.

C Language Basics:
Character Set, Key Words, Identifiers, Data Types, Variables and Constants, Operators, Expressions, Type Conversions, Statements, Managing Console Input and Output Operations.

MODULE II **(8 Hours)**

Control Structures:
Decision Making and Branching - If, Nested if-else and Switch, Loop Structures - While, Do-While and For, Unconditional Jumps - Continue, Break and Goto.

Arrays and Strings:
Concept of Arrays, Declaration and Manipulation of Arrays, One Dimensional and Multidimensional Arrays, Applications of Arrays, Concept of Strings, String Handling Functions, Array of Strings.

MODULE III **(12 Hours)**

Pointers:
Pointer Variable and its Importance, Dereferencing, Pointer Arithmetic and Scale Factor, Pointers and Arrays, Pointer and Strings, Array of Pointers, Pointers to Pointers.

Functions:
Designing Structured Programs, User Defined and Standard Functions, Formal and Actual Arguments, Function Prototype, Parameter Passing, Functions Returning Multiple Values, Functions Returning Pointers, Pointers to Functions, Nesting of Functions, Recursion, Passing Arrays to Functions.

Scope and Extent:
Scope Rules, Storage Classes - Auto, Extern, Register and Static.

MODULE IV **(10 Hours)**

Structures, Unions and Enumerations:
Declaration and Initialization of Structures, Structure as Function Parameters, Structure Pointers, Unions, Enumerations.

File Input and Output:
Defining a File, Opening and Closing a File, Input/output Operations in Files, Random Access to Files, Error Handling.
Command Line Arguments, Dynamic Memory Management, Pre-Processor Directives.

Text Books:

1. E. Balagurusamy, "Programming in ANSI C", 4th edition, 2007, McGraw-Hill Publication, New Delhi. (Module 1: Chapters 1-4, Module 2: Chapters 5-8, Module 3: Chapters 9, 11, Module 4: Chapters 10, 12-14)
2. R.Thareja, "Introduction to C Programming, 2nd Edition,July 2015, Oxford University Press.

Reference Books:

1. Pradip Dey, Manas Ghosh, "Programming in C", Second Edition, Oxford University Press, 2011.
2. Brian W. Kernighan, Dennis Ritchie, "The C Programming Language" (2nd Edition), 1988, Prentice Hall.
3. K.R. Venugopal, S.R. Prasad, "Mastering C", McGraw-Hill Education India
4. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

Course Outcomes:

CO1: Develop flowcharts and algorithms for given problems and implement them through C programs.
CO2: Use operators, control structures and arrays to write C programs.
CO3: Exercise user-defined functions to solve given problems.
CO4: Inscribe C programs that use pointers, structures and unions.
CO5: Implement the file operations in C programming for a given application.

CAC102	Computer Organization and Architecture	3-0-0	Credit 3

Course Objectives:

To understand the functions and design of various units of digital computers to store and process the information, fundamental concepts of processing units, concepts of various memory systems, input/output, Interrupts.

MODULE I **(10 Hours)**

Number system –
Binary, decimal, octal, hexadecimal, Conversion - Binary to decimal, decimal to binary, octal to decimal , decimal to octal, octal to binary, binary to octal, hexadecimal to binary, binary to hexadecimal, hexadecimal to Decimal, decimal to hexadecimal, hexadecimal to octal, octal to hexadecimal,

Binary arithmetic –
Addition, subtraction (simple method),

Logic gates –
AND, OR, NOT, NAND, NOR, Exclusive-OR, Exclusive NOR,

Combinational circuits –
Design of Combinational Circuits – Adder / Subtracter – Encoder – Decoder – MUX / DEMUX, Flip-Flops, Counters, Registers

MODULE II **(10 Hours)**

Basic Computer Organization and Design:
Instruction codes, computer registers, computer instructions, timing & control, instruction cycle, memory reference instructions, input-output and interrupts, design of basic computer, design of accumulator logic.

Microprogrammed Control Unit:
Control memory, address sequencing. **Central Processing Unit**: Introduction, general register organization, stack organization, instruction formats, addressing modes.

MODULE III **(10 Hours)**

Pipeline and Vector processing:
Parallel Processing, pipelining, arithmetic pipeline, RISC Pipeline, Vector Processing, Array Processors.

Input-Output Organization:
Peripheral devices, input-output interface, asynchronous data transfer, modes of data transfer, priority interrupt, direct memory access, input-output processor

MODULE IV **(10 Hours)**

Memory organization:
Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.

Multiprocessors:
Characteristics of multiprocessor, Interconnection Structure, Interprocessor Communication & Synchronization.

Text Books:

1. M. Mano, "**Computer System and Architecture**", 3rd Edition, PHI Publication.
2. W Stallings, "**Computer Organization & Architecture**", PHI Publication.

Reference Books:

1. J. P. Hayes, "**Computer Architecture and Organization**", McGraw Hill Publication.
2. Carl Hamachar, Zvonko Vranesic, Safawat Zaky, "**Computer Organization**" Tata McGraw Hill Publication
3. V. Rajaraman, T. Radhakrishnan, "**Computer Organization and Architecture**", PHI Publication.

Course Outcomes:
1. To know about number system and arithmetic operations over it.
2. To know the basics computer organization and its design.
3. Understanding pipeline and vector processing.
4. To know about the memory organization.

CAS101	Discrete Mathematics	3-0-0	Credit 3

MODULE-1 **(07 Hours)**

Logic:
Propositions and logical Operations, Conditional statements; Predicate Calculus-First order logic, universal and existential quantifiers; Proof Techniques- methods of proof, Mathematical induction, recurrence relations.

MODULE-II **(10 Hours)**

Relation and Diagraphs-
Properties of relations, composition of relations, closure operation on relations, equivalence relations and partitions, paths in relation and diagraphs, Operations on relations, Transitive closure and Warshall's Algorithm. Partial ordered sets (poset), Hasse diagram, External elements of partially ordered sets Functions, Functions for computer science, Growth of functions, Permutation functions.

MODULE-III **(13 Hours)**

Directed and undirected graphs, basic terminology, paths and circuits, Eulerian paths and circuits, Hamiltonian paths and circuits, Transport Network, Graph coloring. Trees: definition and properties, rooted trees, tree traversals preorder, inorder, postorder, binary trees, labeled trees, spanning trees, cut sets, Graph traversals , BFS and DFS, Minimum cost spanning trees-Prim's and Kruskal's algorithm, Shortest paths in weighted graphs- Dijkstra's algorithm.

MODULE-IV **(12 Hours)**

Binary operations, semi-groups and groups, subgroups, cosets, Lagrange's theorem, Product and quotient semi-groups and groups, Normal subgroup, Homomorphism; coding of binary information and error detection, group codes, decoding and error correction. Lattices, finite Boolean algebra, functions of Boolean algebra.

Text Books:

1. Bernard Kolman, Robert Busby, Sharon C. Ross, *Discrete Mathematical Structures*, Sixth Edition, 2008, Pearson Education Inc., New Delhi. / Prentice Hall of India (PHI) Pvt. Ltd., New Delhi. Ch.2(2.1-2.4), 3(3.5), 4(4.1-4.5,4.7,4.8), 5, 6(6.1-6.5), 7(7.1,7.2,7.5), 8(8.1-8.4,8.6), 9(9.1-9.5), 11(11.1-11.3

Reference Books:

1. Kenneth H. **Rosen**, *Discrete Mathematics and Its Applications*, Sixth Edition, 2008, Tata McGraw-Hill (TMH) Publications Pvt. Ltd., New Delhi.
2. D. S. **Malik** & M. K. Sen, *Discrete Mathematical Structures*, First Edition, 2005, CENGAGE Learning India Pvt. Ltd., New Delhi.
3. Richard **Johnsonbaugh**, Discrete Mathematics, Seventh Edition, 2008, Pearson Education Inc., New Delhi.

CAH101	Management Information System	3-0-0	Credit 3

Course Objectives:

1. Describe the type and appropriate model of wireless fading channel based on the system parameters and the property of the wireless medium.
2. Analyze and design receiver and transmitter diversity techniques.
3. Determine the appropriate transceiver design of multi-antenna systems and evaluate the data rate performance.
4. Distinguish the major cellular communication standards (1G/2G/3G systems).

MODULE-1 **(08 Hours)**

Introduction to Management Information System: What is information and information system, what is Business? Why information System, perspectives of information system, contemporary approaches to information system, learning to use information system- key management issues, system approach to problem solving.

MODULE-II **(10 Hours)**

Information System in the enterprise: Major types of information system, systems from a functional perspective, integrating functions and business processes, Management system for linking the Enterprise.

MODULE-III **(10 Hours)**

Information systems, organizations, management and strategy: Organizations and
information systems, how information system impact organizations and business firms, impact of IT on management decision making, management information system and business strategy for competitive force, Internet impact on competitive advantage, value chain model, synergies, core competencies and network based strategies.

MODULE-IV **(12 Hours)**

The digital farm: Electronic Business and electronic commerce and digital farm, e- Commerce, e-Business and digital farm, management opportunities, challenges and solutions,
Ethical and social issues in information system: ethics in an information society, moral dimensions of information system.
IT infrastructure and Platforms: IT infrastructure, infrastructure component, contemporary hardware platform trend, contemporary software platform trends.
Organizing data in a traditional file environment: database approach to data management.
Telecommunications, network and the internet: contemporary networking infrastructure, Internet.

Text Books:

1. Management Information Systems by Kenneth C Laudon- Prentice Hall.

Reference Books:

1. James A. O'Brien, George M. Marakas, "ManagementInformation Systems", Eighth Edition, 2008, McGraw-Hill.
2. James A. Senn "Analysis and Design of Information Systems",McGraw-Hill Education, New Delhi.

Course Outcomes:

1. Understand what information is, what business is and how information is key to successful execution of a business firm.
2. understand role of various information systems in business processes
3. identify, describe and analyze role of IT in business problems from organizational and management aspects
4. understand the electronic business, build and manage information system for local and global business scenarios ethically ,organization of data and communication

CAH102	Business Communications	3-0-0	Credit 3

Course Objectives:

1. To develop communication skills and soft skills of students.
2. To enhance the ability to use targeted grammatical structures meaningfully and appropriately in oral and written production
3. To improve their general English knowledge that can assist them towards achieving their goal of effectively communicating in English.
4. To enhance the ability of students to participate in group discussion and personal interviews.
5. To familiarize the student with the sounds of English in a nutshell, particularly long and short vowels, some consonants, stress and intonation.

MODULE-1 **(08 Hours)**

Introduction to business communication: Meaning, importance, the process of communication, principles of communication, verbal and nonverbal communication, barriers to communication, channels of communication, cross cultural communication. Difference between Professional and General communication.

MODULE-II **(12 Hours)**

The Sounds of English:
Vowels, diphthongs, consonants, consonant clusters
The International Phonetic Alphabet (IPA); phonemic transcription.
Problem sounds
Syllabic division and word stress
Sentence rhythm and weak forms
Contrastive stress in sentences to highlight different words
Intonation: falling, rising and falling-rising tones

Functional Grammar: verbs, Tense, Voices, conditionals, concord, direct and indirect speech, Elimination of common errors.

MODULE-III **(10 Hours)**

Paragraph Writing, Coherence and Cohesion, Business letters, Job Application, Letters, Resume
Reports- Types, Format, Choice of Vocabulary, Proposals: Purpose, Types, Characteristics, Structure

MODULE-IV **(10 Hours)**

Oral presentations, Interviews, Group discussion, Soft skills, Business Etiquette.

Text Books:

1. Das,B.K. et al. An Introduction to Professional English and Soft Skills: Cambridge University.
2. Kumar, Sanjay & PuspLata. Communication Skill:Oxford University Press.
3. Conner, J.D.O. Better English Pronunciations: Cambridge University Press.
4. Leech,G.N. and Jan Svartik. A Communicative Grammar of English: OUP.

Reference Books:

1. Raman, Meenakshi. & Sangeeta Sharma .Technical Communication, Principle and Practice: Oxford University Press.
2. Chaturvedi & Chaturvedi. Business Communication- Concepts, Cases & Applications: Pearson.
3. Rai, Urmila and S M Rai. Communication for Management: HPH.

Course Outcomes:

1. Demonstrate preparation and research skills for oral presentations
2. Develop proper listening skills
3. Articulate and enunciate words and sentences clearly and efficiently
4. Show confidence and clarity in public speaking projects
5. Demonstrate ability to gather information and apply it to persuade or articulate one's own point of view
6. Understand the rules of spelling and grammar
7. Read and analyze text and be able to summarize ideas in writing
8. Organize thoughts in a manner that emphasizes flow and paragraph development
9. Understand different writing techniques

CAC104	Programming in C Lab	0-0-3	Credit 3

Experiment List

At least five C programs from each of the following

1. Tokens, data types and type casting, operators and expressions.
2. Console input and output.
3. Decision control structures - if, nested if-else, switch.
4. Loop controls - while, do-while and for.
5. Unconditional jumps - continue, break, goto.
6. Various operations on one-dimensional arrays and matrixes.
7. Strings and string-handling functions.
8. Pointers, address operators and pointer arithmetic, pointers to arrays, pointers to pointers.
9. Modular program development using functions, recursion, pointers to functions.
10. Structures, unions and enumerations, accessing their members, pointers to structures and unions.
11. Files and file operations, standard streams.
12. Command line arguments.
13. Dynamic memory allocation and de-allocations.
14. Different pre-processor directives.

CAH103	Business Communications Lab	0-0-3	Credit 3

Experiment List

1. Communication process and the major types of written, verbal and nonverbal communications used in business and professional communication.
2. Compose a letter or memo using clear, concise language as required for a defined audience.
3. Types of business messages that may include good news, unfavorable news, persuasive messages, sales messages, or general information.
4. Business reports or proposals that demonstrate the ability to gather, organize and present information.
5. Prepare and deliver an oral business presentation in a clear, confident, and effective manner, with visual aids (if needed).
6. Interpersonal communication skills needed to build interpersonal cooperation in the business environment including meetings and work teams.
7. Communication principles and processes that improve the effectiveness of an organization's communication climate.
8. Strategies for communicating across cultures.

	Extra- Curricular activities & Social Work	0-0-2	Credit 2

Objective:

Extra-curricular activities (ECA) are activities that take place outside regular class teaching and yet are related to student learning. As such, they fall within the scope of the college curriculum. ECA take care of the students' different developmental needs such as their sense of moral values and attitudes, skills and creativity. Through their participation in ECA, students can learn to communicate, to cooperate with other people and in addition to enrich their life experience. If students are given the opportunities to organize ECA, they will gain first-hand experience of programme planning and leadership, thus enabling themselves to discover and develop their potential.

Experiment List

Activities:

Social Skills and Awareness

- Interaction with Eminent Personalities
- Elocution
- Picnics
- Self-reliance Programme
- Career Guidance
- Dramatics
- Out Station Excursions
- Camp Fire Interactions
- Assembly Talks
- Team-building Games such as Dumb Charades, Fish Bowl etc.
- Talent Search Activities

- Mock Interviews
- Mock parliament
- College Departments' Management
- Student Club Activities
- Inter-school Festivals & Competitions
- Market Surveys

Social Responsibility

- Socially Useful Productive Work (SUPW)
- Campus Maintenance
- Rural Medical Camps
- Leadership Training
- Life Skills Training
- Adult Education
- Green Corps – Environment Programme
- Rural Upliftment Programmes
- Visit to Old-age Homes
- AIDS Awareness Campaigns
- Eradication of Child Labour

1. Each student is required to take computer awareness class of nearby primary Oriya medium and English medium students. Creative work shall be encouraged. Plantation inside institute campus may be taken as the social work. Each student is required to submit a report with colour photographs pasted for authentication and evaluation.

Course Objectives:

1. reinforcing classroom learning and allowing students to put their knowledge and skills into practice;
2. facilitating the teaching of certain skills and the inculcation of certain values which may present difficulties in a formal classroom setting;
3. promoting students' personal development by broadening their interests, developing their potential and providing opportunities for character formation and leadership training;
4. promoting students' social development by offering opportunities for the broadening of their social experiences, the practice of social skills and the internationalization of moral and social values; and
5. making school life more challenging and interesting.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year MCA (2018-19 Admission Batch)

2nd Semester

CAC201	Data Structures	3-0-0	Credit 3

Course Objectives:

The course is designed to provide a concrete knowledge of different data structures. Students shall be able to choose the appropriate data structure for specified problems and learn the efficient way of organizing and operating with a large amount of data. It will also help the students to efficiently implement the different data structures in various other domains like database management system, compiler construction etc.

MODULE I **(08 hours)**

Fundamentals: Introduction to Data Structures, Classification of Data Structures, Algorithms, Measuring Space and Time Complexities, Asymptotic Notations, Abstract Data Types.
Arrays: Storage Structures for Arrays, Sparse Matrixes, Strings, Pattern Matching.

MODULE II **(12 hours)**

Linked Lists: Dynamic Memory Management, Single Linked Lists, Double Linked Lists, Circular Linked Lists, Operations on Polynomials.
Stacks and Queues: Representation, Linked Stacks and Queues, Operations on Stacks and Queues, Applications of Stack and Queues.

MODULE III **(10 hours)**

Trees: Terminology, Representation, Binary Trees, Binary Search Trees, Searching, Insertion and Deletions Operations in a Binary Search Tree, Height-Balanced Trees, M-way Search Trees, B-Trees, B+ Trees, General Trees, Representation of General Trees and Binary Trees, Forests, Application of Trees.

MODULE IV **(10 hours)**

Graphs: Terminology, Representation, Path Matrix, Graph Traversal, Shortest Path Problems, Topological Sort.
Searching and Sorting Techniques: Linear and Binary Search, Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Heap and Heap Sort, Radix Sort, Comparison of Sorting Techniques.
Hashing: Hash Functions and Hashing Techniques.

Text Book:

1. Seymour Lipchitz. “Data Structures”, TMH (2010). (Module 1: Chapters 1-4, Module 2: Chapters 5-6, Module 3: Chapter 7, Module 4: Chapters 8-9)
2. R.Thareja, “Data Structures Using C”, June 2014,Oxford University Press

Reference Books:

5. Tremblay, Jean-Paul, and Paul G. Sorenson, "An introduction to data structures with applications", McGraw-Hill, Inc., 1984.
6. Alfred V. Aho, John E. Hopcropt& Jeffrey D. Ullman,“Data Structures and Algorithm”, First Edition, 1983, Pearson Education Inc., New Delhi.

Course Outcomes:

CO1: Identify different data structures suitable to solve problems and understand the concept of ADT.
CO2: Analyze algorithms to determine their correctness and time efficiency.
CO3: Understand the linear data structures such as arrays, stacks, and queues and apply them to solve specific computational and real-life problems.
CO4: Learn the concept and different operations applicable to trees and graphs.
CO5: Understand basic searching, sorting and hashing techniques.

CAC202	OOPs using C++	3-0-0	Credit 3

MODULE I

Software Crisis – Software Evolution – Basic Concepts of Object-Oriented Programming – Benefits of OOP – Object-Oriented Languages - Applications of OOP – Application of C++ - Structure of a C++ Program – Tokens – Keywords – Identifiers – Basic Data Types – User defined Data types – Derived data types – Symbolic constants – Type compatibility – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ - Manipulators – Type cast operator – Expressions and their types- Implicit conversions – Control structures – The main function – Function prototyping – inline functions – Function overloading.

MODULE II

Specifying a class – Defining member functions – Making an outside function inline – Nesting of member functions – Private member functions – Array within a class – Memory allocation for objects – Static data members – Static member functions – Array of objects - Objects as function arguments – Friendly functions – Returning objects – Constant member functions – Constructors – Parameterized constructor – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Destructors.

MODULE III **(10 Hours)**

Defining operator overloading – Overloading unary operators – Overloading binary operators – Overloading binary operators using friend function – Rules for overloading operators - Defining derived classes – Single inheritance – Making a private member inheritable – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance - Virtual base classes – Constructors in derived class – Member classes: Nesting of classes.

MODULE IV

Pointer to objects – this pointer – Pointers to derived classes – Virtual functions – Pure virtual functions – C++ Stream classes – Unformatted I/O operations – Managing output
with manipulators.

MODULE V

Classes of file stream operations – Opening and Closing files – Detecting end of file – More about open() function – File modes, File pointers and their manipulation – Sequential input and output operations –

Command-line arguments- Templates: class templates and function templates.

Text Books:

1. Object Oriented Programming with C**++,** E. Balagurusamy, Sixth Edition-2013, McGraw Hill Education (India) Private Limited, New Delhi.

UNIT I – Chapter 1 (Except 1.3, 1.4),
Chapter 2 (Only 2.6),
Chapter 3 (Except 3.20, 3.21, 3.22), Chapter 4
UNIT II – Chapter 5 (Except 5.18, 5.19), Chapter 6 (Except 6.8, 6.9, 6.10)
UNIT III – Chapter 7, Chapter 8
UNIT IV – Chapter 9, Chapter 10
UNIT V – Chapter 11 (Except 11.8), Chapter 12 (Only 12.2, 12.3 and 12.4)

Reference Books:

3. C++ - The Complete Reference, Herbert Schildt, TMH, 1998.
4. C++ How to Program, Paul Deitel, Harvey Deitel, PHI, Ninth edition (2014).
5. Ashok N.Kamthane, Object Oriented Programming with ANSI & Turbo C ++,Pearson Education, 2006.
6. Object-Oriented Programming With C++, Poornachandra Sarang, 2nd Edition, PHI Learning Private Limited, New Delhi, 2009.
7. Object-Oriented Programming Using C++, Alok Kumar Jagadev, Amiya Kumar Rath and Satchidananda Dehuri, Prentice-Hall of India Private Limited, New Delhi, 2007.

CAC203	**Microprocessor & Assembly level language programming**	**3-0-0**	**Credit 3**

Course Objectives:

To understand the functions and design of various units of Microprocessor, fundamental concepts of instruction sets and assembly language programming

MODULE I **(12 Hours)**

History of Microprocessor ,8085 Architecture and Register Organization, Fundamental block Diagram, Bus Organization, registers, ALU, Control section, pin diagram,8085 Instruction Set, Instruction Classifications, Instruction word size, Instruction format, Addressing Modes, Assembly Language Programming. Flip-Flops. Memory, I/O devices, Addressing memory and I/O Devices, Memory Mapping, Memory Interfacing, Tri-State Devices, Buffers.

MODULE II **(10 Hours)**

Introduction to Advanced Instructions, Instruction Cycles, Machine Cycle, Fetch Cycle, Timing Diagram, Stack and Subroutine, Counter and Time delay, Debugging .Programming Techniques with Additional instructions : Looping, Counting, Indexing.

MODULE III **(10 Hours)**

Interfacing Chips: 8255A (PPI), 8155(Multipurpose Programmable Device), Interrupts, 8259A (PIC), Serial I/O and Data Communication, Serial Data Communication Standard (RS 232C) 8257 or 8237A (DMA Controller), 8251A (USART) .

MODULE IV **(08 Hours)**

16 Bit Processor 8086: Introduction, Architecture, Pin Diagram, Min and Max Mode, Addressing Modes.

Text Books :

1. Ramesh S Gaonkar, "Microprocessor Architecture Programming and Application with the 8085" Penram International Publishing (India)

Reference Books:

1. B. Ram, "Fundamentals of Microprocessor and Microcomputers", Dhanpat Rai Publication.
2. Nagaoor Kani, "Microprocessors and Microcontrollers",Mc Graw Hill Education

Course Outcomes:

1. To know the pin configuration of Microprocessor.
2. To know about the Instruction sets and operation over their operation.
3. To know about the addressing modes.

CAC204	Operating Systems	3-0-0	Credit 3

Course Objectives:

The objective of the course is to **u**nderstand fundamental operating system terminologies like processes, threads, files, semaphores, IPC , shared memory regions, etc., to understand how the operating system abstractions can be used in the development of application programs, or to build higher level abstractions. Understand the principles of concurrency and synchronization, resource management techniques

MODULE I **(10 Hours)**

Introduction to OS: Definition, Evolution and Types of Operating System, user's view & System view of Operating system, Hardware protection: Dual mode operation, I/O protection, Memory Protection, CPU protection. System components of operating system, operating system services, Understanding System calls with examples.

MODULE II **(10 Hours)**

Process Management: Process Identification & its state, PCB, Process Scheduling: scheduling criteria, different types of scheduler: long term, short term, medium term, Types of scheduling: Pre-emptive, Non-pre-emptive, FCFS,SJF, SRTF, Round Robin, Priory scheduling, multilevel queue scheduling, multilevel feedback queue scheduling, Real time scheduling, context switching, Process creation, Inter Process Communication. Process Synchronization: Cooperating process, Critical Section problem and solution for two processes and multiple process. Semaphore. Classic synchronization Problems: Producer-Consumer, Reader-Writer, Dining philosopher. Deadlock: Necessary condition, RAG, methods to handle deadlock: Prevention, detection and avoidance algorithms, Recovery from deadlock. Introduction to Threading.

MODULE III **(10 Hours)**

Memory Management: Address binding, Logical-vs-physical address space, Swapping, Contiguous memory allocation, Fragmentation, Non-contiguous memory allocation: paging, segmentation, H/W support for Paging & Segmentation, Protection and sharing in paging & segmentation .Virtual Memory: demand paging, Page replacement policy: FIFO, LRU, Optimal, Belady's anamoly, allocation of frames, thrashing

MODULE IV **(10 Hours)**

File Management: File attribute, File operations, file access method, File protection, File system structure, directory implementation, Allocation methods. Disk Management: Disk Structure, Disk scheduling.

Text book:-

3. Operating System Concept by Galvin Silverscatz Gagne, Wiley Publication

Reference Book:

1. Modern *Operating System*, A.S.Tanenbaum ,PHI Publishers

Course Outcomes:

1. To know about the requirement of OS.
2. To know about the process and its Management.
3. To know about the memory management.
4. To know about the creation of file and its management.

CAC205	Computational Mathematics & Numerical Methods	3-0-0	Credit 3

MODULE-1 **(10 Hours)**

Computer arithmetic, errors, significant digits, machine computation, numerical solution of algebraic and transcendental equations by simple iteration method, Bisection method, Regula-falsi method, Newton-Raphson method and their rate of convergence.

MODULE-II **(08 Hours)**

Solution of simultaneous linear system of equations by Cramer's Rule, Stability, Gauss- elimination method, Gauss-Jordan method, Matrix inversion by Gauss-Jordan method, LU decomposition, Iterative method for solving linear equations by Gauss-Jacobin and Gauss-Seidel method, Eigen value & Eigen vector problems.

MODULE-III **(12 Hours)**

Interpolation: Newton's forward and backward interpolation formulae, Lagrange's interpolation formula, divided differences, Newton's divided difference formula, Inverse interpolation. Numerical differentiation based on Newton's forward and backward interpolation formula, Numerical integration by Trapezoidal rule, Simpson's1/3 rd rule, Simpson's 3/8 rule, error estimates of the rules, Gaussian quadrature formulae (2-point,3-point and 4-point).

MODULE-IV **(12 Hours)**

Numerical solution of ordinary differential equation using Taylor Series method, Euler method, Modified Euler's method, Picard's method, Runge-Kutta method of order two and four, Predictor Corrector methods.

Text Books:

4. 1.*M.K.JAIN, S.R.K.IYENGER,R.K.JAIN,* Numerical methods for scientific and engineering computation, New Age International Limited Ch.1(1.1-1.4),2(2.1-2.3,2.5),3(3.1,3.2,3.4,3.5), 4(4.1,4.2), 5(5.6,5.8), 6(6.3,6.4,6.7)

Reference Books:

1. S. Rajasekaran, "Numerical methods in Science and Engineering: a practical approach", S. Chand and company Ltd., New Delhi. Chapters: 1, 3.0-3.4, 4.1, 4.2, 4.4, 7.0-7.7, 9.0-9.4, 9.6, 9.8, 10.0, 10.2, 10.5, 11.0-11.7, 11.9
2. T. Veerarajan and T. Ramachandran, Theory and problems in Numerical methods, Tata McGraw-Hill Publications, New Delhi. Chapter-9.
3. W. Chenny and D. Kincaid, "Numerical Mathematics and Computing", CENGAGE publication
4. J. H. Mathews, " Numerical methods for Mathematics, Science and Engineering", PHI publication

CAH201	Engineering Economics & Costing	3-0-0	Credit

Course Objectives:

1. Learning objective of managerial economics is to understand concept and nature of managerial economics & its relationship with other discipline (concepts of demand and supply).
2. The learner is equipped with the knowledge of estimating demand for a product & the relationship between price & demand.
3. Different types of cost & how to analyze a project economically (With the help of Break even analysis & capital budgeting).
4. Understand the nature of computation, characteristics of planning in the different market structure as well as Fiscal policy, Inflation & concept Business Cycle.

MODULE-1 **(08 Hours)**

Nature and Scope of Managerial Economics, Role and Responsibility Of Managerial Economics. The Fundamental Concept of Managerial Economics, Theory of the Firm And The Role Of Profits Theory Of Demand Concept, Determinants Of Demand, Demand Functions. Theory of Supply-Concept, Determination, Analysis, Supply Function. Elasticity of Demand-Concept, Measurement, Concept of Consumer Surplus.

MODULE-II **(12 Hours)**

Analysis & Cost Estimation- Economic Concept of Cost, Different Types of Cost. Cost Function- Long Run Short Run Cost, Break-Even Analysis, Make Or Buy Decision, Capital Budgeting..

MODULE-III **(08 Hours)**

Market Structure and Pricing Decisions- The Perfectly competitive market and Monopoly market Model, Monopolistic Competition and Oligopoly.

MODULE-IV **(12 Hours)**

National income: Theory, Concept and Measurement, Business Cycles, Fiscal Policy, Inflation.

Text Books:

1. H. L. Ahuja, Managerial Economics (S. Chand)
2. Dr. N. Appa Rao, Dr. P. Vijay, Managerial Economics & Financial Analysis (Cengage Publication New Delhi-2011

Reference Books:

1. V. Maheswari, Managerial Economics (S. Chand)
2. S.A. Siddigri & A.S. Siddigri, Managerial Economics & Financial Analysis (New Eye International Publishers, 2012)

Course Outcomes:

1. Understand the internal and external decisions to be made by managers
2. Design competition strategies, including pricing, product differentiation, research & development and marketing, according to the natures of products and the structures of the markets.
3. Analyse real-world business problems with a systematic theoretical framework.

CAC206	Data Structures Lab	0-0-3	Credit 3

Experiment List

Implementation of the following through C/C++ programming

1. One-dimensional array and matrix operations -traverse, insert, delete, search, sort, merge, add, multiply, transpose etc.
2. Sparse matrix operations - transpose, convert to 3-tuple form etc.
3. Single, double and circular linked list operations - create, traverse, insert, delete, search, sort, merge.
4. Stack operations using arrays.
5. Implementing a stack using a linked list.
6. Implementing infix, prefix and postfix notations using stacks.
7. Queue operations using arrays.
8. Implementing queues using linked lists.
9. Implementing a circular queue, priority queue and dequeue using linked lists.
10. Binary search tree operations - insert, delete, traverse(pre-order, in-order, post-order).
11. Heap & AVL tree implementations.
12. Graph representation with matrix and adjacency lists.

13. Linear & binary search.

14. Sorting techniques - bubble sort, insertion sort, selection sort, merge sort, quick sort, heap sort.

15. Implementing set related operations and hashing.

CAC207	OOPs using C++ Lab	0-0-3	Credit 3

Experiment List

1. Programs on concept of classes and objects.(1 class)
2. Programs using inheritance. (1 class)
3. Programs using static polymorphism. (1 class)
4. Programs on dynamic polymorphism. (1 class)
5. Programs on operator overloading. (1 class)
6. Programs on dynamic memory management using new, delete operators.(1 class)
7. Programs on copy constructor and usage of assignment operator. (1 class)
8. Programs on exception handling. (1 class)
9. Programs on generic programming using template function & template class.(1 class)
10. Programs on file handling. (1 class).

CAC208	Microprocessor & Assembly level language programming Lab	0-0-3	Credit 3

1. Verification on 8085 Instruction set.
2. Addition, Subtraction, Multiplication & Division of tow 8-bit numbers
3. Development of code conversion Programs:
   a) Binary to Gray
   b) Gray to Binary
   c) ASCII to Binary
   d) Binary to ASCII
4. Identification of the ports and pins of I/O ports of Intel 8255.
5. Generation of Square, Triangular and Sinusoidal waveforms using DAC.
6. Study of Interrupt RST 7.5.
7. Stepper Motor control using 8085 Microprocessor

CAC209	Operating Systems Lab	0-0-3	Credit 2

1. Introduction to software, operating system, types of operating system, history of operating system, different features of operating system, introduction to Unix, Linux.
2. Unix file system, difference between Unix and Windows operating system, Installation of Unix.
3. What is shell, practical implementation of some commands like who, who am I, date, cal, pwd, uname, passwd, man commands
   1. Display the user connected to the server.
   2. Display the terminal information about your terminal connection.
   3. Create a directory IGIT.
   4. Write the command to see the calendar of previous, current, next month of the current year.
4. Use of commands like – mkdir, cd, cat, touch, cp, rmdir, rm, mv, wc, File
   1. Write the command to create a file in your name in your directory and write 5 lines into that file and

save it.

2. What will cat file1 file1 file1 file1 display, where file1 is a file name?
3. Using cat display contents of a file with numbering each line.
4. Create blank files t1, t2, t3, t4 in one command.
5. What will be the output of wc*?

5. Use of commands like – comm, diff, ls command with details, chmod commands with details, pipeline.
   1. Display all filenames containing 6 characters.
   2. Display all filenames whose starting letter is not p, q, r.
   3. Give write, execute permission to owner, read, write, execute permission to group and no permission to others to a specific file.
   4. Write the commands to see the details of a particular file.
   5. Write the commands to display the day of the week.
6. Input/output redirection operator-Input, Output, Append, Filter command- head, tail, cut,paste, sort.
   1. Write the command to read a file and count the no. of line in one command.
   2. What is the output of wc<file1>file2, where file1 is the exiting file and file2 is the new file.
   3. Write the output for wc>filename where filename is the new file name.
   4. Create two file and sorting that two file and store it in another new file.
   5. Use head and tail command to select the line no.5 to the end of particular file.
7. Use of come commands like- tr, uniq commands with details, grep command with details, more, less, find.
   1. Search the line in a specified file whose starting letter is not ‘a’.
   2. Remove repeated lines from a file.
   3. Convert the contents of the specified file into upper case.
   4. How to navigate a page when you read file, if the page size is more.
   5. Display the unique value of a particular file.
8. About vi editor, input mode, command mode, executable mode, text deletion in command mode, saving and quitting text in ex mode, navigation movement in command mode, pattern search and replace.
   1. How to append file1 to file2?
   2. How do you delete from wherever you are to the bottom of the page?
   3. How do you insert a file inside the another line at a particular part of the file?
   4. Create a file with 10 lines. Search a pattern “this” and it is replaced by “that” in the whole file.
   5. Display the no. of characters of 1^{st} 3 lines of a particular file.
9. About shell programming, shell variable, user created variable.
   1. Write a shell script program to compare two files.
   2. Write a shell script program for counting words of a file.
   3. Write a shell script program for rename a file.
   4. Write a shell script program to display date, calendar, present working directory and user name.
   5. Write a shell script program to enter 2 numbers and perform addition, subtraction, multiplication and division.
10. Shell programming using if condition, nested if condition, positional parameter.

1. Create an equivalent command to ‘mv’ using positional parameter.
2. Using positional parameter calculate average of three number.
3. Write a shell script program to enter a number and test that no. is even or not.
4. Write a shell script program to find out whether a file is dummy file or not. If it is dummy file then rename that dummy file.
5. Write a shell script program to check whether a file is exist or not. If the file exist then copy the contents into another file.

11. Programming by using other control statement like: **while, for.**

1. Write a shell script program to find even and odd numbers between 1 to 20.
2. Write a shell script program to find out the factorial of a number.
3. Write a shell script program to add 1 to 10 by using for loop.
4. Write a shell script program to test that the entering number is a Armstrong number or not.

12. Programming by using other control statement like: **case**.

1. Write a shell script program to enter a number and to see the corresponding month name by using case.
2. Write a shell script program to enter an alphabet and test that is vowel or not.
3. By using case do the arithmetic operation.
4. By using case execute the current calendar, current date, present working directory and list of files.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure for M.Sc. in Applied Chemistry

(2018-19 Admission Batch)

First Semester				Second Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods / Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods / Week)**	**Credits**
ACC101	**Programme Core-1** Inorganic Chemistry-I	3-1-0	4	ACC201	**Programme Core-6** Inorganic Chemistry-II	3-1-0	4
ACC102	**Programme Core-2** Organic Chemistry-I	3-1-0	4	ACC202	**Programme Core-7** Organic Chemistry-II	3-1-0	4
ACC103	**Programme Core-3** Physical Chemistry-I	3-1-0	4	ACC203	**Programme Core-8** Physical Chemistry-II	3-1-0	4
ACC104	**Programme Core-4** Quantum Chemistry	3-1-0	4	ACC204	**Programme Core-9** Spectroscopy – II	3-0-0	3
ACC105	**Programme Core-5** Spectroscopy – I	3-1-0	4	ACC205	**Programme Core-10** Bio-chemistry	3-0-0	3
Total (Theory)		**20**	**20**	**Total (Theory)**		**18**	**18**
Practical/ Sessional				**Practical/ Sessional**			
ACC106	**Lab-1** Inorganic Chemistry –I Laboratory	0-0-6	2	ACC206	**Lab-3** Inorganic Chemistry- II Laboratory	0-0-6	2
ACC107	**Lab-2** Organic Chemistry Laboratory	0-0-6	2	ACC207	**Lab-4** Physical Chemistry-I Laboratory	0-0-3	2
				ACC208	**Lab-5** C - Programming for Chemist	0-0-3	2
Total (Practical/ Sessional)		**12**	**4**	**Total (Practical/ Sessional)**		**12**	**6**
TOTAL		**32**	**24**	**TOTAL**		**30**	**24**
TOTAL SEMESTER CREDITS: 24				TOTAL SEMESTER CREDITS: 24			
TOTAL CUMULATIVE CREDITS: 24				TOTAL CUMULATIVE CREDITS: 48			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure for M.Sc. in Applied Chemistry

(2018-19 Admission Batch)

Third Semester				Fourth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
	Programme Core-11	3-0-0	3		**Programme Core-14**	3-0-0	3
ACC301	Inorganic Chemistry-III			ACC401	Analytical Techniques		
	Programme Core-12	3-0-0	3		**Programme Core-15**	3-0-0	3
ACC302	Organic Chemistry-III			ACC402	Supramolecular Chemistry		
	Programme Core-13	3-0-0	3		**Programme Elective-III (Any One)**	3-0-0	3
ACC303	Environmental Chemistry			ACE401	Medicinal Chemistry		
	Programme Elective-I (Any One)	3-0-0	3	ACE402	Chemistry of Nano-Materials		
ACE301	Research Methodology			ACE403	Chemistry of Natural Products		
ACE302	Material Science				**Programme Elective-IV (Any One)**	3-0-0	3
	Programme Elective–II (Any One)	3-0-0	3	ACE404	Polymer Chemistry		
ACE303	Industrial Processes			ACE405	Nuclear Chemistry		
ACE304	Frontiers in Inorganic Chemistry			ACE406	Heterogeneous Catalysis		
	Total (Theory)	**15**	**15**		**Total (Theory)**	**12**	**12**
	Practical/ Sessional				**Practical/ Sessional**		
ACC304	Physical Chemistry–II Laboratory	0-0-6	2	ACJ401	**Project**	0-0-15	10
ACC305	Environmental Chemistry Laboratory	0-0-3	2				
ACJ301	Seminar & Review	0-0-6	3				
Total (Practical/ Sessional)		**15**	**7**	**Total (Practical/ Sessional)**		**15**	**10**
TOTAL		**30**	**22**	**TOTAL**		**27**	**22**
TOTAL SEMESTER CREDITS: 22				TOTAL SEMESTER CREDITS: 22			
TOTAL CUMULATIVE CREDITS: 70				TOTAL CUMULATIVE CREDITS: 92			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year M.Sc. (2018-19 Admission Batch) in Applied Chemistry

1st Semester

ACC101	Inorganic Chemistry-I	3-1-0	Credit 4

MODULE I **(7 Hours)**

Metal - Ligand Bonding

Valence bond theory, Crystal-Field Theory, Limitations of crystal field theory, elementary idea of angular overlap model, molecular orbital theory for octahedral, tetrahedral and square planar complexes, σ and π bonding in molecular orbital theory, Ligand field theory.

MODULE II **(15 Hours)**

Electronic spectra of Transition Metal Complexes

Spectroscopic ground states, term symbols for d^n ions, Racah parameters, selection rules and intensities of bands, Orgel diagram, correlation and Tanaube-Sugano diagrams, spectra of 3d metal-aqua complexes of trivalent metal ions (d^1-d^6), divalent Mn, Co and Ni, calculation of Dq, B and β parameters, CT spectra.

Spectral properties of lanthanide and actinide metal complexes.

MODULE III **(8 Hours)**

Metal-ligand Equilibria in Solution

Stability of metal complexes, Stepwise and overall stability constant, factors affecting the stability constant, determination of stability constants and their applications, compositions of metal complexes by Job's method.

MODULE IV **(12 Hours)**

Inorganic Reaction Mechanism

Reactivity of metal complexes, inert and labile complexes, factors affecting the reactivity of complexes, mechanisms of substitution (acid, base and anation) reactions of octahedral complexes, isotope effects, Berry's pseudo rotation, Swain-Scott equation, substitution reactions of square planar complexes, trans-effect – theories and applications in synthesis of metal complexes, Redox reactions: mechanism of one election transfer reaction (inner sphere and outer-sphere), Marcus theory for outer-sphere reactions.

Reference Books:

1. D. F. Shriver, P.W. Atkins, Inorganic Chemistry, 3rd edition, Oxford University, Oxford, 1999.
2. N. N. Greenwood, A. Earnshaw, Chemistry of the Elements, Pergamon Press, 2nd edition, 2002.
3. B. Douglas, D. McDaniel, and J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd edition, John Wiley, New York, 1993.
4. D. Katakis, and G. Gordon, Mechanism of Inorganic Reactions, John Wiley & Sons, N. Y, 1987.

5. J. E. Huheey, E. A. Keiter, R. L. Keiter & O. K. Medhi, Principles of Structure and Reactivity (1st impression), Pearson education, 2006.
6. F. Basolo & R. G. Pearson, Mechanism of Inorganic Reactions, Wiley Eastern, 1967.
7. F. A. Cotton, G. Wilkinson, C. A. Murillo & M. Bochmann, Advanced Inorganic Chemistry, 6thedition, John Wiley, 1999.
8. R. G. Wilkins, The Study of Kinetics and Mechanism of Reactions of Transition Metal Complexes, Allyn & Bacon, Boston, 1974.
9. Robert B. Jordan, Reaction Mechanisms of Inorganic and Organometallic Systems, Oxford University Press, 1998.
10. A. K. Das and M. Das, Fundamental Concept of Inorganic Chemistry, Vol. 4 and 5, CBS Publisher & Distributor Pvt. Ltd., New Delhi, 2014.

ACC102	Organic Chemistry-I	3-1-0	Credit 4

MODULE I **(8 Hours)**

Nature of bonding in organic molecules

Delocalized chemical bonding conjugation, cross conjugation, resonance, hyper conjugation, bonding in fullerenes, tautomerism. Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons, Huckel's rule, energy level of □-molecular orbitals, annulenes, antiaromaticity, □-aromaticity, homo-aromaticity, PMO approach.

MODULE II **(8 Hours)**

Stereochemistry

Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity, enantiotropic and diastereotropic atoms, groups and faces, stereospecific and stereoselective synthesis. Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus. Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars, steric strain due to unavoidable crowding.

MODULE III **(12 Hours)**

Reaction Mechanism

Types of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects. Hard and soft acids and bases.

Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes.

Effect of structure on reactivity- resonance and field effects, steric effect, quantitative treatment. The Hammett equation and linear free energy relationships, substituent and reaction constants, Taft equation.

MODULE IV **(14 Hours)**

Name Reaction

Diazonium coupling, vilsmeier reaction, Gattermann-Koch reaction,The Von Richter, Sommelet-hauser, Smiles rearrangements, Sandmeyer reaction, Free radical rearrangement, Hunsdiecker reaction, Hydroboration, Michael reaction, Wittig reaction Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin Stobbe reactions, Pinacol-pinacolone, Wagner-Meerwein, Demjanov, Benzil-Benzilic acid, Favorskii, Arndt-Eistert synthesis, Neber, Beckmann, Hofmann, Curtius, Schmidt, Baeyer-villiger, Shapiro reaction.

References:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley, 6th edition, 2006.
2. Advance edition Organic Chemistry, F. A. Carey and R. J. Sundberg, Part A and B Springer, 5th edition, 2005
3. A Guide Book of Mechanism in Organic Chemistry, Peter Sykes, Longman.6th edition, 1999
4. Structure and Mechanism in Organic Chemistry, C. K. Ingold, Cornell University Press, 3rd edition, 1957.
5. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall, 6th edition, 1992.
6. Modern Organic Reactions, H. O. House, W.A. Benjamin. 2nd edition, 1972.
7. Reaction Mechanism in Organic Chemistry, S. M. Mukherjee and S. P. Singh, Macmillan.3rd edition (2009).

ACC103	Physical Chemistry-I	3-1-0	Credit 4

MODULE-1 **(10 Hours)**

Classical Thermodynamics

Brief concepts of laws of thermodynamics, Free energy, chemical potential and entropy, Third law of thermodynamics and determination of entropy, Entropy and probability, Boltzmann-Planck equation, Partial molar properties (partial free energy, molar volume and molar heat content), Their significance and determination. Concepts of fugacity, activity coefficient and their determination.

MODULE-II **(8 Hours)**

Biophysical Thermodynamics

Bioenergetics and Thermodynamics; Phosphoryl group transfer and energy currency-ATP; Biological Oxidation and reduction reactions Metabolic processes: Introduction to metabolism of carbohydrates: Glycolysis, TCA Cycle, Gluconeogenesis.

MODULE-III **(12 Hours)**

Statistical Thermodynamics

Concept of probability, Starling approximations, most probable distribution Brief Concepts on Ensembles, Canonical, Grand Canonical and Micro-canonical ensembles. Bose-Einstien statistics, Fermi-Dirac statistics and Maxwell-Boltzmann statistics. Significance of partition function, Calculation of thermodynamic properties and equilibrium constant in terms of partition functions, Evaluation of transnational, vibrational and rotational partition function for monoatomic and polyatomic ideal gases.

MODULE-IV **(12 Hours)**

Dynamics

Theories of reaction rates, Collision theory, Transition state theory, Arrehenius equation and the activated complex theory, Reaction between ions, Salt effect, Steady-State Kinetics, Kinetic and Thermodynamic concept of Reactions, Treatment of unimolecular reaction (Lindemann-Hinshelwood and Rice-Ramspeger-Kassel-Marcus (RRKM) theories), Dynamic chain ($H_2 + Br_2$) reaction, pyrolysis of CH_3CHO, Decomposition of ethane).

Reference Books:

1. S. Glasstone, Thermodynamics for Chemists, Affiliated East West Press, 1965.
2. P.W. Atkins, Physical Chemistry, 8th edition, Oxford University Press, 1998.
3. D. A. McQuarrie and J. D. Simon, Physical Chemistry: A Molecular Approach,Viva Student edition 2015.
4. J. Rajaram and J. C. Kuriacose, Thermodynamics for Students of Chemistry, Shobanlal Nagin Chand Co 1986.
5. Biophysical Chemistry (Principles and Techniques), A. Upadhyay, K. Upadhyay, N. Nath, Himalaya Pub. House, 1st edition, 2009.
6. Chemical Kinetics and Reaction Dynamics, S. K. Upadhyay, Anamaya Publishers, New Delhi, India 2006.
7. Chemical Kinetics, K. J. Laidler, PEARSON LEARNING, 3rd edition, 2003.

ACC104	Quantum Chemistry	3-1-0	Credit 4

MODULE-1 **(12 Hours)**

Symmetry and Group Theory in Chemistry

Symmetry elements and symmetry operation, definitions of group, subgroup, relation between orders of a finite group and its subgroup. Conjugacy relation and classes. Generators, Point symmetry group. Representations of group operators, The great orthogonality theorem (without proof) and its explanation. Irreducible and reducible representation. Bases of representation, Character of a representation. Character table and its meaning. Reduction formula.

MODULE-II **(8 Hours)**

Quantum Mechanical Formalism

Operators, Eigen values and eigen functions, basic postulates of quantum mechanics, Schrodinger equation and discussion of solutions of the, Schrodinger equation to some model systems viz., translational motion of a particle (particle in a box), the harmonic oscillator, the rigid rotator, the Hydrogen and Hydrogen like atom.

MODULE-III **(10 Hours)**

Approximate Methods

The variation theorem, linear variation principle. Perturbation theory (first order and non-degenerate). Applications of variation method and perturbation Theory to the Helium atom, multielectron atoms, self-Consistent Field Approximation, Hartree-fock Self-Consistent Field (HFSCF) Theory. Theory of Angular momentum: Angular Momentum Classical and Quantum Mechanical concept, Angular momentum in many electrons atoms, splitting of Term Level into Atomic Levels.

MODULE-IV **(12 Hours)**

Theory of chemical bonding

Diatomic molecules

The Born Oppenheimer Approximation, The Molecular Orbital Theory (MOT), Hydrogen molecule ion, Hydrogen molecule, Valence Bond Theory (VBT), diatomic molecules in general, comparison of MO and VB Theories.

Huckel Molecular Orbital Theory

Huckel theory of conjugated systems (Ethylene, Allyl systems, butadiene, cyclopropenyl, cyclobutadiene, bicyclobutadiene), Calculation of bond order, charge density, free valence index, Application of group theory for the simplification of MO determinants of naphthalene.

Reference Books:

1. Quantum Chemistry, R. K. Prasad, revised edition 3rd edition, New Age International (P) Limited

edition, Publishers
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill, 1997, 4th edition, New Delhi.
3. Quantum Chemistry, Ira N. Levine, Pearson, 2007, 5th edition, New Delhi.
4. Quantum Chemistry, D. A. McQuarrie and J. D. Simon, Viva, 2007, 1st edition, New Delhi.
5. Quantum Chemistry, J. P. Lowe, Academic Press, 2nd edition, New York.
6. Molecular Quantum Mechanics, Atkins and Friedman, Oxford Univ. Press, 3rd edition, New York, 1997.

ACC105	Spectroscopy – I	3-1-0	Credit 4

MODULE-1 **(10 Hours)**

Atomic Spectroscopy

The electromagnetic spectrum, A general discussion on various molecular excitation processes, Spectra of hydrogen and hydrogen like atoms, alkali metals spectra, L-S coupling, Term symbols, Space quantisation, Zeeman effect, Stark effect, Paschen-Back effect.

MODULE-II **(12 Hours)**

Molecular Spectroscopy

Molecular Spectra of Diatomic Gases, Classification of molecules, Rotational Spectra, Vibrational Spectra, Vibrational-Rotational Spectra, P, Q and R Branches.

MODULE-III **(10 Hours)**

Raman Spectroscopy

Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, Mutual exclusion principle. Resonance Raman spectroscopy, coherent anti Stokes Raman spectroscopy (CARS).

MODULE-IV **(10 Hours)**

Mössbauer Spectroscopy

Introduction, Interpretation of Isomer Shifts, Quadrupole Interactions, Paramagnetic Mössbauer Spectra, Mossbauer Emission Spectroscopy, Applications

Reference Books:

1. Spectroscopy, G. M. Lampman, D. L. Pavia, G. S. Kriz and J. R. Vyvyan, 4th edition, CENGAGE Learnings, 2010
2. Physical Methods for Chemists, R. S. Drago, Scientific Publishers, 2nd edition, 1992
3. Spectrometric Identification of Organic Compounds, R. M. Silverstein, F. X. Webster, D. J. Kiemle, D. L. Bryce, Willey, 8th edition, 2015.
4. Textbook of Organic Chemistry 1st edition, P. S. Kalsi, New Age International (P) Ltd. Pub.
5. A Complete Introduction to Modern NMR Spectroscopy, Roger S. Macomber, Willey Publication, 1997

6. Modern NMR Spectroscopy: A Guide for Chemists. J. K. M. Sanders, B. K. Hunter. Oxford University Press, 1993
7. Mass Spectrometry: A Textbook, J. H. Gross, Springer, 3rd edition, 2017
8. Molecular structure and Spectroscopy, G. Aruldhas, PHI Learning Pvt. Ltd., 2nd edition, 2008.
9. Introduction to Molecular Spectroscopy, G. M. Barrow, McGraw Hill Book Company Inc., International Student edition, 1962.

ACC106	Inorganic Chemistry-I Laboratory	0-0-6	Credit 2

1. Semi micro qualitative analysis of inorganic mixtures containing anions, common cations, less familiar element (W, Mo, Ce, Th, Zr, V and U), insoluble (sulphate, oxides, halide).
2. Preparation and quantitative analysis of complexes
   - cis-potassium diaquabis(oxalate)chromate(III) complex [analysis of oxalate and chromium]
   - Hexamminecobalt(III)chloride [analysis of cobalt]
   - Preparation of pentamminechlorocobalt(III)chloride.
   - Potassium tris-(oxalato)aluminate(III)
   - Hexaaminecobalt(III) chloride
   - Tetraaminecopper(II) sulphate.
3. Volumetric analysis
   - Volumetric estimation of Ca and Mg in Dolomite solution.
   - Estimation of alumina in Bauxite
   - Determination of Fe % & Si % in cast metal of aluminium
   - Determination of Si % in pig iron.

References:

1. G. Svehla, Vogel's Qualitative Inorganic Analysis, 6th edition, Orient Longman New Delhi, l987.
2. V.V. Ramanujam, Inorganic Semi-micro Qualitative Analysis, 3rd edition, National Publishing Company, Madras, 1990.
3. J. Bassett, G. H. Jeffery and J. Mendham, and R. C. Denny,Vogel's text book of Quantitative Chemical Analysis, 5th edition, Longman Scientific and Technical, 1999.
4. Hand-outs preparation for the laboratory experiments: collections from various literature sources.
5. Elias, A. J., A Collection of Interesting General Chemistry Experiments, Universities Press, (India) Pvt. Ltd., 2002.
6. Roesky, H. W.; Möckel, K., Chemical Curiosities: spectacular experiments and inspiration quotes, VCH, 1996.

ACC107	Organic Chemistry Laboratory	0-0-6	Credit 2

1. Identification of unknown organic compounds
2. Separation, purification and identification of compounds of binary mixture (both are solids, one liquid and one solid) using TLC and column chromatography, Chemical tests.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year M.Sc. (2018-19 Admission Batch) in Applied Chemistry

2nd Semester

ACC201	Inorganic Chemistry-II	3-1-0	Credit 4

MODULE I **(10 Hours)**

Magnetic properties of coordination compounds

Types of magnetic behaviour, magnetic susceptibility and its determination by Gouy, Faraday and VSM method, Pascal's constants and constitutive corrections, paramagnetism, Curie-Weiss law, Van Vleck's equation (derivation excluded) and its applications, spin-orbit coupling, ferro- and anti-ferromagnetism coupling, super paramagnetism, high and low spin equilibria. Anomalous magnetic moments, magnetic exchange coupling and spin crossover.

Magnetic properties of Lanthanide and Actinide metal complexes.

MODULE II **(13 Hours)**

Organometallic Chemistry-I

Stability and 18 electron rules (covalent and ionic),

Alkyls/aryl and hydrides: alkyls and aryls (metal alkyls stabilized carbanion, β-elimination, stable alkyls, agostic alkyls, reductive elimination, preparation of metal allyls).

Metal hydrides: synthesis, characterization, reactions, bridging hydrides.

Pi-complexes: Synthesis, bonding, properties and applications of alkenes and alkynes, allyls, diene, cyclopentane, dienyl, arenes.

Introductory idea on transition metal-carbon multiple compounds: carbene and carbyne.

MODULE III **(14 Hours)**

Organometallic chemistry-II

Reactivity of organo-transition metal complexes: Coordinative unsaturation, substitution reactions (nucleophilic and electrophilic addtion and abstraction), oxidative addition and reuctive elimination, insertion reactions (insertion of CO, SO_2 and alkenes).

Catalysis by organo-transition metal complexes: Alkene isomerisation, hydrogenation and hydroformylation; Zeigler-Natta polymerization of ethylene, reduction of carbon monoxide by hydrogen (Fischer-Tropsch reaction).

MODULE IV **(5 Hours)**

Fluxional Organometallic Compounds

Fluxionality and dynamic equilibria in compounds such as η^{2-} olefin, η^{3-}allyl and dienyl complexes.

Reference Books:

1. The Organometallic Chemistry of the Transition Metals, Robert H. Crabtree, Wiley, 2014.
2. Organotransition Metal Chemistry: From Bonding to Catalysis, John F. Hartwig, University Science Books, 2009.
3. Organotransition Metal Chemistry, Anthony F. Hill, Royal Society of Chemistry,
4. Tutorial Chemistry Text, 2002. Chapters 1 to 7.
5. Organometallics: A concise Introduction, Ch. Elshebroicn and A Salzer, VCH, 2006.
6. Organotransition Metal Chemistry: Applications to Organic Synthesis, S. G. Davies, Pergamon 1982.
7. A. K. Das and M. Das, Fundamental Concept of Inorganic Chemistry, Vol. 4 and 5, CBS Publisher & Distributor Pvt. Ltd., New Delhi, 2014.
8. Organometallic Chemistry, R.C. Mehrotra and A. Singh, New Age International Publishers, 2nd edition, 2000.
9. Elements of Magnetochemistry, R. L. Dutta and A. Syamal, S. Chand & Company Ltd., 1982.

ACC202	Organic Chemistry-II	3-1-0	Credit 4

MODULE I **(12 Hours)**

Pericyclic Reactions

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3–butadiene, 1,3,5–hexatriene and allyl system. Classification of pericyclic reactions. Woodward – Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions – conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions – antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3-dipolar cycloadditions and cheletropic reactions. Sigmatropic rearrangements – suprafacial and antarafacial shifts of H, sigmatroic shifts involving carbon moieties, 3,3– and 5,5–sigmatropic rearrangements. Claisen, Cope and Aza-Cope rearrangements. Fluxional tautomerism. Ene reaction.

MODULE II **(14 Hours)**

Photo Chemistry

Basic principles of photo chemistry, Photochemistry of Carbonyl Compounds Intramolecular reactions of carbonyl compounds – saturated, cyclic and acylic, unsaturated and α- unsaturated compounds. Cyclohexadienones. Photochemistry of alkenes Intramolecular reactions of the olefinic bond – geometrical isomerism, cyclization reactions, rearrangement of 1,4– and 1,5– dienes. Photo-Fries reactions of anilides. Photo-Fries rearrangement. Barton reaction.

MODULE III **(6 Hours)**

Oxidation

Introduction to various oxidative processes:

Hydrocarbons - alkenes, aromatic rings, saturated C-H groups (activated and unactivated), alcohols, diols, aldehydes, ketones, ketals and carboxylic acids, amines, hydrazines, and sulfides, oxidations with ruthenium tetraoxide, iodobenzene diacetate and thallium (III) nitrate.

MODULE IV **(6 Hours)**

Reduction

Introduction to various reductive processes:

Alkenes, alkynes and aromatic rings, carbonyl compounds (aldehydes, ketones, acids and their derivatives), epoxides, nitro, nitroso, azo and oxime groups, hydrogenolysis.

Reference Books:

1. Fundamentals of Photochemistry, K. K. Rohtagi-Mukherji, Wilcy-Eastern.
2. Pericyclic Reactions, S. M. Mukherji, Macmillan, India.
3. Reaction Mechanism in Organic Chemistry, S. M. Mukherjee and S. P. Singh, Macmillan.3rd edition, 2009.
4. Organic synthesis: Clayden, Greeves, Warren and Wouthers, Oxford Univ. Press, 2nd edition, 2012.

ACC203	Physical Chemistry-II	3-1-0	Credit 4

MODULE I **(10 Hours)**

Electrochemistry

Interionic attraction theory and Debye-Huckel treatment, Derivation of Onsager limiting law and its verification and modification, Activities, activity coefficients, Debye-Huckel treatment, Debye-Huckel-Bronsted equation, Salt effect, Determination of activity coefficients from solubility method, Ion association, Determination of thermodynamicdissociation constant of weak electrolytes by Shedlovsky method and by EMF method, Nernst equation, redox systems, electrochemical cells.

MODULE II **(10 Hours)**

Electrodics

Thermodynamics of electrified interface equations. Derivation of electro-capillarity, Lippmann equations (surface excess), methods of determination. Structure of electrified interfaces, Helmltoz-Perrin, Guoy–Champman, Stern models.

Introduction to corrosion, homogenous theory, forms of corrosion, corrosion monitoring and prevention methods.

MODULE III **(12 Hours)**

Surface phenomena

Surface tension, Capillary action, Adsorption, types of adsorption, Gibbs adsorption isotherm, Freundlich's adsorption isotherm, Langmuir's adsorption isotherm and its limitations, BET adsorption isotherm and its applications, Heat of adsorption, estimation of surface areas of solids from solution adsorption studies. Amphiphilic molecules and surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micelle concentration (CMC), Krafft temperature, Factors affecting the CMC of surfactants, counterion binding to micelles.

MODULE IV **(10 Hours)**

Transport phenomena

Diffusion coefficients, Fick's first and second laws, relation between flux and viscosity, relation between diffusion coefficient and mean free path, relation between thermal conductivity/viscosity and mean free path of a perfect gas, Einstein relation, Nernst-Einstein equation, Stokes-Einstein Debye equation (SEDITION), Einstein-Smoluchowski-equation.

Reference Books:

1. Chemical Kinetics-K. J. Laidler, pearson education, 2004
2. D. A. McQuarrie and J. D. Simon: Physical Chemistry- A Molecular Approach
3. Kinetics and Mechanism of Chemical Transformations, J. Rajaraman and J. Kuriacose, McMillan
4. Micellse, Theoretical and Applied Aspects, V. Moroi, Plenum.
5. Modern Electrochemistry Vol.I and Vol.II. J. O. M. Bockris and A.K.N. Reddy, Plenum.
6. Elements of Physical Chemistry, P. Atkins and J. dePaula, 6th edition, Oxford Press, 2015

ACC204	Spectroscopy – II	3-0-0	Credit 3

Module I **(14 Hours)**

Nuclear Magnetic Resonance (NMR) Spectroscopy

Nuclear spin; Calculation of nuclear spin (I), nuclear resonance, Instrumentation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant 'J'. Classification (ABX, AMX, ABC, A2B2 etc.), spin decoupling; basic ideas about instrument, NMR studies of nuclei other than proton–^{13}C, ^{19}F, ^{31}P. ^{11}B and ^{195}Pt (preliminary idea), advanced experimental techniques DEPT, Two dimensional NMR spectroscopy: COSY, HETCOR, NOE, NOESY. Applications of NMR

Module II **(10 Hours)**

Nuclear Quadruple Resonance (NQR) Spectroscopy

Quadruple nuclei, quadruple moment, Electric field gradient (EFG), Energies of the Quadrupole Transitions, Effect of a Magnetic Field on the Spectra, Relationship between Electric Field Gradient and Molecular Structure, Applications, Double Resonance Techniques

Module III **(8 Hours)**

Electron Spin Resonance (ESR) Spectroscopy

Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants spin Hamiltonian, spin densities and McConnell relationship, measurement techniques, applications.

Module IV **(10 Hours)**

Mass Spectrometry

Overview of mass spectrometry, presentation of spectra Sample introduction, Inonization methods, mass analysis, Detection and quantification, determination of molecular weight, determination of molecular formula: isotope effect and basis of HRMS, structural analysis and fragmentation patterns: Stevenson's rule, retro Diels-Alder reaction, McLafferty rearrangements. Application of mass spectrometry for inorganic complexes

Problems involving UV, IR, NMR and Mass spectroscopy.

Reference Books:

1. Spectroscopy, G. M. Lampman, D. L. Pavia, G. S. Kriz and J. R. Vyvyan, 4th edition, CENGAGE Learnings, 2010
2. Physical Methods for Chemists, R. S. Drago, Scientific Publishers, 2nd edition, 1992
3. Spectrometric Identification of Organic Compounds, R. M. Silverstein, F. X. Webster, D. J. Kiemle, D. L. Bryce, Willey, 8th edition, 2015.
4. Textbook of Organic Chemistry 1st edition, P. S. Kalsi, New Age International (P) Ltd. Pub.
5. A Complete Introduction to Modern NMR Spectroscopy, Roger S. Macomber, Willey Publication, 1997
6. Modern NMR Spectroscopy: A Guide for Chemists. J. K. M. Sanders, B. K. Hunter. Oxford University Press, 1993
7. Mass Spectrometry: A Textbook, J. H. Gross, Springer, 3rd edition, 2017
8. Molecular structure and Spectroscopy, G. Aruldhas, PHI Learning Pvt. Ltd., 2nd edition, 2008.
9. Introduction to Molecular Spectroscopy, G. M. Barrow, McGraw Hill Book Company Inc., International Student edition, 1962.

ACC205	Bio-chemistry	3-0-0	Credit 3

MODULE I **(12 Hours)**

Carbohydrates & Lipids

Structure and Function of Carbohydrates: Monosaccharide, oligosaccharides, polysaccharides (starch, Glycogen, Cellulose), Optical Isomerism;

Structure and Function of Lipids: Saturated and unsaturated fatty acids, triacylglycerols, Phosphoglycerides, Sphingolipids, Waxes and Sterol

MODULE II **(10 Hours)**

Proteins

Structure and Function of Proteins: 20 Amino acids, Peptide bond, Hierarchy of protein architecture, Ramachandran plot, 3-D structure;

Structure and Function of Nucleic Acids: DNA, RNA, Double Helix Model of DNA, Denaturation and Renaturation DNA; replication, transcription and translation.

Structure and function of Hormones, Minerals and Vitamins; Bio-complexes: Nucleoproteins, Glyco-proteins, Lipoproteins and Vitamin complexes.

MODULE III **(10 Hours)**

Transport Mechanism

Biologically important metal ions (Na, K, Mg, Ca, Cu, Fe, Zn, Co and Mo) and their functions, mechanism of transport of metal ions through biological fluids and membranes, different types of passive and active transport processes and their mechanism, Na^+ /K^+ pump, calcium pump, and ionophores. Storage and transport of iron, copper and zinc, siderophores, structure and function of ferritin, transferrin in regard to Fe-storage and transportation. Chemistry of porphyrin, Iron porphyrins (Heme proteins): Hemoglobin (Hb), Myoglobin (Mb) and their behavior as oxygen carrier, O_2 affinity, co-operativity and Bohr's effect.

MODULE IV **(10 Hours)**

Enzymes

Preliminary idea about enzyme, cofactor, co-enzyme, apoenzyme, prosthetic group, metal-activate enzyme and metalloenzyme. Enzyme-substrate binding problem, carboxypeptidase, carbonic anhydrase and their biological significance

Reference Books:

1. Principle of Bio-Chemistry – Lehinger, Nelson and Cox, 7th Edition, Mcmillan Education, 2016.

2. Biochemistry, L. Stryer, 8th Edition, Macmillan Publication, 2015.
3. Fundamentals of Biochemistry – Voet & Voet, 4th Edition, 2010.
4. Biochemistry, C. B. Powar & G. R. Chatwal, 2nd Edition, Himalaya Publishing House, 2015.
5. Biochemistry, Rastogi, 3rd Edition, Tata McGraw Hill, 2010.

ACC206	Inorganic Chemistry- II Laboratory	0-0-6	Credit 2

1. Preparation of selected inorganic compounds and their study by UV Visible.
2. Preparation of N, N-bis (salicyldehyde) ethylenediamine, salenH_2. Co(Salen).
3. **Preparations**

Preparation of following compounds and their studies by electronic spectra measurements.

- *cis*-K[$Cr(C_2O_4)_2(H_2O)_2$]
- $K_3[Fe(C_2O_4)_3]$
- $[Ni(NH_3)_6]Cl_2$
- $Ni(dmg)_2$

ACC207	Physical Chemistry-I Laboratory	0-0-3	Credit 2

1. Chemical Kinetics: Kinetics of reaction between bromate and iodide.
2. Determination of rate constant of base hydrolysis of ester by;
   i) volumetric method & ii) conductometric method.
3. Partial Molar Volume : Determination of PMV by intercept method, density measurements
4. Determination of ionization constants of weak acids and verification of Oswald's Dilution law.
5. Conductometric titration of Strong/Weak acid with Strong/Weak base
6. Conductometric titration of a mixture of HCl+CH_3COOH with NaOH
7. Potentiometric titration of strong acid with strong base.

Reference Books:

1. Experimental Physical Chemistry by Das and Behera
2. Practical Physical Chemistry by B. Vishwanathan and P. S. Raghavan
3. Experimental Physical Chemistry by V. D. Athawale

ACC208	C - Programming for Chemist	0-0-3	Credit 2

MODULE I **(12 Hours)**

Computer Programming in C

Elements of the computer language. Constants and variables. Operations and symbols. Expressions. Arithmetic assignment statement. Input and Output. Format statement. Termination statements. Branching statements such as IF or GO TO statement. LOGICAL variables. Double precision variables. Subscripted variables and Dimension. DO statement. FUNCTION and SUBROUTINE. COMMON and DATA statements. (Students learn the programming logic and these language features by 'hands on' experience on a personal computer from the very beginning of this topic).

MODULE II **(12 Hours)**

Programming in Chemistry

Development of small computer codes involving simple formulae in chemistry, such as van der Waals equation, pH titration, kinetics, radioactive decay. Evaluation of lattice energy and ionic radii from experimental data. Linear simultaneous equations to solve secular equations within the Hückel theory. Elementary structural features such as bond lengths, bond angles, dihedral angles etc. of molecules extracted from a database such as Cambridge data base.

MODULE III **(10 Hours)**

Use of Computer Programmes

Programmes with data preferably from Physical Chemistry Laboratory. Further, the students will operate the packages MS-WORD, POWER POINT AND EXCEL. ChemDraw, Origin etc.

Reference Books:

1. Computers and Common Sense, R. Hunt and J. Shelley, Prentice Hall
2. Computational Chemistry, A.C. Norris.
3. Microcomputer Quantum Mechanics, J.P. Killngbeck, Adam Hilger.
4. C Programming Language by Brian W. Kernighan and Dennis M. Ritchie.
5. An Introduction to Digital Computer Design, V. Rajaraman and T. Radhakrishnan, Prentice Hall.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure for M.Sc. in Applied Mathematics

(2018-19 Admission Batch)

First Semester				Second Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
AMC101	**Programme Core-1** Real Analysis	3-1-0	4	AMC201	**Programme Core-6** Topology	3-1-0	4
AMC102	**Programme Core-2** Ordinary Differential Equations	3-0-0	3	AMC202	**Programme Core-7** Complex Analysis	3-1-0	4
AMC103	**Programme Core-3** Discrete Mathematics	3-1-0	4	AMC203	**Programme Core-8** Numerical Analysis	3-0-0	3
AMC104	**Programme Core-4** Abstract Algebra	3-0-0	3	AMC204	**Programme Core-9** Partial Differential Equations	3-0-0	3
AMC105	**Programme Core-5** Linear Algebra	3-1-0	4	AMC205	**Programme Core-10** Continuum Mechanics	3-1-0	4
				AMC206	**Programme Core-11** Measure Theory & Integration	3-1-0	4
Total (Theory)		**18**	**18**	**Total (Theory)**		**22**	**22**
Practical/ Sessional				**Practical/ Sessional**			
AMC106	**Lab-1** Programming using C++ Lab	0-0-3	2	AMC207	**Lab-3** Lab on Numerical Analysis	0-0-3	2
AMJ101	**Lab-2** Seminar-I	0-0-3	2				
Total (Practical/ Sessional)		**6**	**4**	**Total (Practical/ Sessional)**		**3**	**2**
TOTAL		**24**	**22**	**TOTAL**		**25**	**24**
TOTAL SEMESTER CREDITS: 22				TOTAL SEMESTER CREDITS: 24			
TOTAL CUMULATIVE CREDITS: 22				TOTAL CUMULATIVE CREDITS: 46			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure for M.Sc. in Applied Mathematics

(2018-19 Admission Batch)

Third Semester				Fourth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
	Programme Core-12	3-1-0	4		**Programme Core-16**	3-1-0	4
AMC301	Functional Analysis			AMC401	Differential Geometry		
	Programme Core-13	3-1-0	4		**Programme Core-17**	3-0-0	3
AMC302	Probability & Stochastic Process			AMC402	Matrix Computation		
	Programme Core–14	3-0-0	3		**Programme Elective-II (Any One)**	3-1-0	4
AMC303	Optimization Techniques			AME401	Computational Fluid Dynamics		
AMC304	**Programme Core–15** Integral Equations & Calculus of Variations	3-0-0	3	AME402	Theory of Computation		
				AME403	Finite Element Method		
				AME404	Data Structure with C++		
	Programme Elective–I (Any One)	3-1-0	4		**Programme Elective-III (Any One)**	3-0-0	3
AME301	Fluid Dynamics			AME405	Graph Theory		
AME302	Number Theory & Cryptography			AME406	Theory of Relativity & Cosmology		
AME303	Computational Finance			AME407	Artificial Intelligence		
AME304	Relational Data Base Management System			AME408	Design Analysis & Algorithm		
Total (Theory)		**18**	**18**	**Total (Theory)**		**14**	**14**
Practical/ Sessional				**Practical/ Sessional**			
AMC305	Introduction to MATLAB (Lab)	0-0-3	2	AMC403	Matrix Computation Lab	0-0-3	2
AMJ301	Seminar-II	0-0-3	2	AMJ401	Dissertation & Project	0-0-12	8
Total (Practical/ Sessional)		**6**	**4**	**Total (Practical/ Sessional)**		**15**	**10**
TOTAL		**24**	**22**	**TOTAL**		**29**	**24**
TOTAL SEMESTER CREDITS: 22				TOTAL SEMESTER CREDITS: 24			
TOTAL CUMULATIVE CREDITS: 68				TOTAL CUMULATIVE CREDITS: 92			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year M.Sc. (2018-19 Admission Batch) in Applied Mathematics

1st Semester

AMC101	Real Analysis	3-1-0	Credit 4

Module-1 (4 hours)

Finite, Countable and Uncountable sets, metric spaces, compact sets, perfect sets, connected sets.

Module-2 (6 hours)

Convergent sequences, subsequences, Cauchy sequences, upper and lower limits, some special sequences, series, series of nonnegative terms, The number e, the root and ratio tests , power series, summation by parts, absolute convergence, addition and multiplication of series, rearrangements.

Module-3 (6 hours)

Limits of functions, continuous functions, continuity and compactness, continuity and connectedness, discontinuities, monotonic functions, infinite limits and limits at infinity.

Module-4 (8 hours)

Definition and existence of the integral, properties of the integral, integration of vector valued functions, rectifiable curves.

Module-5 (8 hours)

Uniform convergence, uniform convergence and continuity, uniform convergence and integration, uniform convergence and differentiation, equicontinuous families of functions, the stone-weierstrass theorem.

Module-6 (8 hours)

Linear transformations, differentiation, the contraction principle, the inverse function theorem, the implicit function theorem, the rank theorem, determinants, derivatives of higher order, differentiation of integrals.

Textbook:

1. Rudin.W., *Principles of mathematical analysis*, McGraw-Hill international editions, Chapter.2, 3, 4,6,7,9

Reference books:

1. Apostol T., *Mathematical analysis*, Narosa.

2. Royden H.L., *Real analysis*, Maxwell Macmillan International Editions.

3. Das G. and Pattanayak S., *Mathematical analysis*, Tata McGraw-Hill, India.

AMC102	Ordinary Differential Equations	3-0-0	Credit 3

Module-1(15 hours)

Existence and uniqueness of Solution: Lipchitz condition, Gronwall inequality, successive approximations, Picard's theorem, second order linear equations, separation and comparison theorems, solutions in series, method of Laplace transforms for solving ordinary differential equations, series solutions (power series, Frobenius method), Legendre and Bessel functions and their orthogonal properties.

Module-2(10 hours)

Systems of differential equations: Existence and uniqueness of solution of systems, systems of linear differential equations, nth order equations of a first order system, fundamental matrix, non- homogeneous linear systems, linear systems with constant coefficients, linear second order ordinary differential equations with variable coefficients, Eigen values and Eigen vectors.

Module-3 (15 hours)

Boundary value problems for ordinary differential equations: Green's functions, construction of Green's functions, non-homogenous boundary conditions. Self-adjoint Eigen value Problems, Sturm-Liouville Systems, Eigen values and Eigen functions, expansion in Eigen functions. Stability of linear and nonlinear systems, asymptotically stability, critical points, autonomous Systems, lyapunov stability.

Text book:

1. Tyn Myint-U, *Ordinary differential equations*, New York, Chapters: 2, 3(3.1-3.5), 4(4.1- 4.4), 5(5.1-5.6), 6(6.1-6.4), 7(7.1-7.3), 8(8.1-8.5)

Reference Books:

1. Deo S. D., V. Lakshmikantham and V. Raghavendra, *Text book of Ordinary differential equations*, 2nd edition, Tata Mc Graw Hill
2. Boyce W. and Diprima R., *Elementary differential equations and boundary value Problems*, Wiley, New York.

AMC103	Discrete Mathematics	3-1-0	Credit 4

Module-1 (12 Hours)

Fundamentals of logic, Logical inferences, Methods of proof of logical inferences, First order logic, Inference for quantified propositions, Order relations, Recurrence relation, Solution to recurrence relation, Generating functions, Recurrence relation, Solution to recurrence relation, Generating functions, Principle of Inclusion and exclusion, Application of Inclusion and Exclusion Principle .

Module-2 (8 Hours)

Set Theory, Relation and their properties, Partitions, Closure of Relations, Warshall's Algorithm, Equivalence relations. Posets, Enumerations, Hasse diagrams .Algebraic systems, Lattices, Distributive and Complemented Lattices, Boolean Lattices And Boolean Algebra, Boolean Functions and Boolean Expressions.

Module-3 (8 Hours)

Graphs: Basic concepts, Isomorphic graphs, Sub-graphs, Regular graph, Walk, paths and circuits. Planar graphs, Euler formula, Multi graphs and Euler Circuits, Hamiltonian graphs.

Module-4 (12 Hours)

Trees and properties, Spanning trees, Minimal spanning tree, Kruskal's and prim's algorithm to find Minimal spanning tree. Shortest path Problem, Dijkastra's algorithm. Directed trees

and Binary trees. Graph Coloring, Chromatic number, chromatic partitioning, chromatic polynomial, Four colour problem, Five colour problem, Six colour problem.

Text Book:

1. J. L.Mott, A. Kandel, T. P.Baker , Discrete *mathematics for Computer Scientists & Mathematicians*, Second Edition, PHI.

   Chapters : 1,2,3,4(4.1-4.5), 5, 6(6.1-6.5), 10 (10.1- 10.10), 11(11.1 – 11.7)

Reference Books:

1. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, **Sixth** Edition, 2008, Tata McGraw Hill Education, New Delhi. .Chapters: 1, 2(2.4), 4, 6(6.1, 6.2, 6.4-6.6), 7- 9.
2. C. L. Liu , and D. Mohapatra, *Elements of Discrete Mathematics***, Third** Edition, 2008, Tata McGraw Hill Education, New Delhi .Chapters: 10 (10.1- 10.10), 11(11.1 – 11.7).
3. Udit Agarwal, *Discrete Mathematical Structures*, **First** Edition, 2008, Dhanpat Rai & Co.

AMC104	Abstract Algebra	3-0-0	Credit 3

Module-1(8 Hours)

Normal subgroups, Isomorphism theorems, Automorphisms, Permutation groups: Cyclic decomposition & alternating group An. Structure theorems for groups: Direct product, finitely generated abelian groups.

Module-2(10 Hours)

Invariants of a finite abelian group, Sylow's theorem. Unique factorization domains & Euclidean domains: Unique factorization domain, Principal ideal domains, Euclidean domains, Polynomial rings over UFD.

Module-3(10 Hours)

Algebric extensions of fields: Irreducible polynomials and Einstein criterion, Adjunction of roots, Algebraic extensions. Algebraically closed fields, Normal separable extensions: Splitting fields, Normal extensions. Normal separable extensions: Multiple roots, Finite fields, Separable extensions.

Module-4(12 Hours)

Galois Theory: Automorphisim groups and fixed fields, Fundamental theorem of Galois theory. Application of Galois theory to classical problems: Roots of unity and Cyclotomic polynomials, Cyclic extensions, Polynomials solvable by radicals, Symmetric functions, Ruler and compass constructions.

Text Book

1. P.B. Bhattacharya, S.K. Jain and S.R.Nagpaul, *Basic Abstract Algebra*, Cambridge University Press. Chapters: 5(Art 2, 3), 7(Art 1, 2), 8(Art 1-4), 11(Art 1-4), 15(Art 1-3), 16(Art 1, 2), 18(Art 1-5).

Reference Books:

1. I.N. Herstein, *Topics in Algebra*, Wiley Eastern limited.
2. W.J. Gilbert and W. K. Nicholson, *Modern Algebra with Applications*, **Second** Edition, Wiley-Interscience.
3. J. B. Gallian, *Contemporary Abstract Algebra*, **Fourth** Edition, 2011, Narosa Publishing House.
4. J. B. Fraleigh, *A First Course in Abstract Algebra*, **Seventh** Edition,2013, Pearson New International Edition

AMC105	Linear Algebra	3-1-0	Credit 4

Module-1 (12 Hours)

Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigen values and eigenvectors, minimal poly nomial, Cayley-Hamilton theorem.

Module-2 (12Hours)

Matrix representation of linear transformations. Linear functional, dual spaces, reflexivity. Change of basis, canonical forms, diagonal forms, triangular forms, rational canonical form, Jordan canonical form, Hermitian, Skew-Hermitian and unitary matrices.

Module-3 (16 Hours)

Adjoint of a linear operator, unitary diagonalizability, normal operators, special types of normal operators, self-adjoint operators, unitary operators and isometries, structure of normal operators, orthogonal projection, orthogonal resolution of identity, spectral theorem, positive operators. Gram-Schmidt process for orthogonalisation, projection operator, quadratic forms, positive definite forms, Sylvester's law of inertia.

Text Book:

1. Gilbert Strang, *Introduction to Linear Algebra*, **4**th edition, Wellesley. Cambridge Press. Chapters-1-5, 6.1-6.4.

Reference Books:

1. I.N. Herstein, *Topics in Algebra*, Vikas Publishing House Pvt. Ltd.
2. M. Artin, *Algebra*, Prentice Hall of India.
3. K. Hoffman and R. Kunze, *Linear Algebra*, Pearson Education.
4. S. Lang, *Linear Algebra*, Undergraduate Texts in Mathematics, Springer-Verlag, NewYork.

AMC106	Programming using C++ Lab	0-0-3	Credit 2

(Minimum 10 experiments to be done)

1. **Experiment No.1:** Write a C++ program that prints the first 10 integers (using for loop).
2. **Experiment No.2:** Program to multiply matrix (10 x 10) with a vector using variation in Loop Splitting using multiple barriers.
3. **Experiment No.3:** Write Fibonacci Series Program in C++.
4. **Experiment No.4:** (a) Write Prime number program in C++.
   (b) Print next Prime number.
5. **Experiment No.5:** Write Armstrong Number Program in C++.
6. **Experiment No.6:** Write C++ program to Check Number is Palindrome or not.
7. **Experiment No.7:** Write. (a) Reverse Number Program in C++.
   (b) Reverse of any Number Using for loop.
8. **Experiment No.8:** Write a C++ program that uses functions to perform the following operations on Single linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal in both ways.

9. **Experiment No.9:** Write a C++ program that uses functions to perform the following operations on Double linked list: i) Creation ii) Insertion iii) Deletion.
10. **Experiment No.10:** Write a C++ program that uses functions to perform the following operations on Binary Tree: i) Creation ii) Insertion iii) Deletion.
11. **Experiment No.11:** Write C++ program that use both recursive and non-recursive functions to perform the Binary search operation for a Key value in a given list of integers.
12. **Experiment No.12:** Write a C++ program that implement Bubble Sort method to sort a given list of integers in descending order.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year M.Sc. (2018-19 Admission Batch) in Applied Mathematics

2nd Semester

AMC201	Topology	3-1-0	Credit 4

Modul-1(15hous)

Countable and uncountable sets, infinite sets and the axiom of choice, well-ordered sets, topological spaces, basis and sub basis for a topology, order topology, product and subspace topology, closed sets and limit points. Continuous functions and homeomorphism, metric topology, connected spaces, connected subspaces of the real line, components and local connectedness.

Modul-2(15hous)

Compact spaces, basic properties of compactness, compactness and finite intersection property, compact subspaces of the real line, compactness in metric spaces, limit point compactness, sequential compactness and their equivalence in metric spaces, local compactness and one point compactification.

Modul-3(12hours)

First and second countable spaces, lindelof space, separable spaces, separable axioms, Hausdorff regular and normal spaces. The Urysohn lemma, completely regular spaces, the Urysohn metrization theorem, imbedding theorem, Tietu extension theorem, Tychonoff theorem, Stone-Cech campatification.

Text Book

1. Munkres J.R., *Topology*, **2**nd Edition, Pearson Education, 2000.

   Chapters: 1(7, 9, 10), 2 (excluding section 22), 3, 4(excluding section 36), 5.

Reference Books

1. Joshi K.D., *Introduction to General Topology*, Wiley Eastern Ltd., 1983.

2. Pervin W.J., *Foundation of General Topology*, Academic Press, 1964.

AMC202	Complex Analysis	3-1-0	Credit 4

Module-1 (10 Hours)

Algebra of complex numbers, the complex plane Polar, representation and roots of complex numbers, Spherical representation of extended complex plane. Elementary properties and examples of analytic functions: The exponential, Trigonometric functions, bilinear transformation, cross ratio, mappings from disc

to disc, disc to half plane and half plane to half plane. Mappings of elementary transformations.

Module-2 (12 Hours)

Complex integration: Power series representation of analytic functions, Zeros of analytic functions, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Classification of singularities.

Module-3 (18 Hours)

Contour integral, Cauchy's theorem, Cauchy's integral formula, Residue theorem and applications for evaluating real integrals. the index of a point with respect to a closed curve, the general form of Cauchy's theorem, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Phragmen-Lindelof theorem. Open mapping theorem. The Argument Principle; The Maximum modulus Principle. Taylor series, Laurent series, calculus of residues.

Text Book:

1. J.B. Conway, *Functions of one Complex variable*, Springer-Verlag, International Student-Edition, Narosa Publishing House, 1980. Chapters: III, IV (excluding art.6), V.

Reference Books:

1. T.W. Gamelin, *Complex Analysis*, Springer International Edition.

2. R.V. Churchill and J.W. Brown, *Complex Variables and Applications*, McGraw Hill.

3. W. Rudin, *Real and complex analysis*, McGraw-Hill Book Co.

AMC203	Numerical Analysis	3-0-0	Credit 3

Module –I (14 Hours)

Solution of equations in one and two variables: Muller's method, for two variables; fixed point iteration, Newton's method. Interpolation; Hermite, cubic spline and piecewise interpolation Natural cubic splines, B-Splines Numerical differentiation; first order derivative, higher order derivative, Richardson's extrapolation.

Module -II :(14 Hours)

Numerical integration; Romberg integration, Gaussian Quadrature (2-pt,3-pt,4-pt),asymptotic error formula and their applications , Newton- Cotes rules, Numerical solution to ODE, Taylor's series methods, Adaptive Runge - Kutta method, predictor- corrector method, convergence and stability theory for multistep methods.

Module -III: (14 Hours)

Matrix Eigen value problem, power method, shifted power method, inverse power method, RQ method, error and stability results. Numerical solution to partial differential equations, parabolic, elliptic, hyperbolic equations using finite difference method.

Text Books

1. Burden Richard & Faires J.Douglas, *Numerical Analysis*, **9**th Edition (chapter – 3,4,5,6,7), Cengage Learning, 2010
2. Atkinson Kendall E, *An introduction to Numerical Analysis*, **2***nd**Edition,John Wiley & Sons*

Reference Books

1. Fusset L.V, *Applied numerical Analysis Using MATLAB,***2***nd Edition, PEARSON*
2. Jain M.k, Iyengar S.R.K & Jain R.K, *Numerical methods for Scientific and Engineering Computation*, **6**th Edition, New Age International(P) Ltd.
3. Chapra steven C & Canale Raymond P., *Numerical methods for Engineers*, **7**th Edition, McGraw Hill Education.

AMC204	Partial Differential Equations	3-0-0	Credit 3

Module-I (14 Hours)

Linear and quasilinear first order partial differential equations, method of characteristics, second order linear equations in two variables and their classification, Cauchy problem for 1st order equation, orthogonal surfaces, first order nonlinear equations, characteristics compatible system, Charpit's method. Classification of second order PDE and Canonical forms, adjoint operators, Riemann's method.

Module-II (12 Hours)

Derivation of Laplace & Poisson equation, boundary value problem, separation of variables, Dirichlets and Newmann problem for a rectangle, solution of Laplace equation in cylindrical and spherical coordinates.

Formation and solution of diffusion equation, Dirac-delta function, separation of variable method, solution of diffusion equation in cylindrical and spherical coordinates.

Module-III (12 Hours)

Formation and solution of one dimensional wave equation, canonical reduction, D' Alembert's solution, initial value problem and boundary value problem for two dimensional wave equation, periodic solution of one

dimensional heat equation in cylindrical and spherical coordinates, uniqueness of the solution for the wave equation, Duhamel's Principle.

Text Book

1. Rao K.Sankar, *Introduction to Partial differential equations*, **2**nd Edition, Prentice Hall of India, New Delhi, 2005 Chapters: 0(0.4-0.11, (except 0.11.1)), 1(1.1-1.5), 2(2.1, 2.2, 2.5-2.7, 2.10-2.13), 3(3.1-3.7, 3.9), 4(4.1-4.12 except (4.5, 4.6 & 4.10)).

Reference Books

1. McOwen Robert.C., Partial differential equations: methods and applications, **2**nd Edition, Pearson Education, New Delhi, 2005.
2. Sneddon I.N., Elements of partial differential equations, McGraw Hill, New Delhi, 1983.
3. Dennemeyer R., Introduction to partial differential equations and boundary value problems, McGraw Hill, New York, 1968.
4. Raisinghania M.D. Advanced differential equations, S.Chand & Company Ltd, New Delhi.2001

AMC205	Continuum Mechanics	3-1-0	Credit 4

Module-1 (14 Hours)

Vector calculus: Derivative of a Scalar Function of a Vector ,The del Operator ,Divergence and Curl of a Vector ,Cylindrical and Spherical Coordinate Systems ,Gradient, Divergence, and Curl Theorems ,Tensor calculus, Eigen values & Eigen vectors of Tensors. Kinematics of Continua: Descriptions of Motion: Configurations of a Continuous Medium , Material Description, Spatial Description, Displacement Field ,Analysis of Deformation :Deformation Gradient Tensor ,Isochoric, Homogeneous, and Inhomogeneous Deformations , Change of Volume and Surface, Strain Measures: Cauchy–Green Strain Tensors

Module-2 (14 Hours)

Conservation of Mass, Momenta, and Energy: Conservation of Mass: Material Time Derivative, Continuity Equation in Spatial and Material Description, Conservation of Momenta : Principle of Conservation of Linear Momentum ,Equation of Motion in Cylindrical and Spherical Coordinates ,Principle of Conservation of Angular Momentum, Thermodynamic Principles :The First Law of Thermodynamics: Energy Equation ,Energy Equation for One-Dimensional Flows ,The Second Law of Thermodynamics

Module-3 (12 Hours)

Constitutive Equations: Elastic Solids: Generalized Hooke's Law ,Material Symmetry, Monoclinic, Orthotropic and Isotropic Materials ,Transformation of Stress and Strain Components, Constitutive Equations for Fluids: Ideal Fluids, Non-Newtonian Fluids, Heat Transfer: Fourier's Heat Conduction Law ,Newton's Law of Cooling.

Text Books:

1. J. N. Reddy, An Introduction to Continuum Mechanics with Applications, Cambridge University Press, 2008.Chapters 2(2.4,2.5.4,2.5.5),3(3.2,3.3,3.4.1),5(5.2.2-5.2.4,5.3.1-5.3.3,5.4.2,5.4.4,5.4.5),6(6.2.2-6.2.7,6.3.2-6.3.4,6.4.2-6.4.3)
2. M. Gurtin, An Introduction to Continuum Mechanics, Academic press, 1981.

Reference Books:

1. O. Gonzalez and A. M. Stuart, A First Course in Continuum mechanics, Cambridge University Press, 2008.
2. J. N. Reddy, Principles of Continuum Mechanics: A Study of Conservation Principles with Applications, Cambridge University Press, 2010.
3. Y. R. Talpaert, Tensor analysis and Continuum Mechanics, Springer, 2003.
4. R. Temam and A. Miranville, Mathematical Modelling in Continuum Mechanics, Cambridge University Press, 2005.

AMC206	Measure Theory & Integration	3-1-0	Credit 4

Modul-1 (14hours)

Measure on the real line: Introduction, Lebesgue outer measure, measurable sets, Borel sets, regular measure, measurable functions, Borel and Lebesgue measurable functions. Integration of functions of a real variable**:** Integration of nonnegative functions, Lebesgue integral, Fatou's lemma, Lebesgue monotone convergence theorem, the general integral, Lebesgue dominated convergence theorem, integration of series, Riemann and Lebesgue integrals.

Modul-2 (14hours)

Abstract measure spaces: Measures and outer measures, extensions of measure, uniqueness of the extension, completion of a measure, measure spaces, integration with respect to a measure. Inequalities and the L_p-spaces: L_p spaces, convex functions, Jensen's inequality, inequalities of Holder and Minkowski, convergence in measure, almost uniform convergence.

Modul-3 (12hours)

Signed measures and their derivatives: Signed measures and the Hahn decomposition, the Jordan decomposition, The Radon Nikodym theorem and some applications.

Complex Measures: Total variation, absolute continuity, consequences of Radon Nikodym theorem, Riesz representation theorem.

Text books

1. Barra G.D., *Measure theory and Integration*, Woodhead Publishing. 2003, [Chapter: 2(2.1 - 2.7), 3(3.1 - 3.4), 5(5.1 -5.6), 8(8.1- 8.5), 9(9.3 - 9.6)].
2. Royden H.L., *Real Analysis*, The Macmillan Company. 2010.

Reference Books

1. Natanson I.P., Hewitt E. & Boron L.F., Theory of Functions of a Real Variable, Vol. I & II, Literary Licensing, LLC 2013.
2. Rana I.K., An Introduction to Measure and Integration, Narosa Publishing House.2007.
3. Rudin W., Real and Complex Analysis, **3**rd Edition, McGraw Hill 1987.
4. Munroe M.E., Introduction to Measure and Integration, Addison Wesley, 1953.

AMC207	Lab on Numerical Analysis	0-0-3	Credit 2

List of Experiments (20 Hours)

1. Study of Introduction to MATLAB
2. Study of basic matrix operations.
3. To solve linear equations.
4. Solution of Linear equations for Underdetermined and Over determined Cases.
5. Determination of Eigen values and Eigen vectors of a Square matrix.
6. Solution of differential equations of Non linear Equations.
7. Solution of differential equations using Euler Method.
8. Solution of differential equation using 4th order Runge- Kutta method.
9. Determination of roots of a polynomial using Regulafalsi Method, Newton Raphson method, Muller Method.
10. Determination of polynomial using method of Least Square Curve Fitting.
11. Determination of polynomial fit, analyzing residuals, exponential fit and error bounds from the given data.
12. Solution of the system of linear equations using Gauss Seidel Method.
13. Integrate numerically using Gauss Quadrature Rule.
14. To interpolate y using the given pair of values of x and y by Lagrange's interpolation.
15. To find the smallest positive root using fixed point iteration method.
16. To find the derivative at the final point using Newton's Backward Difference and Forward Difference Method.
17. To integrate numerically using Trapezoidal & Simpson's Rule.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure for M.Sc. in Applied Physics

(2018-19 Admission Batch)

First Semester				Second Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
APC101	**Programme Core-1** Classical and Relativistic Mechanics	3-1-0	4	APC201	**Programme Core-6** Statistical Mechanics	3-1-0	4
APC102	**Programme Core-2** Mathematical Methods in Physics	3-1-0	4	APC202	**Programme Core-7** Electrodynamics	3-1-0	4
APC103	**Programme Core-3** Quantum Mechanics-I	3-1-0	4	APC203	**Programme Core-8** Quantum Mechanics –II	3-1-0	4
APC104	**Programme Core-4** Solid State Physics	3-1-0	4	APC204	**Programme Core-9** Basic Electronics	3-1-0	4
APC105	**Programme Core-5** Numerical Methods & Computer Programming in C	3-1-0	4	APC205	**Programme Core-10** Nano Science and Nanomaterials	3-1-0	4
Total (Theory)		**20**	**20**	**Total (Theory)**		**20**	**20**
Practical/ Sessional				**Practical/ Sessional**			
APC106	**Lab-1** Electricity and Magnetism Lab	0-0-3	2	APC206	**Lab-3** Basic Electronics Lab	0-0-3	2
APC107	**Lab-2** Optics Lab	0-0-3	2	APC207	**Lab-4** Modern Physics Lab	0-0-3	2
Total (Practical/ Sessional)		**6**	**4**	**Total (Practical/ Sessional)**		**6**	**4**
TOTAL		**26**	**24**	**TOTAL**		**26**	**24**
TOTAL SEMESTER CREDITS: 24				TOTAL SEMESTER CREDITS: 24			
TOTAL CUMULATIVE CREDITS: 24				TOTAL CUMULATIVE CREDITS: 48			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure for M.Sc. in Applied Physics

(2018-19 Admission Batch)

Third Semester				Fourth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
	Programme Core-11	3-1-0	4		**Programme Core-13**	3-1-0	4
APC301	Relativistic Quantum Mechanics & Field Theory			APC401	Atomic and Molecular Physics		
	Programme Core-12	3-1-0	4		**Programme Elective-II (Any One)**	3-1-0	4
APC302	Nuclear and Particle Physics			APE401	Condensed Matter Physics-II		
	Programme Elective– I (Any One)	3-1-0	4	APE402	Nuclear Physics-II		
APE301	Condensed Matter Physics-I			APE403	Particle Physics-II		
APE302	Nuclear Physics-I			APE404	Electronics-II		
APE303	Particle Physics-I				**Open Elective- II (Any One)**	3-1-0	4
APE304	Electronics-I			APO401	Physics of Semiconductor Devices		
	Open Elective-I (Any One)			APO402	Fibre Optics		
APO301	Advanced Characterisation Techniques	3-1-0	4	APO403	Medical Physics		
APO302	Physics of Materials			APO404	Vacuum Science Technology		
APO303	Gravitation, Cosmology and Astrophysics						
APO304	Non Linear Dynamics						
	Total (Theory)	**16**	**16**		**Total (Theory)**	**12**	**12**
	Practical/ Sessional				**Practical/ Sessional**		
APJ301	Technical Document writing & Seminar	0-0-3	2	APJ401	**Dissertation & Project**	0-0-12	8
APC303	Introduction to SciLAB Lab	0-0-3	2		**Programme Elective-II Lab (Any One Corresponding Lab)**	0-0-3	2
	Programme Elective-I Lab (Any One Corresponding Lab)	0-0-3	2	APE405	Condensed Matter Physics-II Lab		
APE305	Condensed Matter Physics-I Lab			APE406	Nuclear Physics-II Lab		
APE306	Nuclear Physics-I Lab			APE407	Particle Physics-II Lab		
APE307	Particle Physics-I Lab			APE408	Electronics-II Lab		
APE308	Electronics-I Lab						
	Total (Practical/ Sessional)	**9**	**6**		**Total (Practical/ Sessional)**	**15**	**10**
	TOTAL	**25**	**22**		**TOTAL**	**27**	**22**
TOTAL SEMESTER CREDITS: 22				TOTAL SEMESTER CREDITS: 22			
TOTAL CUMULATIVE CREDITS: 70				TOTAL CUMULATIVE CREDITS: 92			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year M.Sc. (2018-19 Admission Batch) in Applied Physics

1st Semester

APC101	Classical and Relativistic Mechanics	3-1-0	Credit 4

UNIT-I **(14 classes)**

Lagrangian and Hamiltonian Formulation: Calculus of variations and Euler-Lagrange equation, Brachistochrone problem, Hamilton's principle, Legendre transformation and Hamilton equations of motion, physical significance of Hamiltonian, derivation of Hamilton's equations of motion from a variational principle, Routh's procedure.

Canonical transformations: Canonical transformation, types of generating function, conditions for canonical transformation, integral invariance of Poincare, Poisson and Lagrange bracket, Poisson and Lagrange Brackets as canonical invariant, infinitesimal canonical transformation, conservation theorems and symmetry properties, Liouville's theorem.

UNIT-II **(14 classes)**

Hamilton -Jacobi Theory: Hamilton - Jacobi equation, Harmonic oscillator and Kepler problem by Hamilton -Jacobi method, Action angle variables and its application to simple harmonic oscillator.

Small oscillations: Problem of small oscillations, example of two coupled oscillators, general theory of small oscillations, normal coordinates and normal modes of vibration, free vibrations of a linear triatomic molecule.

Rigid body motion: Independent coordinates of a rigid body, orthogonal transformations, the Euler's angles, Cayley-Klein parameters, Euler's theorems on motion of a rigid body, infinitesimal rotations, rate of change of a vector, Coriolis Force.

UNIT-III **(14 classes)**

Rigid body dynamics: Angular momentum and kinetic energy of motion about a point. The inertia tensor and momentum of inertia, eigen values of inertia tensor and the principal axis transformation. The heavy symmetrical top with one point fixed.

Elements of Relativistic Mechanics: Interpretation of Lorentz transformations as orthogonal transformation in 4-dimensional Minkowski space, Lorentz scalars, 4-vectors and 4-tensors in Minkowski space, Laws of mechanics in covariant form and the proper time interval, 4-vector position, 4-vector velocity and 4-vector momentum, generalisation of Newton's force equation to covariant form, energy-momentum relation in relativistic mechanics, Poincare group.

BOOKS:

1. Classical Mechanics- H. Goldstein, Narosa Publishing House, 2nd Edition
2. Classical Mechanics – L. D. Landau and E. M. Liftshitz, Elsiever.
3. Classical Mechanics- H. C. Corben & P. Stehle, Dover Publication, 2nd Edition
4. Classical Dynamics- S. T. Thornton & J. B. Marion, Cengage Learning, 5th Edition
5. Analytical Mechanics- L. N. Hand and J. D. Finch, Cambridge University Press 1st edition

6. Classical Mechanics: J. C. Upadhayaya, Himalaya Publishing House.

APC102	Mathematical Methods in Physics	3-1-0	Credit 4

UNIT-I **(13 classes)**

Complex Analysis: Preliminary ideas on complex analysis, Cauchy's Integral formula, simply and multiply connected region, Laurent and Taylor's expansion, residue theorem, application in solving definite integrals. Ordinary differential equations, differential operations and Sturm Liouville theory, Partial differential equations.

Integral Transforms: Development of Fourier Integral, Fourier Transforms – Inversion Theorem & Derivatives, Convolution Theorem, Momentum Representation, Transfer Functions, Laplace Transform - Derivatives, Properties, Inverse Laplace Transform and applications to solution of differential equations.

UNIT-II **(14 classes)**

Linear vector space: Definition, linear independence, basis and dimension, scalar product, dual vector, Cauchy-Schwarz inequality, orthonormal basis, Schmidt orthogonalisation process. Linear Transformations, isomorphism and automorphism.

Groups and Group representation: Definition of groups, Finite groups, example from solid state physics, sub groups and classes, Group Representation, Characters, Infinite groups and Lie groups, Lie-algebra, Irreducible representation of SU(2) and O(3).

UNIT-III **(14 classes)**

Greens function and its applications: Definition of the Green's Function, Solution of inhomogeneous ordinary and partial differential equation by Green function method. Physical meaning of the Green function, Green function in electrostatics, Green functions for the time independent and time dependent wave equation Green function of the wave equation.

Tensors in physics: Cartesian tensor, covariant, contravariant and mixed tensors, tensor algebra, the Kronecker delta and Levi-Civita symbol, tensors in Minkowski space, tensor calculus, tensors in general relativity, Covariant derivative and the Reimann-Christoffel symbol, Ricci and Curvature tensor.

Special functions: Solution of Bessel, Laguerre, Hermite and Legendre Equation by generating function method and their properties.

BOOKS:

1. Mathematical methods of physics-Arfken and Weber, Academic Press, 7th edition
2. Mathematical Methods for Physics and Engineering, K.F. Riley, M.P. Hobson and S. J. Bence, Cambridge University Press.
3. Mathematical methods of physics- Mathews & R.L. Walker, W.A. Benjamin, 2nd edn
4. Advanced Engineering Mathematics-Erwin Kreyszig, John Wiley & Sons, Inc.
5. Mathematical Method for Physical Sciences - M. L. Boas (Wiley India) 2006
6. Mathematical Physics A Modem Introduction to its Foundations-Sadri Hassani, Springer

APC103	Quantum Mechanics-I	3-1-0	Credit 4

UNIT-I **(12 classes)**

Mathematical Tools of Quantum Mechanics: Linear Vector Space and Hilbert space formalism, Inner product spaces, dual spaces, Dirac notation, square integrable functions, expansion of vectors in an orthonormal basis, Gram-Schmidt procedure for orthonormalisation.

Operators: Linear operators, adjoint of operators, Hermitian, Skew Hermitian, unitary , inverse and projection operators, commutator algebra, uncertainty relation, matrix representations of vectors and operators, matrix elements, eigenvalues and eigenvectors of an operator, characteristic equation, degeneracy, Diagonalisation, simultaneous diagonalisation of commuting Hermitian operators, change of basis and unitary transformation. Dirac delta function in one and three dimension. Representation of vectors and operators in position and momentum spaces.

UNIT-II **(14 classes)**

Postulates of quantum mechanics: Basic postulates, state of a system, probability density, observables and operators, measurement in quantum mechanics, expectation values, time- evolution of state of a system, time evolution operator, stationary states, conservation of probability, equations of motion in Schrodinger picture, Heisenberg picture and Dirac picture.

Symmetry and Conservation laws: Space and time translation symmetries, generator, parity operator, Invariance of Hamiltonian under space rotation.

Harmonic Oscillator: Operator method solution to one dimensional Harmonic oscillator, creation and annihilation operators.

Angular momentum: Angular momentum operators, components of angular momentum L_x, L_y, L_z and L^2 and their commutation relations, raising and lowering operators (L_+ and L_-), L_x, L_y, L_z and L^2 in spherical polar co-ordinates, Eigenvalues and eigenfunctions of L_z and L^2 (operator method), Spherical harmonics, matrix representation of L_+, L_- and L^2, Spin angular momentum, spin 1/2, Pauli spin matrices and their properties, eigenvalues and eigenfunction,

UNIT-III **(16 classes)**

Total angular momentum: Eigen value problem of J_z and J^2. Addition of angular momenta, Clebsch- Gordan coefficients, calculation of C.G. coefficients for angular momenta (1/2, 1/2) and (1/2, 1) cases.

Schrodinger Equation for Central Potentials in three dimension: Separation of the wave equation in spherical polar coordinates, free particle, expansion of plane wave in spherical harmonics, bound states of 3D square well potential, 3D isotropic Harmonic oscillator, Rigid Rotator.

Hydrogen atom: Reduction to one body problem, radial equation, power series solution to the radial equation, spectrum of Hydrogen and Hydrogen like atoms, degeneracy and radial probability.

BOOKS:

1. Quantum Mechanics, Concepts and Applications : N. Zettili, Wiley, 2nd edition, 2009
2. Quantum Mechanics : B. H. Bransden and C. J. Joachain, Pearson Education, 2007
3. Principles of Quantum Mechanics: R. Shankar, Springer, 2nd edition, 2015
4. Introduction to Quantum Mechanics: David J. Griffith , Pearson, 2nd edition, 2015

APC104	Solid State Physics	3-1-0	Credit 4

UNIT-I **(12 classes)**

Crystal Solids: Basic ideas on Crystalline solids, Symmetry operations for 2- dimensional crystal, Translation and point operation, Screw axis, Glide plane, Bravais lattices, Crystal planes and Miller indices, Inter-planar distance, Index system for crystal planes, Close packed structures: Cubic and hexagonal structure.

Lattice Vibration and Thermal Properties of Solids: Lattice waves, Vibrations of one dimensional linear mono and diatomic lattice, salient features of dispersions curves, phonon density of states, Quantization of Lattice vibration, Concept of Phonon, inelastic scattering of neutron and photon by phonon, Lattice heat capacity, Debye & Einstein model, Anharmonic crystal interactions, thermal conductivity and thermal expansion.

UNIT-II **(15 classes)**

Electronic theory of matter: Formation of energy bands, K-space diagram, Nearly free electron model (NFEM), Bloch Theorem, Kronig-Penny model, distinction between metals, insulators, intrinsic semiconductors, reduced, periodic and extended zone schemes, Electrons and Holes in semiconductors, Silicon crystal structure, Donors and acceptors in the band model, electron effective mass, Sommerfeld theory of free electron gas, Density of states, Thermal equilibrium, Fermi-Dirac distribution function for electrons and holes, Fermi energy. Equilibrium distribution of electrons & holes, derivation of *n* and *p* from *D(E)* and *F(E)*, Fermi level and carrier concentrations, The *np* product and the intrinsic carrier concentration. General theory of *n* and *p*, Carrier concentrations at extremely high and low temperatures, complete ionization, partial ionization, freeze –out, Variation of E_F with doping concentration and temperature, Motion and Recombination of Electrons and Holes, mobility, Mechanism of carrier scattering, Drift current and conductivity, Carrier diffusion, diffusion current, Total current density, Einstein relationship between diffusion coefficient and mobility.

UNIT-III **(15 classes)**

Magnetism: Classical theory of diamagnetism, Langevin theory of Paramagnetism, Quantum theory of Paramagnetism, Paramagnetic susceptibility of conduction electron, Magnetic properties of rare earth ions & iron group ions with graphical representation, Ferromagnetism: Wiess theory, Curie point, Exchange integral, saturation magnetization and its temperature dependence, Saturation magnetization at absolute zero, ferromagnetic domains, Anisotropy energy, Bloch wall, Antiferromagnetism: Neel temperature, Ferrimagnetism: Curie temperature, susceptibility of ferrimagnets.

Dielectric Properties: Definitions, local field, Clausius-Mossotti relation, Polarizability.

Superconductivity: Experimental survey, Meissner's effect, heat capacity, energy gap, isotope effect, Type-I and Type-II superconductors, London theory, Idea of cooper pairing in BCS theory, Basic idea of High-T_c

superconductors.

BOOKS:

1. Introduction to Solid State Physics - C. Kittel, Wiley 8th Edition.
2. Solid State Physics – N. W. Ashcroft and N. D. Mermin, Harcourt College Publisher.
3. Solid States Physics– H. Ibach & H. Luth, Springer Publisher
4. Elementary Solid State Physics-M Ali Omar, Pearson Edition
5. Solid-state Physics- A J Dekker, Macmillan India Publisher
6. Solid-state Physics-S. O. Pillai, New Age International Publisher, 7th Edition
7. Solid states Physics – M A Wahab, Narosa Publisher, 3rd Edition

APC105	Numerical Methods & Computer Programming in C	3-1-0	Credit 4

UNIT-I **(15 classes)**

Algorithm, flowchart, Structured Programming Approach, structure of C program (header files, C pre-processor, standard library functions, etc.), identifiers, basic data types and sizes, Constants, variables, arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bitwise operators, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation. Input-output statements, statements and blocks, if and switch statements, loops:-while, do-while and for statements, break, continue, go to, programming examples.

Designing structured programs: - Functions, parameter passing, storage classes- extern, auto, register, static, scope rules, user defined functions, recursive functions. Arrays- concepts, declaration, definition, accessing elements, and functions, two-dimensional and multi-dimensional arrays, applications of arrays. pointers-concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory management functions, command line arguments.

UNIT – II **(15 classes)**

Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit fields, C program examples. Input and output – concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling.

UNIT – III **(12 classes)**

1. Error calculation and handling of error in programing.
2. Interpolation: Linear, Quadratic and Cubic and Spline methods. Newton's, Lagrange's, Stirling's and Bessel's interpolation formulae
3. Integration: Trapezoidal, Simpson, Weddle's and Gaussian Quadrature methods
4. Differentiation: Numerical derivative (1st and 2nd order) based on Stirling's interpolation
5. Root Finding: Bisection and Newton-Raphson Method
6. Differential Equation: (1st and 2nd order): Euler's method, Runge-Kutta Method (4th order algorithm), Finite difference method.
7. Solution of simultaneous linear equation: Matrix inversion method, Gaussian elimination method, LU decomposition method,

8. Least square fitting of a set of points to a straight line

BOOKS:

1. E. Balagurusamy : "C Programming" Tata McGraw-Hill
2. J. B. Scarborough :Numerical Mathematical Analysis (Oxford and IBH)
3. P. Dey& M. Ghosh, "Computer Fundamental & Programming in C"- Oxford University Press
4. Deitel -"C How to programme" PHI publication/ Pearson Publication
5. George W. Collins, II: Fundamental Numerical Methods and Data Analysis.

APC106	Electricity and Magnetism Lab	0-0-3	Credit 2

1. Measurement of current, voltage and frequency with CRO.
2. Determination of magnetic susceptibility of a paramagnetic solution using Quinck's tube method
3. Determination of magnetic susceptibility of a paramagnetic solution using Gouy's methos
4. Measurement of dielectric constant by plate capacitor.
5. Determination of Planck's constant using LEDs of at least 4 different colours.
6. Measurement of Planck's constant using black body radiation and photo detector
7. Setting up and study of unregulated power- supply with various filters and determination of ripple factor.
8. Determination of power factor of a fan.
9. Measurement of the ballistic constant using the Hilbert's magnetic standard.
10. Measurement of ballistic constant by standard solenoid.
11. Measure of a magnetic field by using a search coil and Bismuth spiral.
12. Experiments to obtain B.H. curve.
13. Any other experiments suggested by the Course Teacher

APC107	Optics Lab	0-0-3	Credit 2

1. Michelson's interferometer: determination of wavelength of sodium lines.
2. Study of polarization using Malu's law
3. Specific rotation by sugar solution using polarimeter
4. Study of Brewster's law.
5. Determination of the wavelength of sodium light using plane diffraction grating.
6. Spectral lines of mercury light using plane diffraction grating.
7. Study of Fabry-Perot interference.
8. Determination of wavelength of He-Ne LASER using plane diffraction grating

9. Determination of angular spread of He-Ne LASER using plane diffraction grating.
10. Study of interference using LASER source and a double slit and to find the wavelength of He-Ne LASER source.
11. Study of Babinet Compensator.
12. Resolving power of Grating
13. Resolving power of telescope
14. Experiment with narrow wire.
15. Any other experiments suggested by the course teacher.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Syllabus for 1st Year M.Sc. (2018-19 Admission Batch) in Applied Physics

2nd Semester

APC201	Statistical Mechanics	3-1-0	Credit 4

UNIT-I **(14 classes)**

Classical Statistical Mechanics: Basic principles and application of classical statistical mechanics, Liouville's theorem, Transport phenomenon, Boltzman transport equation, micro canonical ensemble, Review of thermodynamics, equipartition theorem, classical ideal gas, Gibb's paradox, Canonical ensemble and energy fluctuation , grand canonical Ensemble and density fluctuation , Equivalence of Canonical and grand canonical ensemble.

UNIT-II **(16 classes)**

Quantum Statistical Mechanics: The density matrix, ensembles in quantum mechanics, Ideal gas in micro canonical and grand canonical ensemble ; Distribution function for Fermi-Dirac system, equation of state for ideal Fermi gas, Theory of white dwarf stars. Ideal Bose gas, photons and Planck's law, statistics of photon and phonon gas, Bose-Einstein condensation, Landau Diamagnetism; The quantised Hall effect, Pauli paramgnetism, De Haas-Van Alphen Effect.

UNIT-III **(12 classes)**

Phase Transition: Thermodynamics description of Phase Transitions, Phase Transitions of second kind, Landau theory of phase transition beyond mean field, Gaussian fluctuation and Ginzburg criteria, Discontinuity of specific heat, change in symmetry in Phase transition of second kind.

Ising model: Definition of Ising model, One dimensional Ising model, application to Ferromagnetism.

BOOKS:

1. Statistical physics - K. Huang, John Wiley, 2nd Edition
2. Fundamentals of Statistical Physics- B B Laud, New Age International,2012
3. Statistical physics - R.K. Pathria, P. D. Beale, Academic Press, 3rd edition
4. Statistical physics - F. Mohling, Wiley-Blackwell Publisher.
5. Elementary Statistical physics - C.Kittel, C B S Publishers and Distributors
6. Statistical physics – L D Landau & E M Lifsitz, Butterworth-Heinemann 3rd edition
7. Physics Transitions & Critical Phonomena – H.E. Stanly, Oxford University Press
8. Fundamental of Statistical & Thermal physics- F. Reif, Waveland Press, 2010

APC202	Electrodynamics	3-1-0	Credit 4

UNIT-I **(12 classes)**

Maxwell's Equations: Basic ideas on Laplace and Poisson's equations and solutions, gauge transformation and gauge invariance, electromagnetic potential, energy and momentum of electromagnetic fields conservation laws, Maxwell's equations in different media; Magnetic charge; Displacement current; Vector and scalars potentials; Wave equation for potentials; Lorentz and Coulomb gauge conditions; Wave equation for Electric and Magnetic fields in absence of sources.

Covariant Formulation of Maxwell's Equation: Maxwell's equations and equations of continuity in terms of A and J ; Electromagnetic field tensor and its dual; Covariant form of Maxwell's equations; Four vectors, Relativistic Lagrangian and Hamiltonian for a charged particle in presence of external electromagnetic field, Maxwell's equation as Euler-Lagrange equations.

UNIT-II **(15 classes)**

Plane Waves in Non-Conducting Media: Plane waves in non-conducting media; velocity of wave propagation and energy flow; linear, circular and elliptic polarization; Reflection and refraction of electromagnetic waves at a plane interface between dielectrics; normal and oblique incidence; total internal reflection and polarization by reflection, Brewster's angle.

Waves in dispersive media: The oscillator model and dispersion in dielectrics, conductors and plasma, anomalous dispersion and resonant absorption, casual and non-local connection between D and E, Kramers-Kroning dispersion relations. Lorentz theory of dispersion and complex refractive index.

Plane Waves in Conduction Media: Plane waves in conduction media; Reflection and transmission at a conducting surface, attenuation of the wave; Cylindrical cavities and wave guides; Modes in rectangular wave guide and resonant cavities. Kirchhoff 's formulation of diffraction by a circular aperture

UNIT-III **(15 classes)**

Green's Function Solution for Retarded Potential: Green's function solution of potential form of Maxwell's equations, Retarded and advanced Green's Functions.

Multipole Radiation: Potential, Fields and radiation due to an oscillating electric dipole; radiation due to a centre -fed linear antenna; angular distribution of power radiated; Rayleigh Scattering. Magnetic dipole and Electric Quadrupole radiation.

Radiation by Point Charge: Lienard-Weichert potential, Field due to a point charge, Angular distribution of radiation and total power radiated by an accelerated charge, Larmor's formula and its relativistic generalization, Thomson's scattering. bremsstrahlung & synchrotron radiation, Cherenkov radiation, scattering by a small dielectric sphere in long wave length limit, Raleigh scattering.

BOOKS:

1. Classical Electrodynamics - J. D. Jackson, Wiley, 3rd Edition
2. Classical Theory of Fields - L. Landau and Lifsitz, Pergamon press
3. Introduction to Electrodynamics - D. J. Griffiths, Person publisher 4th edition
4. Principles of Optics- M. Born and E. Wolf, Elsiever, 6th edition
5. Fundamental of Electrodynamics- B Podolsky & K S Kunz 1st edition

APC203	Quantum Mechanics –II	3-1-0	Credit 4

UNIT-I **(14 classes)**

Approximation method for stationary states: Time-independent non degenerate perturbation theory, first and second order correction, perturbed harmonic oscillator, anharmonic oscillator, quadratic Stark Effect and polarizability of Hydrogen atom, degenerate perturbation theory, removal of degeneracy, linear Stark effect of Hydrogen atom, Fine structure of Hydrogen and Hydrogen like atom, energy shift due to spin orbit coupling, relativistic correction and Darwin term, normal and anomalous Zeeman effect, strong- field and weak field Zeeman effect, Lande g-factor.

Variational method: The variational principle, trial wavefunctions, calculation of ground state and excited state energy levels, ground state energy of one dimensional harmonic oscillator and Helium atom as examples.

UNIT-II **(14 classes)**

WKB approximation method: General formalism, classical region and classical turning points, validity of WKB approximation method, connection formulae, Bohr-Sommerfeld quantization rule, bound states for potential wells with one rigid wall and two rigid walls, tunneling through potential barrier, cold emission of electrons from metals, Fowler-Nordheim formula, theory of alpha decay, Gamow factor.

Time dependent perturbation Theory: General features, transition probability for constant perturbation, Fermi golden rule, transition probability for a harmonic perturbation, condition for detailed balancing, adiabatic and sudden approximations.

UNIT-III **(14 classes)**

Identical Particles: Symmetric and anti symmetric wave functions, exchange degeneracy, wave function of two identical spin ½ particles, Wave function of many particle systems, Slater determinant, Pauli exclusion principle.

Scattering Theory: Scattering cross section, laboratory and centre of mass frames, scattering amplitude and differential cross section using Green's function, Born approximation and its validity, application to Coulomb potential, screened Coulomb potential and Yukawa potential, Partial wave analysis for elastic and inelastic scattering. Effective range and scattering length, optical theorem, scattering from square well potential, resonance, scattering from black disk and hard sphere potential.

BOOKS:

1. Quantum Mechanics, Concepts and Applications : N. Zettili, Wiley, 2nd edition, 2009
2. Quantum Mechanics : B. H. Bransden and C. J. Joachain, Pearson Education, 2007
3. Principles of Quantum Mechanics: R. Shankar, Springer, 2nd edition, 2015
4. Introduction to Quantum Mechanics: David J. Griffith , Pearson, 2nd edition, 2015

APC204	Basic Electronics	3-1-0	Credit 4

UNIT-I **(14 classes)**

Amplifiers: Frequency response of linear amplifiers, amplifier pass band, R.C.L.C. and transformer coupled amplifiers, Frequency response, gain band-width product, Feedback amplifiers, effects of negative feedback, Boot-strapping the FET, Multistage feedback, stability in amplifiers, noise in amplifiers.

Operational amplifiers: The differential amplifiers, integral amplifier, rejection of common mode signals. The operational amplifier input and output impedances, application of operational amplifiers, unit gain buffer, summing, integrating and differentiating amplifiers, comparators and logarithmic amplifiers.

UNIT-II **(12 classes)**

Oscillator Circuits: Feedback criteria for oscillation, phase shift, Wien bridge oscillator, crystal controlled oscillator, Colpitt oscillator, klystron oscillator, Principle of multivibrator, astable, monostable and bistable multi vibrators.

UNIT-III **(16 classes)**

Digital Circuits: Logic fundamentals, Boolean theorem, Logic gates RTL, DTL and TTL gates, CMS switch

RS flip- op, JK flip-flop), T & D-flip-flops, A/D converter, D/A converter, Computer memory, memory cell, memory organisation, ROM, RAM, EPROM. MOS circuits, two phase inverter, dynamic MOS shift register.

Radio Communication: Ionospheric propagation, Antennas of different types, super heterodyne, receiver (Block diagram). Various types of optical fibres and optical communications.

BOOKS :

1. Electronic Fundamental and application : J.D. Ryder, PHI learning
2. Int. Digital Electronics: N W Heap & G W Martin, Springer, 1st Edition
3. Integrated Electronics: Analog & Digital circuit system: Millman and Halkias, McGrwaw Hill 2nd Ed
4. Foundation of Electronics: Chattopadhyay, Rakshit, Saha and Purkait, New Age Int. Pub. 3rd Edn
5. Hand book of electronics-Gupta, Kumar, Pragati Prakasan, (2016)

APC205	Nano Science and Nanomaterials	3-1-0	Credit 4

UNIT-I **(14 classes)**

Fundamental and process of fabrication: The world of small dimensions, Nanoscale Properties (Electrical, Optical, Chemical, Mechanical), Nanoscale visualization techniques, Electron microscopy (TEM, SEM, Cryo-SEM), Scanning probe microscopy (AFM, STM), Diffraction techniques (XRD, synchrotron), Chemical Vapour Deposition, Physical Vapour Deposition, Top-down and Bottom-Up approach , nanoparticles (synthesis, properties and applications).

Fullerenes: Synthesis and Purification of Fullerenes, Chemistry of Fullerenes in the Condensed Phase Endohedral Chemistry of Fullerenes, Conductivity and Superconductivity in Doped Fullerenes, Ferromagnetism in C60. Optical Properties, Some Unusual Properties.

UNIT-II **(14 classes)**

Nano-Device and Components: Structure of carbon nanotube, Classification and physical, mechanical and transport properties of CNT, Some Unusual Properties. Graphene: structure, synthesis and properties, Nanophotonis (Photonic crystal in one, two and three dimensions), Nanofluidics: nanopores and Nano capillaries, Debye length, Nanomechanics (elastic, thermal and kinetic material properties).

Low dimensional Devices: Synthesis of Quantum Dots; Electronic Structure of Nanocrystals; How Do We Study Quantum Dots; Correlation of Properties with Size, Quantum wire, Quantum wells.

UNIT-III **(14 classes)**

Quantum Electronics: Coulomb blockade in nano capacitors and quantum dot circuits. Single Electron Transistor (SET), Quantum information and computing, Sprintonics devices and its classifications, Structural and optical properties of nanomaterials, Molecular Electronics, NEMS, Optical and Magnetic computer.

Applications of Nano Materials: Nanotechnology in Energy systems – Electronics – Environment - Space and Aviation - Textiles - Food & Agriculture - Automotive Industry - Solar Technology - Biotech and Pharmaceutical and drugs - Molecular Nanoelectronics – Nanobots - Photonic crystals – NEMS (Nano Electro Mechanical Systems) based device - Nanosensors and Devices.

BOOKS:

1. Rishal Singh, S.M. Gupta, Introduction to nanotechnology Oxford university press, (2016).
2. T. Pradeep, -Nano: The Essentials, McGraw - Hill education, (2007).

3. Nanophysics and Nanotechnology, E. L. Wolf, WILEY-VCH Verlag GmbH & Co. KGaA, (2004)
4. Nanoscale Science and Technology Edited by R W. Kelsall, Ian W. Hamley, M Geoghegan John Wiley & Sons Ltd (2005)
5. Introduction to Nanoscale Science and Technology, Edited by M. Di Ventra, S Evoy, J R. Heflin Kluwer Academic Publishers (2004)
6. Introduction to Nano Science and Technology: Charles P Poole, F. J. Owens, Wiley (2009).

APC206	Basic Electronics Lab	0-0-3	Credit 2

1. Frequency response of transistor amplifier with the without feedback.
2. Characteristics of Hartley oscillator.
3. Determination of different parameters of transistor.
4. Study of multivibrator Astable.
5. Study of multivibrator Bistable.
6. Study of multivibrator Monostable.
7. To measure the divergence of a laser beam.
8. To find the band gap in a semiconductor using pn junction diode.
9. To show the tunneling effect in tunnel diode using I-V characteristics.
10. To design a Wien bridge oscillator for given frequency using an op-amp.
11. To design a phase shift oscillator of given specifications using BJT.
12. To add two dc voltages using Op-amp in inverting and non-inverting mode
13. To design a precision Differential amplifier of given I/O specification using Opamp
14. To investigate the use of an op-amp as an Integrator.
15. To investigate the use of an op-amp as a Differentiator.

APC207	Modern Physics Lab	0-0-3	Credit 2

1. Measurement of Rydberg constant.
2. e/m measurement by Braun tube .
3. e/m measurement by Magnetron Valve Method .
4. To setup the Millikan oil drop apparatus and determine the charge of an electron.
5. Magnetic field measurement by search coil.
6. Ferroelectric transition point by Dielectric Constant Measurement.
7. Experiments with the ESR Spectrometer, determination of the Lande's g- factor.
8. Resistivity of semiconductor at different temperatures by Four-probe method.
9. Determination of Hall Coefficient by Hall Effect apparatus.
10. Determination of Plank's constant using an optical pyrometer.
11. Determination of Planck's constant using photocell and a ballistic galvanometer.
12. Verification of Bohr's postulates using Frank-Hertz experiment.
13. Any other experiments as suggested by the course teacher.

Registration no: | | | | | | | | | | |

Total Number of Pages:	**B.Tech/B.Arch/MCA/M.Tech/M.Sc**
	SUB_CODE

1st Semester Regular Examination 2018-19

SUBJECT NAME

BRANCH:

Time: 3 Hours

Max Marks: 60

Q.CODE:

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

Q1		**Answer the following questions:**	**(1 x 10)**
	a)		
	b)		
	c)		
	d)		
	e)		
	f)		
	g)		
	h)		
	i)		
	j)		
Q2	**a)**		**(5)**
	b)		**(5)**
Q3	**a)**		**(5)**
	b)		**(5)**
Q4	**a)**		**(5)**
	b)		**(5)**
Q5	**a)**		**(5)**
	b)		**(5)**
Q6	**a)**		**(5)**
	b)		**(5)**
Q7	**a)**		**(5)**
	b)		**(5)**
Q8		**Write short notes on any two:**	**(5 x 2)**
	a)		
	b)		
	c)		
	d)		

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Evaluation Scheme for B.Tech, B.Arch, MCA, M.Tech and M.Sc programmes under Autonomy for 2018-19 Admission Batch

1. Grading System

1.1 A letter grading system shall be followed in the Institute. The uniform Grading System to be followed for all B.Tech, B.Arch, MCA, M.Tech and M.Sc Academic Programmes shall be as described below: A Nine Point grading system on base of 10 shall be followed in the Institute. Categorization of these grades and their correlation shall be as under:

Qualification	Grade	Score on 100 Percentage Points	Point
Outstanding	'O'	90 & above up to 100	10
Excellent	'E'	80 & above but less than 90	9
Very Good	'A'	70 & above but less than 80	8
Good	'B'	60 & above but less than 70	7
Fair	'C'	50 & above but less than 60	6
Below Average	'D'	37 & above but less than 50	5
Failed	'F'	Below 37	2
Malpractice	'M'	-	0
Absent	'S'	-	0

Grade-sheet would be issued year-wise to students who have cleared all the subjects as per syllabus of the lower semesters.

N.B. Grade C shall be considered as average, Grade D shall be pass Grade for theory and Grade C shall be pass Grade for Practical/ Sessional/ Project/ Seminar/ Viva-Voce/ Internship.

1.2 A student's level of competence shall be categorized by a GRADE POINT AVERAGE to be specified as:

SGPA – Semester Grade Point Average
CGPA- Cumulative Grade Point Average
It shall be the basis of judging his/ her overall competence in the course.

1.3 Definition of terms:

(a) POINT – Integer equivalent each letter grade

(b) CREDIT – Integer signifying the relative emphasis of individual course item(s) in a semester as indicated by the Course structure and syllabus.

(c) CREDIT POINT – (b) x (a) for each course item

(d) CREDIT INDEX – ΣCREDIT POINT of course items in a semester

(e) GRADE POINT - $\frac{C \quad II}{\Sigma C}$

SEMESTER GRADE POINT AVERAGE (SGPA)

SGPA - $\frac{C \quad II}{\Sigma C \quad f\epsilon \ a \ S\epsilon}$

CUMULATIVE GRADE POINT AVERAGE (CGPA)

SGPA - $\frac{\Sigma C \quad II \quad o \ a \ p \quad S\epsilon}{\Sigma C \quad o \ a \ p \quad S\epsilon}$ up to a Semester

2. Examinations: The Institute shall have continuous evaluation system for each theory, practical, sessional, design and project papers.

2.1 Theory Papers

A theory paper will have 100 percentage points. The weightage for internal evaluation and the end semester examinations will be as follows:

		Maximum Marks	Pass Marks
Internal Evaluation	(i) Class Test – I of one hour duration	15	-
	(ii) Class Test – II of one hour duration	15	-
	(iii)Quiz/ Surprise Test	05	-
	(iv)Assignments/ Attendance	05	-
	Total	40	-
End Semester Examination of three hours duration		60	21
TOTAL (Internal Evaluation + End Semester Examination)		100	37

Pass grade is D in Theory i.e. 37 percentage points and C i.e. 50 percentage points in all other items.

2.2 Practical Papers

A practical paper shall have 100 percentage points.

Each practical / experiment (work) shall have equal percentage point as its weightage. The relative weightage of the components are also given below in percentage.

(i)	Experiment (work) planning and execution	20 %
(ii)	Results and interpretation	30 %
(iii)	Report	30 %
(iv)	Understanding on the theory related to experiment	20 %
	Total	**100 %**

Minimum score for a Pass in Practical Paper shall be 50 percentage points.

2.3 Sessional Papers

Sessional paper will carry 100 percentage points.

A sessional job has to be evaluated based on the following considerations.

(i)	Quality of job	50 points
(ii)	Understanding of the job and related theory	30 points
(iii)	Quality of report and Viva - Voce	20 points
	Total	**100 points**

Minimum score for a Pass in Sessional Paper shall be 50 percentage points.

2.4 Project Item

A Project item shall carry 100 percentage points.

Evaluation of a major / minor project will be done on following points.

(i)	Understanding the relevance, scope and dimension of the project	10 points
(ii)	Relation to literature / application	10 points
(iii)	Methodology	10 points
(iv)	Quality of Analysis and Results	10 points
(v)	Interpretations and Conclusions	20 points
(vi)	Report	20 points
(vii)	Defence	20 points
	Total	**100 points**

The evaluation shall be done by a committee of teachers where the Project Supervisor shall be a member. His evaluation shall carry 50 percent weightage. The other members shall have 50 percentage weightage. For major project, an external expert shall be involved.

Minimum score for a Pass in Project item is 50 percentage points.

2.5 Seminar Item

Seminar performance will be evaluated by a committee of teachers. It will have the following components.

(i)	Quality of Material	30 points
(ii)	Quality of Presentation	30 points
(iii)	Quality and extent of response from other students	20 points
(iv)	Participation in other Presentations	20 points
	Total	**100 points**

Minimum score for a Pass in Seminar item shall be 50 percentage points.

2.6 Comprehensive Viva - Voce Item

This shall be done by a committee of teachers with participation of an External Expert from an Institution / Industry of repute.

The Comprehensive Viva - Voce Item shall carry 100 percentage points.
Minimum score for a Pass in Viva - Voce is 50 percentage points.

2.7 Internship Item (for B.Tech programmes)

The evaluation shall be done by a committee of teachers.
The Internship Item shall carry 100 percentage points.
Minimum score for a Pass in Internship is 50 percentage points.

2.8 Mandatory Courses/ Audit Courses

Minimum attendance is necessary to clear the Mandatory or Audit courses. No grades are awarded in these courses.