SCHEME & SYLLABUS

OF

B.TECH. (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)

FIRST YEAR B.TECH. (COMMON FOR ALL BRANCHES)

SEMESTER - I

S. N	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	BSC	BS 111 (BSC)	Mathematics -I	2	1	0	2	1	0	80	0	20
2	ESC	ME 112 (ESC)	Mechanical Engineering	3	0	0	3	0	0	80	0	20
3.	ESC	ME 113 (ESC)	Workshop Practice	0	0	1.5	0	0	3	0	80	20
4	ESC	CE 114 (ESC)	Engineering Drawing	0	0	1.5	0	0	3	0	80	20
			NCC/NSS/NSO/ Yoga/Scout	-	-	-	0	0	2	-	-	-
			Total	**5**	**1**	**3**	**5**	**1**	**8**			
			GROUP I									
5.	BSC	BS 100P (BSC)	Engineering Physics	2	0	1	2	0	2	50	30	20
6.	ESC	CE 100 (ESC)	Engineering Mechanics	2	0	1	2	0	2	50	30	20
7.	ESC	EE 100 (ESC)	Electrical Engineering	3	0	1	3	0	2	50	30	20
8.	HSMC	REE100 (HSM)	Environmental Studies and Disaster Management	2	0	0	2	0	0	80	0	20
			Total	**9**	**0**	**3**	**9**	**0**	**6**			
			GROUP II									
5	BSC	BS 100C (BSC)	Engineering Chemistry	2	0	1	2	0	2	50	30	20
6.	ESC	EC 100 (ESC)	Electronics and Instrumentation	2	0	1	2	0	2	50	30	20
7.	ESC	CS 100 (ESC)	Computer Programming for Problem Solving	0	1	2	0	1	4	0	80	20
8.	HSMC	BS100E (HSM)	Communication Skills and Personality Development	2	0	1	2	0	2	50	30	20
			Total	**6**	**1**	**5**	**6**	**1**	**10**			
			Total Credits	**21**								

Note :

1. NCC/NSS/NSO/YOGA/SCOUT is compulsory non credit course and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.
2. The courses BS 100P, CE 100, EE 100, REE 100, BS 100C, EC 100, CS 100 and BS 100E shall be offered in both the semesters. The students will be divided in two groups in I semester itself and shall remain in the same group in II semester as well. However, they have to opt all the eight courses in first year.

SEMESTER – II

S. N	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	BSC	BS 121 (BSC)	Mathematics -II	2	1	0	2	1	0	80	0	20
2	ESC	CE 122 (ESC)	Civil Engineering	1	0	1	1	0	2	50	30	20
3.	ESC	ME 123 (ESC)	Mechanical Drawing	0	0	1	0	0	2	0	80	20
4	ESC	ME 124 (ESC)	Workshop Technology	2	0	1	2	0	2	50	30	20
			NCC/NSS/NSO/ Yoga/ Scout	-	-	-	0	0	2	-	-	-
			Total	**5**	**1**	**3**	**5**	**1**	**8**			

GROUP I												
5	BSC	BS 100C (BSC)	Engineering Chemistry	2	0	1	2	0	2	50	30	20
6.	ESC	EC 100 (ESC)	Electronics and Instrumentation	2	0	1	2	0	2	50	30	20
7.	ESC	CS 100 (ESC)	Computer Programming for Problem Solving	0	1	2	0	1	4	0	80	20
8.	HSMC	BS100E (HSM)	Communication Skills and Personality Development	2	0	1	2	0	2	50	30	20
			Total	**6**	**1**	**5**	**6**	**1**	**10**			
GROUP II												
5.	BSC	BS 100P (BSC)	Engineering Physics	2	0	1	2	0	2	50	30	20
6.	ESC	CE 100 (ESC)	Engineering Mechanics	2	0	1	2	0	2	50	30	20
7.	ESC	EE 100 (ESC)	Electrical Engineering	3	0	1	3	0	2	50	30	20
8.	HSMC	REE100 (HSM)	Environmental Studies and Disaster Management	2	0	0	2	0	0	80	0	20
			Total	**9**	**0**	**3**	**9**	**0**	**6**			
			Total Credits	**21**								

Note :

1. NCC/NSS/NSO/YOGA/SCOUT is compulsory non credit course and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.
2. Students have to undergo in house practical summer training [Branch Code 239 (PSI)] of 15 days at the end of II semester and will be assessed in III semester.

SECOND YEAR B. TECH. (SEMESTER – III)

S. N	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	BSC	BS 231 (BSC)	Mathematics –III	2	1	0	2	1	0	80	0	20
2.	HSMC	BS 232 (HSM)	Human Values	2	0	0	2	0	0	80	0	20
3.	ESC	EE 232(ESC)	Electrical Measurements	2	0	1	2	0	2	50	30	20
4.	ESC	EC 234(ESC)	Analog Electronics	2	0	1	2	0	2	50	30	20
5.	PCC	AI 235 (PCC)	Programming with C++	3	0	2	3	0	4	50	30	20
6.	PCC	AI 236 (PCC)	Digital Logic Circuit Analysis and Design	3	1	0	3	1	0	80	0	20
7.			NCC/NSS/NSO/yoga/Scout	-	-	-	0	0	2	-	-	-
8.	PSI	AI 239 (PSI)	Training –I	0	0	1	0	0	0	0	100	0
			Total	**21**			14	2	10			

SECOND YEAR B. TECH. (SEMESTER – IV)

S. N	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	BSC	BS 242 (BSC)	Discrete Mathematical structure	2	1	0	2	1	0	80	0	20
2.	ESC	EC 243(ESC)	Communication Systems	3	0	0	3	0	0	80	0	20
3.	BSC	BS 244 (BSC)	Mathematics for Data Science	2	1	0	2	1	0	80	0	20
4.	ESC	CS245 (ESC)	Data Structure & Algorithms	3	0	2	3	0	4	50	30	20
5.	PCC	AI246 (PSC)	Computer Architecture	3	1	0	3	1	0	80	00	20
6.	PCC	AI247 (PCC)	Data communication and networking	3	0	1	3	0	2	50	30	20
7.	PCC	AI 248 (PCC)	Structured Query Language & Database Management System	3	0	2	3	0	4	50	30	20
			NCC/NSS/NSO/Yoga/ Scout	-	-	-	0	0	2	-	-	-
			Total Credits	**27**			19	3	12			

NCC/NSS/NSO/YOGA/SCOUT is compulsory non-credit course and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

Note: Students have to undergo a Practical Training-II of 30 days (In house/ Field) at the end of IV Semester for which assessment will be made at the beginning of next semester as CS359 (PSI)

THIRD YEAR B. TECH. (SEMESTER – V)

S. N	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	PCC	AI 351 (PCC)	Programming with Python	3	0	2	3	0	4	50	30	20
2.	PCC	AI 352 (PCC)	Principles of Operating Systems	3	0	1	3	0	2	50	30	20
3.	PCC	AI 353 (PCC)	Introduction to cloud computing	3	1	0	3	1	0	80	00	20
4.	PCC	AI 354 (PCC)	Introduction to Data Science & Machine Learning	3	0	1	3	0	2	50	30	20
5.	ESC	EC 355 (ESC)	Internet of Things Fundamentals & Networking	3	0	1	3	0	2	50	30	20
6	PSI	AI 359 (PSI)	Training –II	0	0	3	0	0	0	0	100	0
			Total Credits	**24**			15	1	10			

THIRD YEAR B. TECH. (SEMESTER – VI)

S. N	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	PCC	AI 361 (PCC)	Artificial Intelligence	3	0	1	3	0	2	50	30	20
2.	PCC	AI 362 (PCC)	Big Data analytics	3	0	1	3	0	2	50	30	20
3.	ESC	EC 363 (ESC)	Sensor Theory and Applications	3	0	1	3	0	2	50	30	20
4 .	PCC	AI 364 (PCC)	Block Chain Technology	3	1	0	3	1	0	80	00	20
5.	ESC	CS 365 (ESC)	Software Engineering	3	0	1	3	0	2	50	30	20
6	PCC	AI 366 (PCC)	Algorithm Design & Analysis	3	0	1	3	0	2	50	30	20
7.	PEC	AI 367 (PEC)	Professional Elective –I (PE-1)	0	1	2	0	1	4	0	80	20
			Total Credits	**27**			18	2	14			

Note: Students have to undergo a Practical Training-III of30 days (In house/ Field) at the end of VI Semester for which assessment will be made in the next semester as CS 479 (PSI)

Professional Elective –I (PE - I)

PE-I (a): AI 367 (PEC)-(a)	**Mobile Application Development**
PE-I (b): AI 367 (PEC)-(b)	**Web Technology**
PE-I (c): AI 367(PEC)-(c)	**Programming with R**

FOURTH YEAR B. TECH. (SEMESTER – VII)

S. N	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	PCC	AI 471 (PCC)	Deep Learning	3	0	1	3	0	2	50	30	20
2	PCC	AI 472(PCC)	Distributed Computing	3	0	1	3	0	2	50	30	20
3	PEC	AI 473 (PEC)	*Professional Elective –II (PE-II)	3	1	0	3	1	0	80	00	20
4	PEC	AI 474 (PEC)	**Professional Elective –III (PE-III)	3	1	0	3	1	0	80	0	20
5.	OE	**__478*** ** (OE)**	***Open Elective-I	3/2	0	0/1	3/2	0	0/2	80/50	0/30	20
6.	PSI	AI 479 (PSI)	Training –III	0	0	3	0	0	0	0	100	0
			Total Credits	**22**			14/ 15	2	4/6			

***Professional Elective –II (PE – II)**

PE-II (a): AI 473(PEC)-(a)	**Information Security Assurance and Forensics**
PE-II (b): AI 473(PEC)-(b)	**Computer Vision**
PE-II (c); AI 473(PEC)-(c)	**Human Computer Interaction**
PE-II (d): AI 473(PEC)-(d)	**Natural Language Processing**
PE- II (e): AI 473(PEC)-(e)	**Introduction to Virtual and Augmented Reality**
PE-II (f): AI 473(PEC)-(f)	**Soft Computing**
PE-II (g): AI 473(PEC)-(g)	**Computer Graphics**

****Professional Elective –III (PE – III)**

PE-III (a): AI 474(PEC)-(a)	**Information Security**
PE-III (b): AI 474(PEC)-(b)	**Business Intelligence**
PE-III (c): AI 474(PEC)-(c)	**Data preparation and analysis**
PE-III (d): AI 474(PEC)-(d)	**Software Defined Networks**
PE-III (e): AI 474(PEC)-(e)	**Graph Theory**
PE-III (f): AI 474(PEC)-(f)	**Real Time Systems**
PE-III (g): AI 474(PEC)-(g)	**Object Oriented Analysis and Design**

*****OPEN ELECTIVE**

Note: The students have to take one open elective out of the list given below:

Offering Department	Course Code	Course Title	Credit		
			Th.	T	P
Civil Engineering	CE478a (OE)	Urban Waste Management	2	0	1
	CE478b (OE)	Ground Improvement Techniques	2	0	1
Mining Engineering	MI 478 (a) (OE)	Engineering Geology	2	0	1
	MI 478 (b) (OE)	Earth Moving Machinery	2	0	1
	MI 478 (c) (OE)	Tunnelling Engineering	2	0	1
Mechanical Engineering	ME 478(a) (OE)	Entrepreneurship And Industrial Management	2	0	1
	ME 478(b) (OE)	Bio Energy System Design	2	0	1
	ME 478(c) (OE)	Energy Conservation And Management	2	0	1
Electronics & Comm. Engg.	EC 478(a)(OE)	Intellectual Property Rights	3	0	0
	EC 478(b) (OE)	E-Commerce	3	0	0
Electrical Engg.	EE 478(a) (OE)	Knowledge Based System	3	0	0
	EE 478(b) (OE)	Advanced Power Converters	3	0	0

	EE 478(c) (OE)	Power Electronics In Renewable Energy Systems	3	0	0
Renewable Energy Engineering	REE 478(OE)	Renewable Energy Technologies	2	0	1
Soil & Water Engineering	SWE 478(OE)	Aerial Photography, RS and GIS	2	0	1
Farm Machinery & Power Engineering	FMP 478(OE)	Machinery For Land Development	2	0	1
Processing & Food Engineering	PFE 478(OE)	Packaging Materials And Methods	2	0	1

FOURTH YEAR B. TECH. (SEMESTER – VIII)

S. N	Category	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	PSI	AI 481	Seminar	0	0	3	0	0	-	0	100	0
2.	PSI	AI 482	Project**	0	0	15	0	0	-	0	100	0
			Total Credits	**18**								

Project: Project can be done by the student in house or in industry as the case may be and as per the norms and guidelines of the college**

COURSE CONTENT
FIRST YEAR B.TECH. (I SEMESTER)

BS111 (BSC) MATHEMATICS – I

Cr. Hrs. 3(2+1+0)

	L	T	P
Credit	**2**	**1**	**0**
Hours	**2**	**1**	**0**

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

CO1 Expand function in Taylor's and Maclaurin's series.
CO2 Trace the Cartesian and Polar curves.
CO3 Apply the partial differentiation to compute the minima and maxima of functions of two variables.
CO4 Compute areas and volumes by integration.
CO5 Solve linear differential equations of higher order and homogenous differential equations with constant coefficients.

Unit-I

Differential Calculus: Taylor's and Maclaurin's expansions, Asymptotes and Curvature (Cartesian Coordinates only), Curve tracing (Cartesian and standard Polar Curves-Cardioids, Lemniscates of Bernoulli, Limacon, Equiangular Spiral).

Unit-II

Differential Calculus :Partial Differentiation, Euler's Theorem on Homogeneous Functions, Maxima & Minima of Two Independent Variables, Lagrange's Method of Multipliers, Jacobians.

Unit-III

Integral Calculus :Double Integral, Areas & Volumes by Double Integration, Change of Order of Integration, Triple integrals, Beta Function and Gamma Function (Simple Properties), Relation between Beta and Gamma functions.

Unit-IV

Differential Equations : Linear Differential Equations of Higher Order with constant coefficients, Homogeneous Linear Differential Equations with constant coefficient.

Text Books/ References

1. Guar, Y.N. and Koul, *C.L, Engineering Mathematics*, Vols. I & II, Jaipur Publishing House, Jaipur .
2. Babu Ram, *Engineering Mathematics-I*, Pearson Education, India
3. B.V. Ramana, *Higher Engineering Mathematics*, Tata McGraw Hill, India
4. J.L. Bansal and H.S. Dhami, *Differential Equations*, Vols. I & II, Jaipur Publishing House, Jaipur
5. M.Ray and Chaturvedi, *A Text Book of Differential Equations*, Student Friend & Co. Publisher, Agra.
6. Rao V. Dukkipati, *Engineering Mathematics*, New Age International (P) Ltd, New Delhi.
7. Gupta C.B., Malik A.K., *Engineering Mathematics –I*, New Age international Publisher.

ME 112 (ESC) MECHANICAL ENGINEERING

Cr. Hrs. 3(3+0+0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Course Outcomes: Upon completion of this course the students will be able to:

CO1: Apply the principles of conservation of mass, first and second laws of thermodynamics to analyse closed steady state systems and processes involving heat and work interactions.
CO2: Show understanding of concepts of reversibility, entropy and Carnot cycle.
CO3 Demonstrate knowledge of properties of steam and ability to compute them from steam tables and Mollier chart.

CO4: Understand construction and working of steam boilers, steam engines and their specific applications.
CO5: Compute efficiency, power output, etc. of various vapour and gas cycles.
CO6: Demonstrate knowledge about construction and working of IC engines.

Unit I

Thermodynamics: Thermodynamic properties, closed and open systems, flow and non-flow processes, gas laws, laws of thermodynamics, internal energy. Application of First Law in heating and expansion of gases in non-flow processes only.

Second law of thermodynamics: Kelvin-Planck and Claussius statements. Reversible processes, Carnot cycle, Carnot theorem. Reversed Carnot cycle.Entropy, physical concept of entropy.

Unit II

Properties of Steam: Difference between gas and vapour, change of phase during constant pressure process. Generation of Steam, triple point and critical point.Internal energy and entropy of steam.Use of steam tables and Mollier chart, heating and expansion of vapour in non-flow processes.

Unit III

Vapour Power Cycles: Introduction to Carnot Cycle, Rankine cycle and modified Rankine cycle.

Steam Generators: Classification of steam boilers.Cochran, Lancashire, Locomotive and Babcock-Wilcox boilers, Boiler mountings and accessories.

Steam Engines: Introduction to simple and compound steam engines.

Unit IV

Gas Power Cycles: Introduction. Air Standard efficiency, other engine efficiencies and terms.Otto, diesel and dual cycles. Calculation of efficiency, mean effective pressure and their comparison.

Internal Combustion Engines: Introduction, Classification, terminology and description of IC Engines. Four stroke and two stroke petrol, gas and diesel engines.Comparison of petrol and diesel engines.Simple carburettor.

Text Books/References

1. M. L. Mathur and F. S. Mehta: Thermal Engineering, (Vol. I, SI Edition), Jain Brothers, New Delhi.
2. R. K. Purohit: Foundation of Mechanical Engineering, Scientific Pub. (India), Jodhpur.
3. P.K. Nag: Engineering Thermodynamics, TMH.

ME113 (ESC) WORKSHOP PRACTICE

Cr. Hrs. 1.5(0 + 0 + 1.5)

	L	T	P
Credit	0	0	1.5
Hours	0	0	3

Course Outcomes: Upon completion of this course the students will be able to:

CO1: Demonstrate knowledge of characteristics of various types of woods used in engineering applications.
CO2: Demonstrate knowledge of tools and operations in carpentry work, black smithy, fitting, sheet metal and plumbing works in engineering practice.
CO3 Identify and use measuring instruments in workshop practice and pipe fittings.
CO4: Learn use of tools in the carpentry, fitting, smithy, sheet metal and plumbing shop to make simple jobs.

Carpentry Shop: Acquaintance with types of wood, tools and their uses. Simple exercises involving basic operations like sawing, planning, chiselling, etc. Preparation of simple joints, cross half lap joint, dovetail joint, bridle joint, tenon and mortise joint.

Smithy Shop: Acquaintance with types of tools and their uses. Simple exercises involving basic operations like bending, drawing, punching, shaping, upsetting, and riveting.

Fitting Shop: Acquaintance with tools, measuring and marking tools, precision measuring tools and their uses. Simple exercises involving basic operations like sawing, chipping, filling, drilling, reaming, threading with taps and dies.

Sheet Metal and Plumbing Shop: Demonstration of basic tools, pipe fittings and operations.

Texts books/References:

1. S.K. HajraChoudhury and A.K. HajraChoudhury: Elements of Workshop Technology (Vol. I), Media promoters & Publishers Pvt. Ltd., Bombay.

CE 114 (ESC) ENGINEERING DRAWING

Cr. Hrs. 1.5(0+0+1.5)

	L	T	P
Credit	**0**	**0**	**1.5**
Hours	**0**	**0**	**3**

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

CO1	Select, Construct and Interpret appropriate drawing scale as per the situation.
CO2	Draw simple curves like ellipse, cycloid and spiral.
CO3	Draw Orthographic projections of points, lines and planes.
CO4	Draw orthographic projection of solids like cylinders, cones, prisms and pyramids including sections.
CO5	Layout development of solids for practical situations.
CO6	Draw isometric projections of simple objects.

Introduction and letter writing.Construction and use of plain, diagonal and vernier scale.Methods of drawing ellipse, parabola and hyperbola.Methods of drawing cycloids, spirals.Orthographic projection and projection of points. Projection of lines, projection of planes, projection of solids.Introduction of prism, pyramid, cylinder and cone. Section of solids, introduction of intersection of surfaces.Development of plane and curved surface.Isometric projection.

Text Books / Reference

1. N.D. Bhatt. Elementary Engg. Drawing, Rupalee publication, Anand.
2. Lakshmi Narayan and Vaishwanar. A Text Book of Practical Geometry, Jain Brother, New Delhi.
3. R.B. Gupta. A Text Book of Engineering Drawing, SatryPrakashan, New Delhi.
4. Fundamentals of Technical Drawing, Parkinson.

BS 100P (BSC) ENGINEERING PHYSICS

Cr. Hrs. 3(2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1	Apply vector calculus approach to problems in electric field and magnetic field.
CO2	Apply laws of physics to simple LRC circuits.
CO3	Learn physics behind various types of lasers and their characteristics.
CO4	Understand the interference and diffraction from wave optics concepts and know its applications.
CO5	Understand polarization of light and its applications.

Unit-I

Electric Field: Line integral of electric field, Potential difference, Field as gradient of potential, Divergence of a vector function, Differential form of Gauss's law, Laplacian, Laplace equations, Curl of a vector function. Gauss's divergence theorem.

Magnetic Field: Curl and Divergence of a magnetic field, Magnetic scalar and vector potential.

Unit-II

Varying Field: Faraday's law-integral and differential form, Self and mutual inductance, Neumann's equation, Charge and discharge of a capacitor through register, Growth and decay of current in LR circuit, Energy stored in electric and magnetic field, Displacement current, Maxwell's equations.

Unit-III

Laser: Coherence, Einstein's coefficient, Spontaneous and stimulated emission, Population inversion,

Laser gain (pumping), Spectral narrowing in laser, Coherence length, Ruby and He-Ne laser.
Interference: Division of amplitude, colour of thin films, Newton's ring, Febry-Perot interferometer-principle, operation, determination of wave length and difference in wave length.

Unit-IV

Diffraction: Double slit Fraunhoffer diffraction pattern, Fraunhoffer diffraction by a plane transmission grating, Formation of spectra.
Polarization: Analysis of linearly, circularly and elliptically polarized light (Half wave and quarter wave plates), Optical activity, specific rotations, Laurent's half shade polarimeter and its use for determination of specific rotation of sugar solution.

Practical

1. To find refractive index and dispersive power of material of prism by spectrometer.
2. To find wave length of light by Newton's ring.
3. To find wave length of light by diffraction grating.
4. To find specific rotation of sugar solution by polarimeter.
5. To find wave length of light by Fresnel Biprism.
6. To find frequency of A.C. mains.
7. To determine dielectric constant of liquid using series resonance method.
8. To study charge and discharge of condenser through a resistor (C.R. Circuit).
9. To study LCR resonant circuit, resonance, quality factor and sharpness in (i) series circuit (ii) parallel circuit.

Text Books/References

1. K.K. Tiwari. (1995). Electricity and Magnetism, S. Chand and Company, New Delhi.
2. N. Subrahmanyam and Brijlal. (1993). A Text Book of Optics,
S. Chand and Company, New Delhi.
3. Ahmed and Lal. (1966). Electricity, Magnetism and Electronics, Unitech House, Lucknow.
4. D.S. Mathur. (1993). Mechanics, S. Chand and Company, New Delhi.
5. Gupta and Kumar. (1995). Practical Physics, PragatiPrakashan, Meerut.

CE 100 (ESC) ENGINEERING MECHANICS

Cr. Hrs. 3(2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1	Draw free body diagrams and determine the resultant of forces and/or moments.
CO2	Determine the centroid and second moment of area of sections.
CO3	Apply laws of mechanics to determine efficiency of simple machines with consideration of friction.
CO4	Analyse statically determinate planar frames.
CO5	Analyse the motion and calculate trajectory characteristics.
CO6	Apply Newton's laws and conservation laws to elastic collisions and motion of rigid bodies.

(A) STATICS

Unit-I

Introduction of condition of equilibrium: Force, system of force, coplanar forces.
Moment and couples: Moment and parallel forces, Couples, General conditions of equilibrium
Practical Applications: Levers, Cracked levers, Steel yards. Sagging chains and toggle joints.
Centre of Gravity: Centre of parallel forces, C.G. in some simple cases, C.G. of Solids.
Moment of Inertia: Moment of inertia, Radius of gyration and perpendicular axis. Determination of moment of inertia of simple sections. Mass of moment of inertia.

Unit-II

Friction: Introduction, Critical angle of friction, Friction on horizontal planes, Friction on inclined planes, Wedge and block, Screw Jack
Machines: Introduction, Effects of friction, Loss of work, Reversible and irreversible machine, Law of machine, Wheel and axle, Differential wheel and axle, Pulley block, Screw jack, Single and double purchase crab, Worm and Worm wheel, System of pulleys.
Frames: Statically determinate plane frames, Method of joints, Method of sections.

(B) DYNAMICS

Unit-III

Rectilinear Motion, Motion under gravity, Projectiles equation of the path, Maximum height attained, Time of flight, Horizontal range. Angle of projection, Projectile from a given height, Projectile on an inclined plane, Problems.
Work, Power and Energy: Work, Power, Work done by torque, Energy, Law of conservation.

Unit-IV

Centripetal and centrifugal forces, Laws of motion: Newton's Law of motion and their explanation, Collision of elastic bodies; Impulse and impulsive force, Principle of conservation of momentum, Loss of kinetic energy during impact.

Practical

1. Verification of law of polygon of forces.
2. Verification of principle of moment in case of compound level.
3. Verification of principle of moment in case of bell crack level.
4. Determination of reaction in case simply supported beam with or without overhang.
5. To determine coefficient of friction between different surfaces on horizontal plane.
6. To determine coefficient of friction between different surfaces in inclined plane.
7. Study of different wheel and Axle.
8. Study of single purchase crab.
9. Study of worm and worm wheel.
10. Study of Weston's pulley block.
11. Determination of mechanical advantage, velocity ratio and efficiency of single purchase crab.
12. Determination of mechanical advantage, velocity ratio and efficiency of double purchase crab.
13. Determination of mechanical advantage, velocity ratio and efficiency of first system of pulley.
14. Determination of mechanical advantage, velocity ratio and efficiency of second system of pulleys.
15. Determination of mechanical advantage, velocity ratio and efficiency of third system of pulleys Flywheel.

Text Books / References

1. I.B. Prasad. Engineering Mechanics, Khanna Publisher, New Delhi.
2. R.S. Khurmi. Applied Mechanics, S. Chand & Company Ltd., New Delhi
3. S.B. Junnarkar. Applied Mechanics, Charotar Publishing House, New Delhi.
4. Saluja. Applied Mechanics, SatyaPrakashan, New Delhi.

EE 100 (ESC) ELECTRICAL ENGINEERING

Cr. Hrs. 4(3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1	Proficiency in solving DC network.
CO2	Know-how of single phase AC circuits
CO3	Competency in solving three phase balanced AC circuits
CO4	Dexterity in using basic electrical instruments
CO5	Comprehension of transformer working principles.

Unit-I

Electro motive force, reluctance, laws of magnetic circuits, determination of ampere-turns for series and parallel magnetic circuits, hysteresis and eddy current losses.

Kirchoff's law, Delta-star and star-delta conversion, source conversion
Network theorems: Thevenin's, Norton's, superposition, and Maximum Power Transfer theorem.

Unit-II

Single Phase EMF generation, average and effective values of sinusoidal and linear periodic wave forms, instantaneous and average power, power factor, reactive & apparent power, solution of R-L-C, series, parallel, series-parallel circuits, complex representation of impedances, phasor diagram, series and parallel resonance.

Unit-III

Transformer:Faraday's laws of Electromagnetic induction, construction and principle operation of single phase transformer, EMF equation, voltage and current relationship and Phasor diagram for ideal transformer.
Fundamentals of DC machines: Working principle, operation and performance of DC machines (Motor and generator)

Unit-IV

Three phase A.C. circuits: Three phase EMF generation, delta and star connection, methods of three phase power measurement; power factor, reactive and apparent power, Series and parallel resonance.
Concept of Three phase induction motor: construction and operation. Basic introduction of single phase induction motor.

Practical

1. To Establish the Voltage-Current Relationship in an Electric Circuit and to Measure the Unknown Resistance by Ammeter-Voltmeter Method (Ohm's Law).
2. Experimentally Verify the Number of Resistance Connected in Series and parallel in an Electric Circuit can be replaced by in Equivalent Resistance without Disturbing the Circuit Condition.
3. Verify Kirchhoff's Current Law and voltage law for a DC Circuit.
4. Verify Superposition Theorem For A DC Circuit.
5. Verify Thevenin's Theorem for a Dc Circuit.
6. To Measure Power and power factor in a Single Phase A.C. Series R-L Circuit.
7. Determination of Choke Coil Parameter Resistance (R) and Inductance (L).
8. To Study The Characteristics of an L-C-R Series Circuit.
9. Testing of Single Phase Energy Meter by Direct Loading Method.
10. Determination of Percentage Regulation of a Single Phase Transformer by Direct Loading Method.
11. Determination of Efficiency of a Single Phase Transformer By Direct Loading Method
12. To perform open circuit and short circuit test for single phase transformer
13. To obtain load characteristics of D.C. shunt/series /compound generator
14. To perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalent circuit parameters
15. To perform no load & blocked –rotor test on 1 ph. induction motor & to determine the parameters of equivalent circuit.

Text Books / References

1. B.L. Therja. Electrical Technology, S. Chand.
2. M.E. Van Valkenberg. Network analysis, PH.I
3. Soni and Gupta. Introduction to Electrical Network Theory, DhanpatRai Publisher.
4. Dr. R.A. Gupta and Dr. Nikhal Gupta. (2002). Fundamentals of electrical & Electronics Engineering, JPH.
5. H.P. Tiwari. (2002). Electrical & Electronics Engineering, College Book Centre, Jaipur.
6. J. B. Gupta. (2002). Fundamentals of Electrical & Electronics. S.K. Kataria and Sons. Dehli.

REE 100(HSM) ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Cr. Hrs. 2(2+0+ 0)

	L	T	P
Credit	**2**	**0**	**0**
Hours	**2**	**0**	**0**

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

CO1 Develop an understanding of different natural resources including renewable resources.

CO2 Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
CO3 Develop an understanding of environmental pollutions and hazards due to engineering/technological activities and general measures to control them.
CO4 Demonstrate an appreciation for need for sustainable development and role of science.
CO5 Aware of important acts and laws in respect of environment.

Unit-I

Environmental Studies: Definition, scope and importance. Natural Resources: Renewable and non-renewable resources and associated problems.
Forest resources: Use and over-exploitation. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects. Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.

Unit-II

Ecosystems: Concept, Structure and function. Energy flow in an ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the various ecosystems.
Biodiversity and its conservation: Introduction, definition, genetic species & ecosystem diversity and biogeographical classification of India.
Value of biodiversity. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation.

Unit-III

Environmental Pollution: definition, cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards.
Solid Waste Management: causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution.
Social Issues and the Environment: Urban problems related to energy; Water conservation, rain water harvesting, watershed management.
Environmental ethics: Issues and possible solutions; Wasteland reclamation, Consumerism and waste products. Environment Protection Act.
Issues involved in enforcement of environmental legislation. Public awareness, Human Population and the Environment: population growth, Family Welfare Programme.
Environment and human health: Human Rights, Value Education, HIV/AIDS, Women and Child Welfare.
Role of Information Technology in Environment and human health.

Unit-IV

Natural Disasters- Meaning and nature, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Climatic change: global warming, Sea level rise, ozone depletion.
Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, accidents.
Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Armed forces in disaster response; Disaster response; Police and other organizations.

Text Books / References

1. Agarwal K.C., Environmental Biology, Nidi Publications, Bikaner, 2001.
2. BharuchaErach. 2005. Text Book of Environmental Studies for Undergraduate Courses, University Grants Commission, University Press, Hyderabad.

3. Chary Manohar and Jaya Ram Reddy. 2004. Principles of Environmental Studies, BS Publishers, Hyderabad.
4. Chaudhary, B.L. and JitendraPandey: Environmental Studies, Apex Publishing House, Udaipur, 2005
5. Climate Change.1995: Adaptation and mitigation of climate change-Scientific Technical Analysis Cambridge University Press, Cambridge.
6. Gupta P.K. 2004, Methods in Environmental Analysis – Water. Soil and Air. Agro bios, Jodhpur.
7. Husain Majid. 2013, Environment and Ecology: Biodiversity, Climate Change and Disaster Management, online book.
8. Jhadav, H. &Bhosale, V.M.: Environmental Protection & Laws, Himalaya Pub. House, Delhi
9. Kaul S.N., AshuthoshGautam. 2002. Water and Waste Water Analysis, Days Publishing House, Delhi.
10. Rao, M.N. and A.K. Datta, Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.
11. Sharma J.P. 2003, Introduction to Environment Science, Lakshmi Publications.
12. Sharma, B.K., Environmental Chemistry, Goel Publishing House, Meerut
13. Sharma, R.K. & Sharma, G. 2005, Natural Disaster, APH Publishing Corporation, New Delhi.
14. Singh Pratap, N.S. Rathore and A.N. Mathur: Environmental Studies, Himanshu Publications, Udaipur, 2004.
15. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno Science Publications.

BS 100C (BSC) ENGINEERING CHEMISTRY

Cr.Hrs. 3(2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

- **CO1** Demonstrate knowledge of science behind common impurities in water and methods to treat them.
- **CO2** Describe the purpose and operational steps of key water treatment processes used to improve water quality including: Coagulation, Sedimentation, Filtration, Disinfection, Corrosion Control, Taste and Odour Control
- **CO3** Know the methods to determine the calorific value of fuels, perform flue gas analysis and combustion analysis.
- **CO4** Apply the science for understanding corrosion and its prevention.
- **CO5** Apply the knowledge of Kinetics of Reactions

Unit- I

Sources of water, common impurities, requisites of drinking water in municipal water supply. Purification of water, sterilization, break point chlorination. Hardness, determination of hardness by Complexometric (EDTA) method, degree of hardness, Boiler troubles, carry over corrosion, Sludge and scale formation. Caustic embrittlement, cause of boiler troubles and their prevention.

Unit- II

Classification of fuels, solid fuels, Proximate and Ultimate analysis of coal, significance of constituents, theoretical method for calculation of Gross and net calorific values. Liquid fuels- Petroleum origin, Refining of Petroleum, knocking, octane number, anti knockingagents . Flue gas analysis by Orsat Apparatus, Calculations based on combustion.

Unit- III

Corrosion and its control:Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion.
Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Unit- IV

Chemical Kinetics-Order and Molecularity of reaction, first and second order reaction, Derivation of equations for first and second order reaction, determination of order of reaction, Energy of activation and Arrhenius equations, Numerical of first and second order reactions.

Practical

1. Determination of viscosity of a liquid.
2. Estimation of free chlorine in a water sample.
3. Determination of temporary and permanent hardness by EDTA method.
4. Determination of Copper Sulphateiodometrically.
5. Estimation of Potassium dichromate iodometrically.
6. Determination of purity of Ferrous Ammonium Sulphate (Mohr's Salt) using Potassium Permanganate.
7. Estimation of available chlorine in Bleaching Powder sample.
8. Analysis of Brass.
9. Determination of Strength of Ferrous Ammonium Sulphate (FAS) using Potassium Ferricyanide as an external indicator.
10. Analysis of Common Salt.

Text Books / References

1. Jain and Jain. Engineering Chemistry, DhanpatRai Publishing Company(P) Ltd., New Delhi.
2. Jain and Gupta. A Text Book of Engineering Chemistry,Jaipur Publishing House,Jaipur
3. B.K. Sharma. Engg. Chemistry(General), Krishna Prakashan Media (P) Ltd., Merrut.
4. S.S. Dara. A Text Book of Engineering Chemistry, S.Chand& Co., New Delhi.
5. M.M. Uppal. A Text Book of Engineering Chemistry,Khanna Publishers, New Delhi.
6. S.S. Dara. A Text Book on Experiments and Calculations in Engg.Chem. S.Chand& Co., New Delhi.
7. Ameta and Yasmin. Practical Engineering Chemistry, Himanshu Publications, New Delhi

EC100 (ESC) ELECTRONICS AND INSTRUMENTATION

Cr.Hrs. 3(2+0+1)
L T P
Credit 2 0 1
Hours 2 0 2

Unit-I

Passive Components: Construction and characteristics of various types of resistors, capacitors & inductors for electronic circuits, color coding of resistors. Semiconductor Devices: Basic theory of semiconductors, constructions and characteristics of PN diode, Zener diode, photodiode, LED, BJT & JFET.

Unit-II

Bipolar Junction Transistor: Introduction to BJT biasing circuits, Basic concept of class-A, class-B, class-AB, class-C amplifiers.

Power supply: Rectifier circuits and filters. Concept of voltage regulators, Zener diode voltage regulators, Transistor series regulator.

Unit-III

Feedback & Oscilloscopes: Concept of positive and negative feedback. Introduction to Oscilloscope.Barkhausen criteria. Working principle of RC- phase shift, Wien bridge, Hartley, Colpitts and Crystal Oscilloscopes.

Unit-IV

Transducers: Active and Passive transducers. Working principle of Thermocouple, LVDT, Strain Gauge and Tacho Generator. Instrumentation: Introduction to data acquisition system. Working principle of Electronic Multimeter, Cathode Ray Oscilloscope, Digital Storage Oscilloscope and Spectrum Analyzer.

Practical

1. Identification and testing of different types of passive and active electronic components: Resistors, Capacitors, Inductors, Diodes, Transistors.
2. Plot the V-I characteristics in forward and reverse bias mode for (a) PN junction diode
(b) ZENER diode and find the cut- in and breakdown voltage respectively.
3. Plot the V-I characteristics of LED diode in forward bias mode and find the glow voltage.
4. Determine the R.M.S value of output voltage and check the waveform on CRO for:
(a) Half wave rectifier with and without filter.
(b) Full wave centre tapped rectifier with and without filter.
(c) Full wave bridge rectifier with and without filter.
5. Plot the input and output characteristics for two configurations of transistors:
(a) NPN/PNP transistor in CE configuration.
(b) NPN/PNP transistor in CB configuration.
6. Determine both theoretically and practically the frequency of oscillation for R-C Phase shift Oscilloscope.
7. Determine the output voltage of an amplifier: (a) with feedback (b) without feedback.
8. Study and perform basic measurement of Digital Multi Meter.
9. Study and perform basic measurement of Cathode Ray Oscilloscope/ Digital Storage Oscilloscope.
10. Study of Spectrum Analyzer and perform basic measurements.

NOTE: *The actual number of experiments may be more than the above mentioned list.*

Text Books / References

1. Millman and Halkias. Integrated electronics: Mc Grew Hill
2. W.D Cooper. Electronics Instrumentation and Measurement : PHI
3. M.L.Gupta. Electrical Engineering Materials
4. Melvino, Principles of Electronics
5. John D. Ryder. Electronics Fundamentals

CS100(ESC) COMPUTER PROGRAMMING FOR PROBLEM SOLVING

Cr. Hrs. 3(0+1+2)

	L	T	P
Credit	**0**	**1**	**2**
Hours	**0**	**1**	**4**

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

CO1	Design, implement, test, debug, and document programs in C using conditional branching and iteration.
CO2	To use arrays, understand how to write and use functions, how the stack is used to implement function calls, and parameter passing options
CO3	Implement recursion functions & use of pointers and structures to formulate programs.
CO4	To be able to create, read and write to/from files and to write simple searching and sorting algorithms

Unit I

Introduction to Programming, Algorithm, Flowchart, Arithmetic expressions and precedence: The Character set, constants, variables and keywords, data types, Type Conversion, Hierarchy of Operations, Conditional Branching: The if Statement, if-else Statement, Nested if-else, Ladder if-else, The Conditional Operators. Loops: While Loop, do-while loop, for Loop, Nesting of Loops, Multiple Initializations in for Loop, break Statement, continue Statement, Decisions using switch, Go to Keyword, finding roots of an equations.

Unit II

Arrays: Array Initialization, Bounds Checking, One and Two Dimensional Arrays, Memory Map of a 2-Dimensional Array, Strings: String Functions- strlen( ), strcpy( ), strcat( ), strcmp( ), Two-Dimensional Array of Characters. Function: Function Declaration and Prototypes, Parameter passing in functions: Call by Value and Call by Reference, Passing Array Elements to a Function, Passing an entire Array to a Function.

Unit III

Recursion: Recursion such as Finding Factorial, Fibonacci series, Ackerman function etc. Structures: Declaring a Structure, Array of Structures. Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures

Unit IV

File handling: create, open, insert, update, search and display operations. Basic Algorithms: Searching: linear & binary, Basic Sorting Algorithms (Bubble, Quick sort and Merge sort), Notion of linked list.

Text books / References

1. "Let us C", Yashwant Kanetkar, Allied Publishers.
2. "The C programming language", Kernighan and Ritchie, Prentice Hall of India.
3. "Programming in ANSI C", E. Balaguruswamy, Tata McGraw Hill.

BS100E (HSM) COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT

Cr. Hrs. 3 (2 + 0 +1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, students will be able to:

CO1	Understand basic grammar principles, and apply them to synthesise and transform sentences and identify common errors in writing
CO2	Demonstrate enhanced communicative ability in English, and develop sensitivity to cultural differences in communication
CO3	Write structured paragraphs and essays, CVs, letters and professional emails
CO4	Understand their personality type, develop leadership qualities and time-management techniques
CO5	Understand the process and types of communication and the barriers to effective communication
CO6	Show improved vocabulary and pronunciation
CO7	Practice skills required for oral presentations, group discussions and interviews

Unit-I

Sentence and its types, Parts of Speech, Articles, Tenses, Concord, Modals, Narration and Voice

Unit-II

Nissim Ezekiel – Goodbye Party for Miss Pushpa T.S. – Poem
(Introduction to Indianisms and Difference between Indian English and Standard English)

George Orwell – Politics and the English Language – Essay
(Writing process and what constitutes good or bad writing; rules of writing for effective communication)

Unit-III

C.V and Resume Writing, Letter Writing, E-mail Writing, Paragraph Writing (Topic sentence, inductive and deductive logic), Essay Writing (Narrative, Descriptive, Expository and Persuasive)

Unit-IV

Personality Traits (Big Five Model), Skills of a Good Leader, Effective Time Management Techniques, Communication: Process and Types (Verbal/Non-Verbal/Para-Verbal, Intrapersonal/Interpersonal, Upward/Downward/Horizontal/Diagonal), Barriers to Effective Communication

Practical (Language Lab)

Phonetics, Group Discussions, Mock Interviews, Presentations, Vocabulary Building (Synonyms, Antonyms, One-Word Substitutes, Idioms and Phrases), Listening Comprehension, Everyday Conversations

Text books / References

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan. 2007
3. High School English Grammar and Composition. Wren and Martin. S. Chand. 2018
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
7. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.
8. The Ultimate Book of Common Errors. Terry O'Brien. Rupa Publications. 2015.
9. Technical Writing for Engineers and Scientists. Barry J. Rosenberg. Addison-Wesley Professional. 2005.
10. Spoken English: A Manual of Speech and Phonetics. R.K. Bansal& J.B. Harrison. Orient Longman. 2013.
11. English Phonetics & Phonology: A Practical Course. P. Roach. Cambridge University Press, London. 2010.
12. Handbook of the International Phonetic Association: A Guide to the Use of the International Phonetic Alphabet. Cambridge University Press.
13. Communicating Your Way to Success: The Success Stories. Dale Carnegie. Manjul Publishing House. 2018.
14. Talk like TED: The Public-Speaking Secrets of the World's Top Minds. Carmine Gallo. St. Martin's Press. 2014.
15. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success. Gopalaswamy Ramesh and Mahadevan Ramesh. Pearson Education. 2013.

FIRST YEAR B.TECH. (II SEMESTER)

BS121 (BSC) MATHEMATICS – II

Cr. Hrs. 3(2+1+0)

	L	T	P
Credit	**2**	**1**	**0**
Hours	**2**	**1**	**0**

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

CO1	Show knowledge of vector calculus and its applications in engineering.
CO2	Solve second order differential equations for application in their field of engineering.
CO3	Solve partial differential equations of first order and higher orders (with constant coefficients).
CO4	Solve simultaneous equations by matrix methods.
CO5	Determine eigenvalues and eigenvectors.
CO6	Diagonalise a matrix and invert a matrix.

Unit-I

Vectors Calculus: Scalar and Vector field, Differentiation of vector functions, Gradient, Divergence, Curl and Differential Operator, Integration of vector functions, Line, Surface and volume Integrals, Green's Theorem in a Plane, Gauss's and Stoke's Theorem (without proof) and their Applications.

Unit-II

Differential Equations: Second Order Ordinary Differential Equations with Variables Coefficients, Exact Forms, Part of Complimentary Function is known, Change of Dependent Variable, Change of Independent Variable, Normal Forms, Method of Variation of Parameter.

Unit-III

Partial Differential Equations: Formation of partial differential equations, Partial Differential Equations of First Order, Lagrange's Form, Standard Forms Higher order linear partial differential equations with constant coefficients.

Unit-IV

Matrices: Rank of a matrix, Inverse of a matrix by elementary transformations, Consistency and Solution of simultaneous linear equations, Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof), Diagonalization of matrix.

Text Books / References

1. Guar, Y.N. and Koul, C.L.(2013), *Engineering Mathematics*, Vols I and ll, Jaipur Publishing house.
2. Bansal, J.L. and Dhami, H.S.(2012), *Differential Equation*Vols I and ll, Jaipur Publishing house.
3. Babu Ram (2011), *Engineering Mathematics –I* , Pearson Education India.
4. B. V. Ramana (2012), *Heigher Engineering Mathematics*, Tata McGrew Hill, India.
5. M. Ray and Chaturvedi, *A text book of Differential Equation*, Student Friend & Co. Publisher, Agra.
6. Rao V. Dukkipati (2012), *Engineering Mathematics*, New Age International (p) Ltd., New Delhi.
7. Gupta C.B., Malik A.K., *Engineering Mathematics –II*, New Age international Publisher.

CE 122 (ESC) CIVIL ENGINEERING

Cr. Hrs. 2(1+0+1)

	L	T	P
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

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

CO1	Demonstrate knowledge of various surveying methods.
CO2	Conduct a compass survey.
CO3	Conduct levelling survey and be able to do RL calculations.
CO4	Demonstrate knowledge of properties of various building materials.
CO5	Plot work profile.

(A) SURVEYING AND LEVELING

Unit-I

Principle and purpose of plane surveying.

Introduction of Chain Surveying: Instrument for chaining, Direct & indirect ranging. Introduction of laser based distance measurement

*Compass Surveying:*True&Magneticmeridian, whole circle bearing &quadrantal bearing system, construction & use of Prismatic & Surveyor Compass, Local attraction.

Introduction of plane table Surveying: Accessories and working operation.

Unit-II

Level and leveling: Definition of various terms used in leveling. Types of Bench mark and their uses. Construction and use of Dumpy level, Leveling staves. Temporary adjustment of Dumpy level. Simple, differential leveling, fly leveling, longitudinal and cross sectioning, plotting of profile leveling. Determination of level by line of collimation and rise and fall method, Arithmetical checks.Level book and record keeping, leveling difficulties and errors in leveling.

(B) BUILDING MATERIAL

Unit-III

Stones: Different types, properties of good building stones, common testing of stones, Dressing of stones and use of stones in construction.

Bricks: Types, raw materials, identification, composition. Properties and uses of ordinary bricks, fire resistant and chemical resistant bricks.
Limes: Definition, sources of lime, slaking of lime, ISI classification of lime.

Unit-IV

Cement: Chemical composition, types of cement, properties, uses and tests on cement.
Mortars: Proportioning, properties of ingredients and use of lime, cement and gauge mortars.
Cement Concrete: Ingredients, common proportions, properties of fresh hardened concrete, Water cement ratio, curing and compaction of concrete.
*Timber :*Properties of good quality timber. Decay and preservation of timber.

Practical

1. Study of accessories used in measurement of distances.
2. Ranging Direct and indirect and use of chain and tape.
3. Study of prismatic compass and taking bearings..
4. Study of Dumpy level, temporary adjustment and R.L. calculations.
5. Simply and differential leveling operation, record in level book, practice for staff reading line of collimation and Rise and fall method calculations.
6. Longitudinal sectioning.
7. Cross sectioning.
8. Fly leveling operation.
9. Plotting of working profile.
10. Introduction of laser based distance measurement.
11. Properties of good quality bricks.
12. Properties of good quality stone.
13. Properties of good quality timber.
14. Physical test of cement.

Text Books / References

1. S.C. Rangwala. Engineering Materials, Charotar Book Stall, Anand.
2. B.C. Punmiya. Surveying & Field Work (Vol. I), Laxmi Publications, New Delhi.
3. Kanetkar T. P., 'Surveying and leveling', Vol. I & II.
4. Duggal S. K., 'Text book-Surveying', Vol. I & II.

ME123 (ESC) MECHANICAL DRAWING

Cr. Hrs. 1(0+0+1)

	L	T	P
Credit	0	0	1
Hours	0	0	2

Course Outcomes: Upon completion of this course the students will be able to:

CO1: Demonstrate knowledge of conventional representation employed in machine drawing.
CO2: Make detailed drawings of simple machine parts in first/third angle projection by proper choice of sectioned views as per need.
CO3 Read, interpret and visualize machine parts from a given drawing.
CO4: Demonstrate knowledge of riveted, welded, threaded and screwed joints and fastenings.

Introduction, conventional representation of different materials used in machine drawing, Introduction to BIS codes.
Orthographic Projection: First and third angle methods of projection. Preparation of working drawing from models and isometric views.Drawing of missing views.
Dimensioning: Different methods of dimensioning.
Sectional Views: Concept of sectioning. Revolved and oblique section. Sectional drawing of simple machine parts
Riveted and Welded Joints: Types of rivet heads and riveted joints. Processes for producing leak proof joints.Symbols for different types of welded joints.
Screw Fastenings: Nomenclature, thread profiles, multistart threads, left and right hand threads. Square headed and hexagonal nuts and bolts.Conventional representation of threads. Different types of lock nuts, studs, machine screws, cap screws and wood screws. Foundation bolts.
Different types of joints: Knuckle joint, cotter joint and universal joint.

Text Books / References

1. N. D. Bhatt. Machine Drawing, Charotar Book Stall, Anand.
2. V. Laxminarayan and ML Mathur. A Text Book of Machine Drawing, Jain Brothers, New Delhi.
3. P. S. Gill. Machine Drawing, S. K. Kataria& Sons, New Delhi.

ME124 (ESC) WORKSHOP TECHNOLOGY

Cr. Hrs. 3(2+0+1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Course Outcomes: Upon completion of this course the students will be able to:

CO1: Understand welding principles, equipment and tools of arc-, gas and resistance welding, brazing and soldering.
CO2: Describe construction, operations and tools of lathe, shaper and drilling machines.
CO3 Understand basic hot and cold forming operations.
CO4: Demonstrate knowledge of types of patterns, cores, moulding sands and tools.
CO5: Understand sand, permanent mould and investments castings and casting defects.

Unit I

Welding: Introduction to types of welding. Principle of electric arc welding, welding tools and safety devices, welding positions, welding joints, types of welds, Resistance welding. Oxyacetylene gas welding, types of flames. Soldering and Brazing.

Unit II

Lathes: Constructional details of centre lathe. Main operations and tools used on centre lathes.
Shaper: Types of shapers. Constructional details of standard shaper, shaper tools and main operations.

Unit III

Drilling Machines: Types of drilling machines. Constructional details of pillar type and radial drilling machines. Main operations. Twist drills, drill angles and sizes.
Forming: Basic descriptions and applications of hot and cold working processes, forging, bending, shearing, drawing and forming operations.
Measurement and Inspection: Classification of measuring instruments, linear and angular measurement, comparators.

Unit IV

Foundry & Casting Practices: Introduction, types of patterns, Mouldings, moulding materials, cores, moulding tools and equipments. Moulding sands, properties of moulding sands.Casting defects. Casting methods: Permanent mould casting, investment casting.

Practical

Practical exercises on welding, pattern making, foundry and machining operations.

Text Books / References

4. Mathur Mehta and Tiwari: Elements of Mechanical Engineering, Jain Brothers, New Delhi.
5. S.K. HajraChoudhury and A.K. HajraChoudhury: Elements of Workshop Technology (Vol. I and II), Media promoters & Publishers Pvt. Ltd., Bombay.

BS231 (BSC) MATHEMATICS – III

Cr. Hrs. 3 (2 + 1 + 0)

	L	**T**	**P**
Credit	**2**	**1**	**0**
Hours	**2**	**1**	**0**

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

CO1	Understand Finite differences, various difference operators and their relationships, factorial notation.
CO2	Use numerical methods in modern scientific computing.
CO3	Find the Inverse Laplace Transform by Partial Fractions.
CO4	Use the Laplace Transform to solve differential equation with constant coefficients.
CO5	Numerically integrate any function by Trapezoidal and Simpson's rule.

Unit-I

Interpolation: Finite differences, various difference operators and their relationships, factorial notation, Interpolation with equal intervals, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula for unequal intervals.

Unit-II

Gauss forward and backward interpolation formulae, Stirling's and Bessel's central difference interpolation formulae.
Numerical Differentiation: Numerical differentiation based on Newton's forward and backward, Gauss forward and backward interpolation formulae.

Unit-III

Numerical Integration: Numerical integration by Trapezoidal, Simpson's rule.
Numerical Solutions of Ordinary Differential Equations: Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta methods.

Unit-IV

Laplace Transform: Laplace transforms of elementary functions, Basic properties of Laplace transform, Initial value theorem, final value theorem and convolution property of Laplace transform, Inverse Laplace transforms, Applications of Laplace transform to solve ordinary differential equations.

Text Book/ References

1. "Text Book of Finite Differences and Numerical Analysis ", H.C. Saxena, S. Chand and Co.
2. "Numerical Methods for Scientific and Engineering computation" ,M.K. Jain, S.R.K. Iyengar and R.K. Jain, New Age International (P) Ltd.
3. "A Text book of Engineering Mathematics", N.P. Bali and Manish Goyal, Laxmi Publication Pvt. Ltd., New Delhi.
4. "Integral Transforms", S.P. Goyal and A.K. Goyal, Jaipur Publishing House, Jaipur.
5. "Numerical Analysis", Bansal, Bhargava, JPH, Jaipur.

BS232 (HSM) HUMAN VALUES

Cr. Hrs. 2 (2 + 0 + 0)

	L	T	P
Credit	**2**	**0**	**0**
Hours	**2**	**0**	**0**

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

CO1	Distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
CO2	Engage in a process of self-reflection and know what they 'really want to be' in their life and profession
CO3	Understand the meaning of happiness and prosperity for a human being.
CO4	Understand harmony at all the levels of human living, and live accordingly.
CO5	Apply the understanding of harmony in existence in their profession, develop commitment and courage to act in order to lead an ethical life

UNIT-I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:- Understanding the need, basic guidelines, content and process for value education; Self Exploration - content and process; 'Natural Acceptance' and Experiential Validation; Continuous Happiness and Prosperity with respect to Human Aspirations; Method to fulfil human aspirations: understanding and living in harmony at various levels

UNIT-II

Understanding Harmony in the Human Beings and their Relationships - Harmony in Myself, Family and Society Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha; Understanding the Body as an instrument of 'I' ,Understanding the characteristics and activities of 'I' and harmony in 'I'; Understanding the harmony of I with the Body: Sanyam and Swasthya;

Understanding harmony in the Family; Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman);

Understanding harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family

UNIT-III

Understanding Harmony in Nature and Existence - Whole existence as Coexistence:-Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature; Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all pervasive Space; Holistic perception of harmony at all levels of existence

UNIT-IV

Implications of the above - Holistic Understanding of Harmony on Professional Ethics:-Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, and develop appropriate technologies and management models; Strategy for transition from the present state to Universal Human Order at the level of individual and society

Note: In each unit, relevant practice exercises and case studies to be taken up. Mode of conduct should be through group discussions.

Text Books/ References

1. "A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Sangal, G P Bagaria, Excel Books,
2. "How the Other Half Dies", Sussan George, Penguin Press.
3. "Small is Beautiful: a study of economics as if people mattered" ,E.F. Schumacher, Blond & Briggs, Britain.
4. "The Story of Stuff", Annie Leonard, 2010, Free Press
5. "Fundamentals of Ethics for Scientists & Engineers", E G Seebauer & Robert L. Berry, Oxford University Press
6. "Professional Ethics includes Human Values", R. Subramanian, Oxford Univ. Press.
7. "Energy & Equity", Ivan Illich, The Trinity Press, Worcester, and Harper Collins, USA
8. "Limits to Growth – Club of Rome's report", Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, Universe Books.
9. "Jeevan Vidya: Ek Parichay", A Nagraj, Divya Path Sansthan, Amarkantak.
10. "Human Values", A. N. Tripathy, 2003, New Age International Publishers.
11. "Science and Humanism", P L Dhar, RR Gaur, Commonwealth Publishers.
12. "Foundations of Ethics and Management", B P Banerjee, 2005, Excel Books.
13. "Indian Ethos and Modern Management ", B L Bajpai, New Royal Book Co.
14. "Engineering Ethics (including Human Values)", M Govindrajran, S Natrajan & V.S. Senthil Kumar, Eastern Economy Edition, Prentice Hall of India Ltd.

EE 232 (ESC): ELECTRICAL MEASUREMENTS

Cr. Hrs. 3 (2 +0+ 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1	Ability to comprehend for the measurement of circuit quantities.
CO2	Capacity to deal with minimization of errors in measurement.
CO3	Capacity for understanding of most useful techniques in a particular case of measurement.
CO4	Ability to understand electronic instruments and related losses.

Unit-I

Measuring Instruments: Principle of operation, construction detail, torque equation, scale shape, uses and error in Moving iron, Electrodynamics and induction instruments for the measurement of voltage, current, power and energy.

Galvanometers: D'Arsonval, Vibration and Ballistic galvanometers, Dynamic equation of motion and its solution for various conditions, Relative damping, logarithmic decrement and galvanometer sensitivities.

Unit-II

Potentiometers: Theory of operation and construction of D.C. and A.C. potentiometers (polar and coordinate type), Their standardization and applications.

Measurements of Resistance: Methods of measurement of medium, low and high resistances, three and four terminal type resistance, Kelvin's double bridge, Price's guard wire and Loss of charge method.

Unit-III

A.C. Bridges-Four arm A.C. Bridge for the measurement of inductance, capacitance, quality and dissipation factor. Screening, Wagner earthing.

Instrument Transformers: Theory and construction of current and potential transformers, Ratio and phase angle errors and their minimization, effects of variation of power factor, secondary burden and frequency on errors, Testing of CTs and PTs.

Unit-IV

Magnetic Measurements-Determination of B-H curve and hysteresis loop of ring and bar specimens, Measurement and separation of iron losses.

Electronic Instruments-Transistor voltmeter, TVM using FET in input stage, Digital voltmeters: Ramp type, integrated type, Measurement of time, phase and frequency using digital counters, Principle and working of cathode ray oscilloscope.

Wave analyzers: Frequency selective and heterodyne wave analyzers and its applications.

Lab/Practical

Lab experiments based on theory

Text Books/References

1. "Electrical & Electronics Measurements & Instrumentation", A.K. Sawhney, Dhanpat Rai & Co.
2. "Electronic Instrumentatio"n, H.S. Kalsi.
3. "Electrical Measurements", E.W.GoldinG.

EC 234 (ESC) ANALOG ELECTRONICS

Cr. Hrs. 3 (2 +0+ 1)

L T P

Credit 2 0 1
Hours 2 0 2

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

CO1 To develop fundamental concepts of analog electronics.

CO2 To enhance the knowledge of feedback concepts and their effects on amplifier performance.

CO3 To master the basic ideas of power amplifiers and tuned amplifiers.

CO4 To understand the concept of oscillator using positive feedback systems.

CO5 To develop an knowledge of operational amplifier and various analog computation using operational amplifiers.

Unit – I

Response of Transistor Amplifier: Review of biasing, classification of amplifiers, distortion in amplifiers, frequency & phase response of an amplifier, cascaded amplifiers responses, transistors model at high frequencies for CE and Emitter follower configuration, high frequency response of two cascaded CE transistor stages.

Unit – II

Feedback Amplifier: Classification of amplifier, feedback concept, general characteristics of negative feedback amplifiers, analysis of a feedback amplifier, various types of feedback and their effects on amplifier performance.

Unit – III

Power Amplifiers: Class A large signal amplifier, second and higher harmonic distortion, transformer coupled amplifiers Efficiency of amplifiers, Push-pull amplifiers (Class A & Class B). Tuned Amplifiers: Single tuned capacitively coupled amplifier & its steady state response determination of Gain, Band width product. Tapped tuned, inductivity coupled single tuned.

Unit – IV

Oscillator: Criteria of oscillations, sinusoidal oscillators, Hartley, Colpits, Wains bridge, Phase shift. General form of oscillators, crystal oscillator, frequency stability. Operational Amplifiers: Basic op-amp, differential amplifier, IC Op-amp & its characteristics, Linear applications of IC Op-amp, Inventor, Adder, Intergrator, Differentiator, Analog computation.

Lab/ Practicals

Lab experiments based on theory.

Text Books/References

1. "Integrated Electronics", Millman & Halkias, McGraw Hill publication.
2. "Engineering Electronics", Alley & Ahwood, John Wiley & Sons Inc, New York London.

AI 235 (PCC): PROGRAMMING with C++

Cr. Hrs. 5 (3 + 0+2)
L T P
Credit 3 0 2
Hours 3 0 4

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

CO1 Modularize computing problems into classes, objects and functions for implementing OOPs concepts.

CO2 Design, develop and analyze C++ programs with various concepts and constructs of OOP such as constructors, destructors, polymorphism, inheritance etc.

CO3 Demonstrate the ability to model simple data structures like arrays, strings, linked lists etc. with efficiency using suitable memory allocation concepts.

CO4 Apply various advance features of C++ such as exception handling, templates, built-in Standard Template Library, I/O streams etc. for making the program more organized, reusable and user-friendly.

CO5 Analyze a given programming problem and design its corresponding object-oriented programming solutions.

Unit –I

Concept of Object Oriented Programming, Objects Classes, Encapsulation, Inheritance, Polymorphism. C/C++. C++ core language. Program structure, Functions. Primitive Data types, Variables, Header and Pre-Processor Directives, cin, cout, iomanip.h. for, while, do-while loops, if, if-else, nested if-else, switch, logical and, or and not operators, break, continue, goto and exit statements, functions, declarations, definitions, returns, Parameters by values by reference, default arguments, Inline functions, Automatic, external, static, variables. Const function arguments. Structures, Defining, Accessing Members, Structure within Structure, Class, Classes and Objects, Objects as Data Types.

Unit – II

Constructors, Overloading, Copy Constructors, Objects and Memory allocations, const and Classes, Objects as Arguments to functions. Arrays and Strings, Arrays as parameters to functions, C++ String class, Operator Overloading: Arithmetic, Logical, Assignment. Pointers, pointer to void, pointers and arrays, pointers and functions, new and delete operators, pointers to objects, Array of pointers to objects, A Linked List example, Pointers to pointers.

Unit – III

Inheritance, Derived class and base classes, Derived class constructors, Overriding member functions, Class Hierarchies, Multiple Inheritances. Virtual Functions, Friend Functions, Static functions, Dynamic Type Information.

Unit – IV

ios, istream, ostream, iostream classes, stream errors, Disk I./O with streams, file pointers, overloading cin, cout operators, multi file programs and projects, Exceptions, Exceptions with arguments, Templates, Linked List using templates. Introduction to Standard Template Library.

Lab/ Practical

Write C++ programs to exhibit the uses and implementation of classes, objects, static member function and array of objects, friend functions, copy constructor, function & operator overloading, Inheritance, uses of pointers, data conversion between objects of different classes, uses of ios and input output operations on files, stack, queue, circular queue and linked list using classes and objects, stack and queue using dynamic memory allocation, exception handling, templates, compile time polymorphism, run time polymorphism using virtual functions and abstract classes

Text Books/References

1. "The C++ Programming Language", Bjarne Stroustrup, Addison-Wesley.
2. "Object Oriented Programming with C++", Robert Lafore, Techmedia Publications.
3. "Introduction to Object Oriented Programming with C++", Yashavant P. Kanetkar, BPB
4. "Let Us C++", Yashavant P. Kanetkar, BPB

AI 236 (PCC): DIGITAL LOGIC CIRCUIT ANALYSIS AND DESIGN

Cr. Hrs. 4 (3 +1+0)
L T P

Credit 3 1 0
Hours 3 1 0

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

CO1	Demonstrate the principles of number system, binary codes and logic families.
CO2	Analyze and design combinational circuits using standard gates and minimization methods.
CO3	Efficiently optimize and minimize logic function using k-maps.
CO4	Design common digital circuit such as - decoders, multiplexers, encoder, demultiplexer etc.
CO5	Analyze and design sequential circuit such as flip-flops, counters, registers etc.

Unit -I

Computer number systems and codes: number systems and their conversion, negative numbers representation, codes; binary coded decimal number (BCD), excess-3 BCD code, gray codes representation.
Logic families: characteristics of digital ICS, diode-transistor logic (DTL) transistor- transistor logic (TTL) TTL output structures: totem pole output, darlington output, open-collector outputs. wired logic, tri-state logic, emitter-coupled logic, metal-oxide semiconductor (MOS) logic, complementary metal oxide semiconductor (CMOS) logic.

Unit - II

Logical operations, logic gates, and boolean algebra: truth table, logical operations and logic gates, logic circuits, realizing circuits from boolean expressions, derived logical functions and gates: the nand gate, the nor gate, the exclusive-or or xor gate, the exclusive-nor, or xnor gate, boolean algebra, boolean algebra theorems, de morgan's theorems, duality theorem, universal gates, deriving the xor function, reducing boolean expressions by algebraic reduction.

Unit - III

Principles of combinational logic circuits: minterm and maxterm designations, canonical forms, karnaugh map: karnaugh map upto six variables. prime implicant (PI), essential prime implicant (epi), simplification of boolean expressions using k-map in pos and sop form, incompletely specified functions (don't care terms), quine-mccluskey minimization method, mixed (bubble) logic combinational circuits. Arithmetic circuits: adders, subtractor, 2-bit full-adder/subtractor, binary parallel adder, bcd adder, multiplier, digital comparator, decoders, encoders, priority encoder, multiplexers, implementation of boolean function with multiplexer, demultiplexer.

Unit - IV

Sequential logic circuits: latches, flip-flops: sr(set-reset) flip-flop, edge-detector circuits, master-slave s-r flip-flop, j-k flip-flop, master-slave j-k flip-flop, d flip-flop, t flip-flop, conversions of flip-flops, mealy and Moore machines. Counters: asynchronous (ripple) counters, propagation delay in ripple counter, asynchronous counters with mod numbers, synchronous (parallel) counters, design of synchronous counters.
registers: serial- in/serial- out, serial- in/parallel- out, parallel- in/serial- out, parallel- in/parallel- out, bi-directional shift register, shift-registers counters (ring counter, Johnson counter).

Text Books/References

1. "Digital Logic and Computer Design", M. Morris Mano, Prentice-Hall.
2. "Digital Fundamentals", Thomas L. Floyd., Pearson Education.

BS 242 (BSC): DISCRETE MATHEMATICAL STRUCTURE

Cr. Hrs. 3 (2 +1+ 0)
L T P

Credit 2 1 0
Hours 2 1 0

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

CO1 Know permutation, combinations & logical operations.
CO2 Understand properties of relations & digraphs.
CO3 Manipulate, represent the relation & digraphs on computer.
CO4 Distinguish paths and circuits and about boolean alzebra.
CO5 Know about group, semi groups, products and quotients of group.

Unit - I

Fundamentals: sets & subsets, operation on sets, sequence, division in the integers, matrices, mathematical structures, logic: proposition & logical operations, conditional statements, method of proof, mathematical induction, counting: permutation, combinations, pigeonhole principle, elements of probability, recurrence relations.

Unit - II

Relations & digraphs: product sets and partitions, relation & digraphs, paths in relation & digraphs, properties of relations, equivalence relations, computer representation of relation & digraphs, manipulation of relations, transitive closure and warshall's algorithm, functions: functions for computer science, permutation of functions, and growth of functions.

Unit - III

Graphs, eular paths & circuits: hamiltonian paths and circuits, coloring graphs, relations & structures: partially ordered sets, extremal elements of partially ordered sets, lattices, finite boolean algebras, boolean functions as boolean polynomials.

Unit - IV

Semigroups & groups: binary operation, semigroups, products & quotients of semigroups, groups, products and quotients of group.

Text Books/References

1. "Discrete Mathematical Structures", Koloman and Busby, P.H.I, New Delhi.
2. "Discrete Mathematical Structure with Application to Computer Science", Trembley Manohar, Tata McGraw Hill.
3. "S. Lipschutz and N.L. Lipson. Discrete Mathematics", Tata Mc-Graw Hill Publication Co. Ltd.

EC 243 (ESC) COMMUNICATION SYSTEMS

Cr. Hrs. 3 (3 +0+ 0)
L T P
Credit 3 0 0
Hours 3 0 0

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

CO1 Understand the fundamental concepts of communication systems.
CO2 Understand and compare different analog modulation schemes.
CO3 Understand and compare different digital modulation schemes.
CO4 Understand the design tradeoffs and performance of communications systems.
CO5 Learn about practical communication systems

Unit - I

Modulation of signals: principles of analog modulation techniques like FM, PM, SSB, generation and detection (block schematics only). frequency division multiplexing and time division multiplexing. pulse modulation: pulse transmission over band limited signals, sampling theory, PAM, DYE diagram.

Unit - II

Digital communication: PCM, DPCM, DM ADM, comparison of the above on the basis of criteria such as bit transmission, signaling rate, error probability, S/N ration, bandwidth requirement. Digital Modulation Techniques: Data transmission such as PSK, FSK, QPSK (QAM) MSK, Inter system comparison.

Unit - III

Coding for communications: information theory, capacity, shannon's theorem, source coding error control coding error detection and correction, block codes, cyclic coder, line code, channel throughput and efficiency.
Modem: principles of modems, function operation. Short and long modems Digital modems, multiplexers, and concentrators.

Unit - IV

Broad view of communication channel: transmission line, primary and secondary line constant, telephone line and cables, public switch telephone network (electronics). fiber optic communication: principles of light communication in fiber, losses in fiber, dispersion, light sores and detectors. satellite communications orbits, satellite altitude, multiple access method.

Text Books/References

1. "Modern Digital Communication", B.P. Lathi, Oxford.
2. "Introduction to Communication system", Tube and Schilling, McGraw Hill.
3. "Electronic Communication", R. Coolen, PHI.

BS 244 (BSC) MATHEMATICS FOR DATA SCIENCE

Cr. Hrs. 3 (2+1 + 0)

	L	T	P
Credit	**2**	**1**	**0**
Hours	**2**	**1**	**0**

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

CO1	Understand the fundamentals of how to construct linear equations to evaluate and observe data collections
CO2	Understand and analyze the concepts of uncertainty and randomness
CO3	Understand and analyze the concept of optimization

UNIT-I

Linear Algebra: Introduction of matrices, Rank of matrices, Eigen values and Eigen vectors, vectors (Linear Independent, Linear dependent, basis), Statistics: describing a single set of data, correlation, Simpson' sparadox, correlation and causation.

UNIT-II

Probability: Introduction, dependence and independence, conditional probability, bayes's theorem, random variables, continuous distributions, normal distribution, the central limit theorem

UNIT-III

Hypothesis and Inference: statistical hypothesis testing, p-values, confidence intervals, p-hacking, Bayesian inference.

UNIT-IV

Classical Optimization Techniques: Unconstrained problems of Maxima-Minima, global maxima and Local maxima, Method of Lagrange's Multipliers for constrained with equality, Constraints in the form of inequalities: Kuhn Tuker conditions.

Text Books/References

1. “Mathematics for Machine Learning”, M. P. Deisenroth, A. A. Faisal, C. S. Ong, Cambridge University Press.
2. "Mathematical Statistics”, J. N. Kapur, H.C. Saxena, S Chand & Co. Ltd, New Delhi.
3. "Fundamentals of Mathematical Statistics”, Sultan Chand &Sons, New Delhi.
4. "Data Science from Scratch: First Principles with Python", Joel Grus, O'Reilly Media
5. “Engineering Optimization”, Singiresu S. Rao., John Wiley & Sons

CS 245 (ESC): DATA STRUCTURE & ALGORITHMS

Cr. Hrs. 5 (3+0 + 2)

	L	T	P
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

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

CO1	Understand and analyze the basic concepts of data structures and algorithms
CO2	Understand and analyze the concepts about searching and sorting techniques
CO3	Understand and analyze the basic concepts about stacks, queues, lists, trees, hashing and graphs
CO4	To enable them to write algorithms for solving problems with the help of fundamental data structures

Unit – I

Introduction: basic terminologies: elementary data organizations, data structure operations: insertion, deletion, traversal etc.; analysis of an algorithm, asymptotic notations, and time-space trade off. searching: linear search and binary search technique and their complexity analysis.

Stacks and Queues: ADT stack and its operations: algorithms and their complexity analysis, applications of stacks: expression conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, types of queue: simple queue, circular queue, priority queue; operations on each type of queues: algorithms and their analysis.

Unit – II

Linked lists: singly linked lists: representation in memory, algorithms of several operations: traversing, searching, insertion into, deletion from linked list; linked representation of stack and queue, header nodes, doubly linked list: operations on it and algorithmic analysis; circular linked lists: all operations their algorithms and the complexity analysis.

Unit – III

Trees: basic tree terminologies, different types of trees: binary tree, threaded binary tree, binary search tree, AVL tree; tree operations on each of the trees and their algorithms with complexity analysis. applications of binary trees. b tree, b+ tree: definitions, algorithms and analysis.

Unit – IV

Sorting and hashing: objective and properties of different sorting algorithms: selection sort, bubble sort, insertion sort, quick sort, merges sort, heap sort; performance and comparison among all the methods, hashing.

Graph: basic terminologies and representations, graph search and traversal algorithms and complexity analysis.

Lab/ Practical

Write C++ Programs to implement the concepts of Data Structures along with all the operations of the respective data structure such as 1-dimensioanl Array, 2-Dimensional Array, Singly Linked list, Circular Linked List, Doubly Linked List, Stacks, Queues, Binary Trees, Binary Search Trees, Graph, Searching, Sorting, and Hashing and other associated data structure concepts

Text Books/References

1. "Fundamentals of Data Structures", Ellis Horowitz, Sartaj Sahni, Computer Science Press.
2. "Algorithms, Data Structures, and Problem Solving with C++", Mark Allen Weiss, Addison-Wesley Publishing Company.
3. "How to Solve it by Computer", R.G. Dromey, Pearson Education
4. "Schaum's Outline Data Structures", Seymour Lipschutz, Tata McGraw Hill, Education.

AI 246 (PSC): COMPUTER ARCHITECTURE

Cr. Hrs. 4 (3 +1+0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1	Understand the fundamental concepts of computer organization and architecture.
CO2	Understand the operations of bus & memory.
CO3	Understand the operations of central processing unit.
CO4	Understand the working of control unit, i/o and parallel processing.

Unit - I

Overview: general organization and architecture, structural / functional view of a computer, evolution / brief history of computers. system buses: computer functions and flow control, interrupts and interconnection, bus design and timings, hierarchy and arbitration.

Unit - II

Memory organization: internal memory: characteristics, hierarchy, semiconductor main memory: types of ram, chip logic, memory module organization, cache memory: elements of cache design, address mapping and translation, replacement algorithms, advanced dram organization, performance characteristics of two – level memories, external memory: magnetic disk, tape, raid, optical memory, high speed memories: associative memory, interleaved memory.

Unit - III

Data path design: fixed point arithmetic, floating point arithmetic, design of basic serial and parallel high speed adders subtractors, multipliers, booth's algorithm, ALU: combinational and sequential ALU.
the central processing unit: basic instruction cycle, instruction sets, formats and addressing, processor organization, register organization, instruction pipelining, co - processors, pipeline processors, risc computers, rics computers versus cisc computers.

Unit - IV

The control unit: micro operations, hardwired implementation, micro programmed control, micro – instruction format, applications of microprogramming
input and output unit: external devices: keyboard, monitor, disk drive and device driver, i/o modules: programmed i/o, interrupt driven i/o, dma,i/o channels and i/o processors, serial transmission and synchronization.

multiprocessor processor organizations: flynn's classification of parallel processing systems, pipelining concepts.

Text Books/References

1. "Computer Organization and Architecture: Designing for Performance", William Stallings, Pearson Education.
2. "Computer Architecture and Organization", John P. Hayes, Tata Mc-Graw Hill.
3. "Structured Computer Organization", Andrew Tannenbaum, Todd Austin, Prentice-Hall.
4. "Computer Organization", V. Carl Hamacher and Zaky, Tata Mc-Graw Hill.

AI 247 (PCC): DATA COMMUNICATION AND NETWORKING

Cr. Hrs. 4 (3 +0+1)

	L	**T**	**P**
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1	Understand and analyze the various modern network architectures from a design and performance perspective.
CO2	Understand and analyze the various concepts, issues and protocols pertaining to Data Link Layer and Medium Access Sub Layer.
CO3	Understand and analyze the various concepts, issues, protocols and routing algorithms pertaining to Network Layer.
CO4	Understand and analyze the various features of Transport layer such as TCP, UDP, QoS.
CO5	Understand some important and popular functionalities of application layer.

Unit -I

Data communication components: representation of data and its flow networks , various connection topology, protocols and standards, OSI model, TCP/IP model, transmission media, lan: wired lan, wireless lans, connecting lan and virtual lan, techniques for bandwidth utilization: multiplexing - frequency division, time division and wave division, concepts on spread spectrum.

Unit - II

Data link layer and medium access sub layer: error detection and error correction -fundamentals, block coding, hamming distance, CRC; flow control protocols - stop and wait, go back – n ARQ, selective repeat ARQ, sliding window, piggybacking, random access, multiple access protocols -pure aloha, slotted aloha, CSMA/CD, CDMA/CA

Unit - III

Network Layer: switching, logical addressing – IPV4, IPV6; fragmentation, address mapping –ARP, RARP, BOOTP and DHCP–Delivery, forwarding and unicast routing protocols, ICMP.

Unit - IV

Transport layer: process to process communication, user datagram protocol (UDP), transmission control protocol (TCP), SCTP congestion control; quality of service, QoS improving techniques: leaky bucket and token bucket algorithm.

application layer: domain name space (DNS), DDNS, TELNET, EMAIL, file transfer protocol (FTP), WWW, HTTP, SNMP, bluetooth, firewalls, basic concepts of cryptography.

Lab/Practical

Write NS2 programs to create various network topologies, connections, data flow among nodes using different agents like UDP, TCP and different traffic generators like FTP, CBR.

Write NS2 programs to implement various routing algorithms like Distance Vector, Link-state routing algorithms.
Configure and connect multiple LANs in packet tracer simulator to understand different concepts like static routing, dynamic routing, DHCP, DNS, HTTP, Classful addressing, VLSM, VOIP, Wireless LAN.
Write various awk scripts to understand different parameters to be considered in networking like Packet delivery ratio, throughput, routing overhead etc.

Text Books/References

1. "Data Communication and Networking", Behrouz A. Forouzan, McGraw-Hill.
2. "Data and Computer Communication", William Stallings, Pearson Prentice Hall India.
3. "Computer Networks", Andrew S. Tanenbaum, Pearson Education.
4. "Internetworking with TCP/IP", Douglas Comer, Prentice Hall of India.
5. "TCP/IP Illustrated", W. Richard Stevens, Addison-Wesley.

AI 248 (PCC): STRUCTURED QUERY LANGUAGE & DATABASE MANAGEMENT SYSTEM

Cr. Hrs.	**5 (3+0+2)**		
	L	**T**	**P**
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

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

CO1	To understand fundamental concepts and principles of data base to design/develop entity relationship diagram for the specified requirement.
CO2	To normalize the databases up to a given normal form and will be able to describe and develop relational algebra and SQL queries
CO3	To understand the challenges of working/implementation of real time concurrent data base application
CO4	To understand the fundamental concepts of NoSQL, and difference between SQL and NoSQL

UNIT-I

Database: introduction, characteristics, actors, advantages; database systems concepts: models, three schema architecture, languages, classification, client/ server architecture; data modeling using ER model, refining ER design to database, entity relationship diagram.

UNIT – II

Relational data model: concepts, constraints. relational algebra, basic SQL; functional dependencies and normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF.

UNIT – III

Transaction processing: introduction, concepts, properties, schedule based on recoverability and serializability; concurrency: 2PL, timestamp ordering, multiversion concurrency, validation techniques, granularity of data items and multiple granularity locking, locks for concurrency control in indexes.

UNIT-IV

NoSQL: history, features of NoSQL, recent trends in IT, problems with conventional approaches, NoSQL benefits and precautions; NoSQL database design and terminology: Managing different Data types, Describing NoSQL, Applying consistency Methods, Evaluating NoSQL.

Lab/Practical

Write SQL queries to exhibit the uses and implementation of database specifying appropriate constraint using DDL commands for creating database, update and retrieval of data base, use different DML commands to manage the database, set operation, aggregate function and basic NoSQL working environment.

Text Books/References

1. "Fundamentals of Database Systems", Ramez Elmasri and Shamkant Navathe, Pearson Education.
2. "Database Systems Concepts", Silberschatz, Korth, Sudarshan, McGraw Hill Publications.
3. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" Sadalage, P. & Fowler. Pearson Education.

AI 351 (PCC): PROGRAMMING WITH PYTHON

Cr. Hrs. 5 (3 +0+ 2)

	L	T	P
Credit	**3**	**0**	**2**
Hours	**3**	**0**	**4**

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

CO1	Use python effectively as a scripting language.
CO2	Use programming constructs like lists, tuples, and dictionaries for designing and writing Python programs.
CO3	Use programming constructs like loops, decision statements and functions to design, modularize and write python programs.
CO4	Use functional and object-oriented programing constructs of python to design and write functional or object oriented python programs as per requirement.

UNIT-I

Features of python, python virtual machine(PVM), memory management and garbage collection, comparison of python with C and JAVA, python comments, Docstrings, Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions.

UNIT – II

Input & output in python: output statements, input statements, command line statements, control statements, string operations: creating, indexing, slicing, concatenation, comparison, splitting and joining, checking membership Functions: defining function, calling function, returning from function, positional arguments, keyword arguments, default arguments, variable length arguments, local and global variables, lambdas functions, function decorators, generators, special variable __name__.

UNIT – III

Operations and use of built-in data structures such as Lists, Tuples, Dictionaries, Sets in python, object oriented programming in python: classes, objects, namespace, instance methods, class methods, static methods, constructors.

UNIT-IV

Advance object oriented programming: inheritance, polymorphism, method overloading and overriding, abstract classes and interfaces; Exceptions, exception handling, type of exceptions, assert statement, user defined exceptions, File handling: text files, binary files, with statement, pickle in python, seek() and tell() methods, zipping and unzipping files; Introduction to regular expression and threads in python.

Lab/Practical

Write python programs to exhibit the uses and implementation of functional and objects oriented features of Python such as control statements, string and characters, functions, lists, tuples, dictionaries, sets, classes, objects, inheritance, polymorphism, abstract classes and interfaces, exception and file handling

Text Books/References

1. "Core Python Programming", R. Nageswara Rao, Dreamtech.
2. "Core Python Programming", Wesley J. Chun, Prentice Hall
3. "Python Cookbook", David Beazley, Brain K. Jones, O'Reilly.

AI 352 (PCC): PRINCIPLES OF OPERATING SYSTEMS

Cr. Hrs. 4 (3 +0+ 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1	Understand and analyze the significance and basic architecture of operating systems.
CO2	Understand and analyze the various processor management issues and challenges of operating system such as process synchronization, concurrency and deadlocks.
CO3	Understand and analyze the various memory management issues and challenges including virtual memory management, paging and thrashing.
CO4	Understand and analyze the various file system management, I/O management, secondary storage management issues and challenges in an operating system.

Unit -I

Introduction: concept of operating systems, generations of operating systems, types of operating systems, OS services, system calls, structure of an OS-layered, concept of virtual machine.

Processes: definition, process relationship, different states of a process, process state transitions, process control block (PCB), context switching. Thread: definition, various states, benefits of threads, types of threads, concept of multithreads. process scheduling: foundation and scheduling objectives, types of schedulers, scheduling criteria: CPU utilization, throughput, turnaround time, waiting time, response time; scheduling algorithms: pre-emptive and non pre-emptive, fcfs, sjf, rr; multiprocessor scheduling: real time scheduling: RM and EDF.

Unit - II

Inter-process communication: critical section, race conditions, mutual exclusion, hardware solution, the producer\ consumer problem, semaphores, event counters, monitors, message passing, classical IPC problems: reader's & writer problem, dinning philosopher problem etc.

Deadlocks: definition, necessary and sufficient conditions for deadlock, deadlock prevention, deadlock avoidance: banker's algorithm, deadlock detection and recovery.

Unit - III

Memory management: basic concept, logical and physical address map, memory allocation: contiguous memory allocation – fixed and variable partition–internal and external fragmentation and compaction; paging: principle of operation – page allocation –hardware support for paging, protection and sharing, disadvantages of paging.

virtual memory: basics of virtual memory – hardware and control structures –locality of reference, page fault , working set , dirty page/dirty bit – demand paging, page replacement algorithms: optimal, first in first out (FIFO), second chance (SC), not recently used (NRU) and least recently used (LRU), thrashing

Unit – IV

I/O hardware: I/O devices, device controllers, direct memory access principles of i/o software: goals of interrupt handlers, device drivers, device independent i/o software, secondary-storage structure: disk structure, disk scheduling algorithms

file management: concept of file, access methods, file types, file operation, directory structure, file system structure, allocation methods (contiguous, linked indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk management: disk structure, disk scheduling - FCFS, SSTF, scan, c-scan, disk reliability, disk formatting, boot-block, bad blocks

Lab/Practicals

Write C programs to exhibit the uses of various linux system calls such as uname(), getpid(), getppid(), groupid(), getenv(), getrlimit() and atexit(), fork(), zombie processes, dup(), dup2(), mkdir(), rmdir(),

getcwd(), and readdir(), stat(), pipe(), mkfifo(),uses of signals, getpwuid(), getgegid(),read(), write(), open() and close() for file handling. Do OS resource management using generic OS simulator

Text Books/References

1. "Operating System Concepts Essentials", Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. "Operating Systems: Internals and Design Principles", William Stallings, Prentice Hall of India.
3. "Operating Systems: A Modern Perspective", Gary J. Nutt, Addison- Wesley.

AI 353 (PCC): INTRODUCTION TO CLOUD COMPUTING

Cr. Hrs.	**4(3+1+0)**		
	L	**T**	**P**
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1 Describe architecture, underlying principles of cloud computing, cloud service and deployment models.

CO2 Analyse the need for virtualization in a cloud environment and apply it in compute, memory and storage levels.

CO3 Explain distributed computation model on large datasets using parallel and distributed programming approaches over cloud platforms.

CO4 Assess security services, standards for cloud computing and analyse the advanced cloud technologies.

Unit- I

Introduction to cloud computing: definition of cloud, evolution of cloud computing, system models for distributed & cloud, software environments for distributed & cloud computing, cloud computing models, Cloud service models: IaaS, PaaS, SaaS, CaaS; desired features of a cloud, basic principles, of cloud computing, challenges and risks, ubiquitous clouds and the internet of things.

Unit –II

Virtual machines and virtualization of cluster and data centres: characteristics of virtualized environments, implementation levels of virtualization, virtualization structures/tools and mechanism, virtualization of cpu, memory and i/o devices, virtual clusters and resources management, virtualization data-centre automation, architectural design of compute and storage clouds.

Unit-III

Service oriented architecture for distributed computing: services & soa, message oriented middleware, workflow in soa, cloud programming & software environments, features of cloud & grid, parallel & distributed programming paradigms: map reduce and hadoop; public clouds platforms and service offerings, programming support of google app engine, amazon aws & azure. case studies: open stack & aneka

Unit-IV

Resource management, cloud security and advancements: cloud security and trust management, data security in cloud, inter-cloud resource management, trust-reputation and security management in p2p systems, p2p file sharing and copyright protection, iam- security standards, federation in the cloud, four levels of federation, federated services and applications, future of federation.

Text Books/References

1. "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, Morgan Kaufmann Publishers.
2. "Mastering Cloud Computing", Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Tata Mcgraw Hill.
3. "Cloud Computing: Implementation, Management, And Security", Rittinghouse, John W., and James F. Ransome, CRC Press.

4. "Cloud Computing - A Practical Approach", Toby Velte, Anthony Velte, Robert Elsenpeter, Tata Mcgraw Hill.

AI 354 (PCC): INTRODUCTION TO DATA SCIENCE & MACHINE LEARNING

Cr. Hrs. 4 (3 + 0+ 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1	Explore data and understand the issues in data preprocessing/ data cleaning.
CO2	Understand the fundamental issues and challenges of machine learning data, and model etc.
CO3	Design and implement various ML algorithms in a range of real world applications.
CO4	Understand unsupervised machine learning algorithms working and implementation.

UNIT-I

Introduction to data science, working with data, exploring data, one dimensional, two dimensional, many dimensional, using named tuples, data classes, cleaning and munging, manipulating data, rescaling, dimensionality reduction, data visualization.

UNIT - II

Machine learning: introduction, application, types of machine learning systems, challenges of machine learning, over fitting and under fitting, correctness, bias-variance tradeoffs, feature extraction and selection. K Nearest Neigbour: the Model, the curse of Dimensionality, naïve bayes model, spams filer implementation, testing and using model.

UNIT – III

Simple linear regression model, using gradient Descent, multiple regression model, least square model , fitting and interpreting the model, goodness of fit, digression, bootstrap, standard errors of regression coefficients , regularization, logistic regression problem, logistic function, goodness of fit, SVM.

UNIT-IV

Decision tree model, entropy, entropy of partition, creating a decision tree, random forest, unsupervised learning techniques, Clustering, K-Means, Gaussian Mixtures, anomaly detection using gaussian mixtures, selecting number of clusters.

Lab/Practical

Write Machine learning programs to exhibit the use and implementation of data pre-processing for missing values, smooth noisy data, identify and remove outliers. Implement machine learning supervised and unsupervised algorithms, train and test the model.

Text Books/References

1. "Data Science from Scratch first principle with Python", Joel Grus, O'Reilly Media inc.,
2. "Hands on Machine Learning with Scikit_Learn, Keras & TensorFlow", Aurelien Geron, Shroff Publisher Pvt Ltd.,
3. "Machine learning in action", Peter Harrington
4. "Deep Learning", Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press
5. "Introduction to Machine Learning", Ethem ALPAYDIN, MIT Press.

EC 355 (ESC): INTERNET OF THINGS FUNDAMENTALS & NETWORKING

Cr. Hrs. 4 (3 +0+ 1)

L	T	P

Credit 3 0 1
Hours 3 0 2

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

CO1	Understand internet of things and its hardware and software components and Comprehend the architectural components and platforms of IoT ecosystem
CO2	Apply appropriate access technology and protocols as per the application requirement
CO3	Appreciate the role of big data, cloud computing and data analytics in a typical IoT system
CO4	Design applications with suitable lightweight data processing and communication methodologies

Unit-I

Introduction, IoT design principles and needed capabilities, IoT fundamentals-Sensing, Actuation, M2M Communication, IoT devices and gateways, Data Management, IoT applications in Industrial automation, agriculture, Healthcare, Home automation, Transportation.

Unit-II

Business process in IoT, Role of Cloud in IoT, IoT application development, solution framework, device integration, unstructured data storage on cloud/local server, smart objects, Connecting objects, protocols and access technologies like IEEE802.15.4, LoRaWAN, LTE-M, BLE, NB-IoT, Sigfox.

Unit -III

IoT network layer, 6LoWPAN, IPv6: IPv6 structure, addressing, routing, interconnecting issues, 6LoWPAN: forwarding, addressing, header compression, neighbour discovery, Routing in LLN, RPL,IoT Data Link layer.

Unit-IV

Application layer protocols, CoAP, MQTT, AMQP, XMPP, Integrating Internet Services with Interoperable data encoding with XML, JSON and CBOR, Sensor data models and representation, lightweight web services for IoT.

Lab/Practical

Laboratory work will be based on the above syllabus with minimum 6 experiments pertaining to above units.

Text Books/References

1 David Hanes, G. Salgueiro, IoT Fundamentals - Networking Technologies, Protocols, and Use Cases for Internet of Things, Cisco Press
2. Jean-Philippe Vasseur, Adam Dunkels, Interconnecting Smart Objects with IP: The Next Internet, Morgan Kaufmann
3. Pethuru Raj, Anupama Raman, The Internet of Things - Enabling Technologies, Platforms and Use Cases, CRC Press
4. Robert Stackowiak, Art Licht, VenuMantha and Louis Nagode, Big Data and The Internet of Things, Apress
5. Peter Waher, Learning Internet of Things, Packt Publishing Ltd
6. Daniel Kellmereit, Daniel Obodovski, The Silent Intelligence: The Internet of Things, DND Ventures
7. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley Publications
8.Vijay MadiSetti, ArshdeepBagha, 'Internet of Things, A hands on Approach, University Press.
9. Rajkamal," Internet of Things: Architecture and Design,"McGraw Hill.

AI 361 (PCC): ARTIFICAL INTELLIGENCE

Cr. Hrs. 4 (3 +0+ 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1 Understand basics of ai, intelligent system and searching algorithm
CO2 Use adversial search to analyze various game playing strategies
CO3 Understand concept of knowledge representation and solve fact using resolution and refutation
CO4 Understand and learn about learning concepts, neural network, and architecture of expert system.

Unit-I

Meaning and definition of artificial intelligence, intelligent agent and environments, nature of environment, problem solving, uninformed search strategies, informed search strategies heuristic functions.

Unit-II

Adversial search, Games, Optimal decision in games, Game playing techniques like minimax procedure, Alpha-beta pruning, Stochastic games, Partially observable games, State-of-the –art game programs, Constraint satisfaction problem.

Unit -III

Knowledge based agents, Propositional logic, First-order logic, Resolution, Forward chaining Backward Chaining, Unification, Uncertain knowledge and reasoning, Probabilities, Bayesian networks.

Unit-IV

Overview of different forms of learning, supervised base learning, Learning Decision Trees, SVM, Unsupervised based learning, Neural Networks, Introduction to Natural language processing ,Robotics ,Expert Systems.

Lab/Practical

Write Python Programs to implement various uninformed and informed search techniques, puzzle problems and games like chess and tic tac toe , heuristic search and logic programming and to implement various language processing codes using NLTK.

Text Books/References

1. ”Artificial Intelligence: A Modern Approach”, Stuart J. Russell & Peter Norvig , Pearson Education .
2. “Introduction to AI & Expert System”, Dan W. Patterson, PHI.
3. “Artificial Intelligence –Structure and Strategies of complex Problem Solving“, George F. Luger, Pearson Education.
4. “Artificial Intelligence”, Elaine Rich, Kevin Knight, Mc-Graw Hill.

AI 362 (PCC): BIG DATA ANALYTICS

Cr. Hrs. 4 (3 +0+ 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1 Understand the concept and challenges of Big data.
CO2 Understand and able to develop Big Data Solutions using Hadoop Eco System
CO3 Understand and gain hands-on experience on Hive and Pig.
CO3 Analyze and implement the concept of NoSQL and MongoDB

Unit-I

Introduction to big data: big data characteristics, types of big data, traditional versus big data, evolution of big data, challenges with big data, technologies available for big data, infrastructure for big data, use of data analytics, desired properties of big data system.

Unit -II

Introduction to Hadoop: Core Hadoop components, Hadoop Eco system, , Hadoop limitations, Hadoop Distributed File system, Processing Data with Hadoop, Managing Resources and Application with Hadoop YARN.
MapReduce programming: Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression

Unit-III

Introduction to Hive: Hive Architecture, Hive Physical Architecture, Hive Data types, Hive Query Language, Introduction to Pig, Anatomy of Pig, Pig on Hadoop, Use Case for Pig, ETL Processing, Data types in Pig running Pig, Execution model of Pig, Operators, functions, Data types of Pig.

Unit-IV

Introduction to NoSQL, NoSQL business drivers, NoSQL data architectural patterns, variations of NOSQL architectural patterns using NoSQL to manage big data, introduction to MongoDB- Data Types in MongoDB, MongoDB Query Language.

Lab/Practicals

Implement programs using Hadoop, Hadoop YARN, MapReduce, Hive, NoSQL and MongoDB to understand the concept and uses of their functions.

Text Books/References

1. " Big Data Analytics", Radha Shankarmani, M. Vijaylakshmi, Wiley
2. " Big Data and Analytics", Seema Acharya, Subhashini Chellappan, Wiley
3. " Big Data ", Anil Maheshwari, Mc Graw Hill
4. " Big Data & Hadoop", V.K. Jain, Khanna Publication.
5. “Big Data Science & Analytics: A Hands-On Approach”, Arshdeep Bahga, Vijay Madisetti, VPT
6. " Big Data Analytics", Venkat Ankam, Packt.

EC 363 (ESC): SENSOR THEORY AND APPLICATIONS

Cr. Hrs. 4 (3 +0+ 1)
L T P

Credit 3 0 1

Hours 3 0 2

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

CO1	Basic understanding of sensors and its advanced engineering problems.
CO2	Assess the applicability and limitations of communication protocols for a real time WSN application
CO3	Familiarize the protocol, design requirements, suitable algorithms, and the state-of-the-art cloud platform to meet the industrial requirement.
CO3	Proactive in understating the routing protocol's function and their implications on data transmission delay and bandwidth

Unit-I

Introduction to Sensors and its classification, Data acquisition system, Sensors for various applications: Occupancy and Motion Detectors, Position, Displacement, and Level, Velocity and Acceleration, Force, Strain and Tactile Sensors, Pressure Sensors, Temperature Sensors.

Unit -II

Wireless Sensor Networks, Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments. Deployment and Configuration: Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self-configuring localization systems, sensor management.

Unit-III

Network Protocols: Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor rnetwork. Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy efficient routing, Unicast, Broadcast and multicast, Geographic routing.

Unit-IV

Data Storage and Manipulation: Data centric and content-based routing, storage and retrieval in network. Applications: Detecting unauthorized activity using a sensor network. Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes etc.

Lab/Practicals

Laboratory work will be based on the above syllabus with minimum 6 experiments pertaining to above units.

Text Books/References

1. Holger Kerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", JohnWiley and Sons, 2005 (ISBN: 978-0-470-09511-9)
2. Raghavendra, Cauligi S, Sivalingam, Krishna M., ZantiTaieb, "Wireless Sensor Network", Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5).
3. Feng Zhao, Leonidas Guibas, " Wireless Sensor Network", Elsevier, 1st Ed. 2004 (ISBN: 13- 978-1-55860-914-3)
4. Kazem Sohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
5. B. Krishnamachari, "Networking Wireless Sensors", Cambridge University Press.
6. N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, andApplications" Springer Verlag

AI 364 (PCC): BLOCK CHAIN TECHNOLOGY

Cr. Hrs. 4 (3+1+0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1	Understand the fundamentals of blockchain technology and cryptography.
CO2	Understand and analyze the concepts of bitcoin network.
CO3	Understand and analyze the concept of various consensus algorithms
CO4	Understand and analyze the concept of smart contracts and ethereum platform.

Unit-I

Introduction to blockchain: history of blockchain, peer to peer (P2P) network, public ledger, double spend problem, features of blockchain, types of blockchain: public, private and consortium based blockchain and applications of blockchain.

Unit -II

Cryptographic primitives: public key cryptography, hash functions, message digest, secure hash algorithms (SHAS-256), digital signature, elliptic curve digital signature algorithms (ECDSA), merkle tree.

Unit-III

Bitcoin definition, transactions: the transaction life cycle, the structure of a block, genesis block, wallet, bitcoin mining, forking: hard and soft fork. consensus algorithms: proof of work, proof of stake, practical byzantine fault tolerance, proof of burn and prof of elapsed time.

Unit-IV

Smart contracts, ethereum basics: gas, the world state, transactions, ethereum virtual machine(EVM), types of accounts, block structure, ether, DApps. ethereum vs bitcoin.

Text Books/References

1. "Mastering Blockchain", Imran Bashir, Packt.
2. "Mastering Bitcoin", Andreas Antonopoulos, O'Reilly Media Inc.
3. "Mastering Ethereum", Andreas Antonopoulos, Gavin Wood, O'Reilly Media Inc.
4. "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, princeton University Press.

CS 365 (ESC): SOFTWARE ENGINEERING

Cr. Hrs. 4 (3+0 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1	Understand different views of software process, process models including difference between prescriptive and agile process
CO2	Understand and analysis the requirement engineering task and validating requirements
CO3	Understand and evaluate procedures, technique and methods to assess software quality (SQA), review software engineering work products, and apply an effective testing strategy.
CO4	Understand and apply relevant software management skills to plan, manage and control a software development project.

Unit -I

Software Engineering, Software process, Introduction to CMM. Software process models – Waterfall model, Incremental, prototyping, RAD, Spiral, concurrent development, Component based development. Introduction to Unified and Agile development-Agile Process- Extreme Programming and other agile Process models. Requirement Engineering: requirement engineering tasks, requirement engineering process, eliciting requirements, requirement analysis and documentation, validating requirements. Analysis modelling – approaches, data modelling.

Unit - II

Design Engineering: concepts, architecture, patterns, modularity, information hiding, functional independence, refinement. Pattern based software design, Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design, Modelling component level design, class based components, design guidelines, cohesion and coupling.

Unit - III

Software Project Management concepts: The management spectrum, People, product, process, project, W5HH principles. Software Process and Project Metrics: software measurements and metrics, metrics for software quality. Software project planning: Observations on estimating, Project planning objectives, Software scope, Resources, Software project estimation, Decomposition techniques, Empirical estimation models: COCOMO Model, Software equation, The Make buy decision, Automated estimation tools. Project Scheduling: concepts, task sets, defining a task network, scheduling, earned value analysis

Unit - IV

Software Configuration Management: Repository, SCM Process, configuration management for Webapps, Software Quality Assurance: Quality concepts, Quality movement, Software quality assurance, tasks, goals and metrics, Formal approaches to SQA, Statistical software quality Assurance, Software reliability, the ISO 9000 Quality Standards, The SQA plan. Software Testing: Software Testing Fundamentals, Black box and white box testing, object oriented testing methods, testing documentation, testing patterns. Risk Management: Software risks, risk identification, projection, refinement, mitigation, monitoring, and management

Lab/Practical

Each student will submit a written report on a mini project as per software engineering practice. Develop use case model, analysis model and design model for project using various UML diagrams likeStructure Diagrams (Diagram, Component, Diagram, Object, Diagram, Profile,Composite Structure Diagram)Behavioral Diagrams (Diagram, Activity,Diagram, Sequence,Diagram, Interaction,Timing Diagram)

Text Books/References

1. "Software Engineering", Roger S. Pressman., McGraw Hill.
2. "An Integrated approach to software Engineering", Jalote Pankaj, Narosa Publishing House, New Delhi.

AI 366 (PCC): ALGORITHM DESIGN & ANALYSIS

Cr. Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1 Analyze the asymptotic performance of algorithms.
CO2 Write rigorous correctness proofs for algorithms.
CO3 Demonstrate a familiarity with major algorithms and data structures.
CO4 Apply important algorithmic design paradigms and methods of analysis.
CO5 Synthesize efficient algorithms in common engineering design situations

Unit –I

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Master's theorem.

Unit - II

Fundamental Algorithmic Strategies: Divide and Conquer, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving , Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.

Unit - III

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit - IV

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard, Cook's theorem, Approximation algorithms.

Lab/Practical

Using any high level language(C/C++/ Java) Programs to implement Divide and Conquer, Greedy algorithm, Dynamic programming, Branch and Bound, backtracking algorithms, Approximation algorithms and other associated algorithms.

Programs to understand the concept of graph and tree algorithms such as DFS, BFS, Shortest path first algorithms, Minimum spanning tree algorithms (Prim's and kruskal), network flow algorithms and other associated algorithms.

Text Books/References

1. "Introduction to Algorithms", Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. "Fundamentals of Computer Algorithms", Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Universities Press publication.

AI 367 (PEC): PE-I(a): MOBILE APPLICATION DEVELOPMENT

Cr. Hrs. 3 (0+1+2)

	L	T	P
Credit	**0**	**1**	**2**
Hours	**0**	**1**	**4**

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

CO1	Understand the basics of mobile application development using Android.
CO2	Understand to make use of various basic components such as widgets, layouts, dialogs, etc for designing the mobile application.
CO3	Understand and implement the database handling with a mobile application.
CO4	Understand the packaging and deployment of a mobile applications, integrating APIs such as Google Maps, GPS, etc., and interaction with social media

Unit –I

Basic Android Concepts: Introduction to Android, Android SDK installation, Android SDK & their codenames, Advantages of android, The Android O/S Architecture, Overview of IDE for Android application, AVD (android virtual device), launch and start the AVD Managing application resources, resource value types, storing different resource values types (string, string arrays, Boolean, colors, integer, animation, & menus);

Unit –II

Android Application Components: Activities & its life cycle , Services & its life cycle, Broadcast receiver, Content provider, Intents, shutting down component, Android Manifest File in detail, Use of Intent Filter.

Widgets: User Interface Elements Form Widgets: TextView, basic Button, Toggle Button, Check Box, Checked TextView, RadioButtons, RadioGroup, SpinnerControl, DatePicker, Time Picker, Chronometer, Progress bar, Rating bar, Option menu, ImageViewTextFields -Various type of TextFileds (Plain text, PasswordText, Numeric Text, EmailText, PhoneText, MultilineText, etc);

Unit –III

Working with various type of dialog : Simple dialog, alert dialog, character picker dialog, date picker dialog, progress dialog, List Dialog, Custom Dialog Toast –(Custom Toast); Features of android Styles and Themes : Basic Styles & Themes in XML layout Various Layouts: layout, Layouts common attribute, Types of Layout (Linear layout, Relative layout, Table layout, Frame layout, Tab layout); Using Data-Driven Containers: List View, Grid View, and Gallery View (Using the Array Adapter); App widgets: Introduction to app widget, Use of App Widgets, Creating app widget configuration activity.

Unit - IV

Data Storage: Introduction to data storage, Introduction to various storage options available in android system; Working with Application Preferences: Creating Private and Shared Preferences, Manipulating with Shared Preferences; Read/Write Data on the Android File System; Storing Structured Data Using SQLite Databases; Creating a SQLite Database, Creating Tables and other SQLite Schema Objects, Creating, Updating, and Deleting Database Records, Querying SQLite Databases, Working with Cursors, Closing and Deleting a SQLite Database.

Packaging and Deployment: Interaction with server side application, Using Google Maps, GPS and Wi-Fi, Integration with social media applications.

Text Books/References

1. "Android Application Development", Rick Rogers, John Lombardo, O"Reilly
2. "Professional Android 2 application development", Reto Meier, Wrox.
3. "Android Wireless Application Development", Lauren Darcey and Shane Conder, Pearson Education.

AI 367 (PEC): PE-I (b): WEB TECHNOLOGY

Cr. Hrs. 3 (0+1+2)

	L	T	P
Credit	**0**	**1**	**2**
Hours	**0**	**1**	**4**

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

- CO1 Apply knowledge of client/server architecture & the HTTP protocol usage of get & post transactions for building web applications on Internet.
- CO2 Design web pages using CSS for standard appearance; add dynamism in the web page using Java Script & DHTML.
- CO3 Design & implement a web application by building a web site using the client and server side technologies for database connectivity and maintain sessions.
- CO4 Understand the impact of using XHTML over HTML for standardizing web pages.

Unit –I

Mark-up languages: HTML Introduction, Basic Tags, Attributes, Heading, Paragraphs, Formatting, Styles, Links, Images, Tables, Lists, Forms, Colors, Layout, Frames, Font, CSS, Entities, Head, Meta tags, URLs, Scripts, Events, URL Encode, Web Server (ITS and Apache).

Unit –II

Cascading Style Sheets: Introduction, Inline Styles, Embedded Style Sheets, Conflicting Styles, Linking External Style Sheets, Positioning Elements, Backgrounds, Element Dimensions, Box Model and Text Flow, Media Types, Drop-Downs, User Style Sheets.

Unit –III

XHTML Introduction, Headings, Linking, Images, Lists, Special Characters and Horizontal Rules, Internal Linking, Meta Elements, Forms, Tables.
JAVA Script: Introduction, Decision Making, Control Statements, Functions, Objects, Arrays, Event Handling.

Unit –IV

PHP: Introduction, Decision, Looping, Arrays, Functions, Forms, Methods, Cookies, Sessions, Error, Exception, Filter, References.
MySQL: Introduction, Connect, Create, Insert, Select, Where clause, order by clause, Update, Delete and ODBC.

Text Books/References

1. "Programming the World Wide Web", Robert W. Sebesta Pearson Education.
2. "Internet and World Wide Web", Dietel & Dietel , Pearson Publication.
3. "Web Technologies", Achyut Godbole, TMH.
4. "PHP 6 and MySQL5 for Dynamic WebSites: Visual Quick Pro Guide", Ullman, Pearson Publication.
5. "An Introduction to Web Design & Programming", Paul S. Wang, Cengage Learning.
6. "The Complete Reference to HTML & XHTML", Thomas A. Powell, TMH.
7. "HTML Black Book", Steven Holzner, Dreamtech Press.

AI 367 (PEC): PE-I(c): PROGRAMMING WITH R

Cr. Hrs. 3 (0+1+2)

	L	T	P
Credit	**0**	**1**	**2**
Hours	**0**	**1**	**4**

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

CO1 R Programming Language to perform basic tasks on Vectors, Matrices and Data frames.
CO2 Use R programming constructs such as structure, loops & functions.
CO3 Using R program to define, calculate, implement probability and probability distributions to solve a wide variety of problems.
CO4 Understand, Analyze, Interpret Correlation and Regression relationships between different variables.

UNIT-I

Introduction R and R Studio, how to run R, R sessions and functions, basic math, variables, data types, vectors, conclusion, advanced data structures, data frames, lists, matrices, arrays, classes.

UNIT – II

R programming structures, control statements, loops, - looping over nonvector sets, - if-else, arithmetic and boolean operators and values, default values for argument, return values, deciding whether to explicitly call return- returning complex objects, functions are objective, no pointers in R, recursion, a quicksort implementation-extended extended example: a binary search tree

UNIT – III

Doing math and simulation in r, math function, extended example calculating probability- cumulative sums and products-minima and maxima- calculus, functions fir statistical distribution, sorting, linear algebra operation on vectors and matrices, extended example: vector cross product- extended example: finding stationary distribution of Markov chains, set operation, input /output, accessing the keyboard and monitor, reading and writer files

UNIT-IV

Graphics, creating graphs, the workhorse of r base graphics, the plot () function – customizing graphs, saving graphs to files. probability distributions, normal distribution- binomial distribution- poisson distributions other distribution, basic statistics, correlation and covariance, t-tests, -anova. linear models, simple linear regression, -multiple regression generalized linear models, logistic regression, - poisson regression- other generalized linear models-survival analysis, nonlinear models, splines- decision- random forests.

Text Books/References

1. "The Art of R Programming", Norman Matloff, No starch press.
2. "R for Everyone", Jared P. Lander, Pearson.
3. "R Cookbook", Paul Teetor-, Oreilly.
4. "R in Action", Rob Kabacoff, Dreamtech Press.

AI 471 (PCC): DEEP LEARNING

Cr. Hrs. 4 (3 +0+ 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1	Understand the concept and regularization of Deep learning
CO2	Analyze and understand the concept of Optimization for Training Deep Models and Convolution networks.
CO3	Understand the concept of Sequence Modeling.
CO4	Implement and understand the application of deep learning and Auto encoder.

UNIT I

Fundamentals of deep networks: defining deep learning, common architectural principles of deep networks, parameters, layers, activation functions, loss functions, optimization algorithms, hyperparameters, and frameworks to deploy deep learning networks, building blocks of deep networs, restricted boltzmann machines.

Regularization for deep learning: parameter norm penalties, norm penalties as constrained optimization, regularization and under-constrained problems, dataset augmentation, noise robustness, semi-supervised learning, multi-task learning, early stopping, parameter typing and parameter sharing, sparse representations, bagging and other ensemble methods.

UNIT II

Optimization for training deep models: challenges in neural network optimization, basic algorithms, parameter initialization strategies, algorithms with adaptive learning rates, approximate second-order methods, optimization strategies and meta algorithms.

Convolutional Neural Networks-the convolution operation, pooling, convolution and pooling as an infinitely strong prior, variants of the basic convolution function, structured outputs , data types, efficient convolution algorithms, random or unsupervised features, the basis for neuroscientific convolutional networks.

UNIT III

Sequence Modeling: recurrent and recursive nets: unfolding computational graphsrecurrent neural networks, bidirectional, encoder-decoder sequence-to-sequence architectures, deep recurrent networks, recursive neural networks,

the challenge of long-term dependencies, echo state networks, leaky units and other strategies for multiple time scales, the long short-term memory and other gated RNNS, optimization for long-term dependencies, explicit memory.

UNIT IV

Applications: large scale deep learning, computer vision, speech recognition, natural language processing, other applications.

Autoencoders: under complete autoencoders, regularized autoencoders, representational power, layer size and depth, stochastic encoders and decoders, denoising autoencoders, learning manifolds with autoencoders, contractive autoencoders, predictive sparse decomposition, applications of autoencoders

Lab/Practical

Write python programs to introduce the field of deep learning using python and Keras library and practice with applications in computer vision, NLP and generative models.

Text Books/References

1. "Deep Learning", Ian Goodfellow and Yoshua Bengio and Aaron Courville, An MIT Press.
2. "Deep Learning: A Practitioner's Approach.", Josh Patterson and Adam Gibson, O'Reilly.
3. "Deep Learning", Amit Kumar Das,Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti, Pearson
4. "Deep Learning" Dr. Rajiv Chopra ,Khanna Publication.
5. "Deep Learning" John D. Kelleher, The MIT Press

AI 472 (PCC): DISTRIBUTED COMPUTING

Cr. Hrs. 4 (3+0 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1	Understand the distributed system architecture, design challenges & issues.
CO2	Evaluate & implement RPC and RMI along with data marshalling.
CO3	Understand the role of DNS, directory & discovery services, logical, physical, vector clocks in distributed systems.
CO4	Evaluate replication and concurrency control measures, for distributed systems.

Unit - I

Characterization of Distributed Systems, Challenges & Examples of Distributed System, Interprocess Communication, Internet Protocol APIs, External Data Representation and Marshalling, Client Server Communications, group communications, IPC in UNIX.

Unit -II

Distributed Objects and Remote Method Invocation, Communication between distributed objects, distributed object model, design issues of RMI, Implementation of RMI, Distributed Garbage collection, Remote Procedure Call, Sun RPC, and Java RMI.

Unit - III

Name Services and Domain Name System, Directory & discovery services, Time & Global states, clocks, events, process states, synchronizing physical clock, Logical time & logical clocks, Coordination and Agreement: Distributed Mutual exclusion, Elections.

Unit IV

Replication: System Model and Group communication, Fault tolerance services, Distributed Shared Memory: design and implementation issues, Sequential consistency and Ivy: The System Model, Write Invalidation, Invalidation protocols; Release consistency and Munin.

Lab/Practical
Programs related to socket programming, RPC, RMI. Practical implementation of different clocks in distributed system. Programs related to group communication, distributed shared memory

Text Books/References

1. "Distributed Systems, Concepts and Design", George Coulouris, Jean Dollimore, Tim Kindberg, Addission Wesley.
2. "Distributed System – Principles and Paradigms", A.S. Tanenbaum, M.S. Steen, Pearson Education.
3. "An Introduction to Parallel and Distributed Computations Through JAVA", Bala Dhandayuthapani Veerasamy, Penram International Publishing (India) Pvt. Ltd.
4. "Distributed Computing", Sunita Mahajan and Seema Shah, Oxford University Press.

AI 473 (PEC): PE-II(a): INFORMATION SECURITY ASSURANCE AND FORENSICS

Cr. Hrs. 4 (3+1 + 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1 Understand motivation of a hacker and various techniques used by the hacker.

CO2 Understand ethical issues related to hacking.

CO3 Perform forensic operations on a given media.

CO4 Understand various cyber crimes and related legal issues.

Unit - I

Introduction: ethics of hacking, hacking process, types of hackers. footprinting, scanning and enumeration, sniffers, encryption and password cracking, spoofing, session hijacking, dos, buffer overflows.

Unit – II

Mail vulnerabilities, web application vulnerabilities, windows and linux vulnerabilities. overview of computer forensics, types of cyber crime. the forensics process, disk imaging, forensics tools, hardware and os fundamentals, disk geometry, partitions, windows and linux file systems

Unit – III

File signatures, string searching, file types, regular expressions, grep, egrep, and fgrep commands. data hiding techniques deleted file recovery, recycle bin, alternate data streams, cryptography, steganography, anti-forensics tools.

Unit – IV

Investigative Techniques: Windows registry files, Email analysis, Internet activity analysis, Live system forensics and incident response, Static and dynamic analysis of executable file, Documentation and reports. Legal Issues: The justice system, Indian IT act and case studies.

Text Books/References

1. "Computer Security Concepts, Issues and Implementation", Alfred Basta and Wolf Halton, Cengage Learning.

2. “Gray Hat Hacking The Ethical Hackers Handbook", Shon Harris et al., TMH.
3. "CEH Study Guide Exam 312-50 Exam", Kimberly Graves, Wiley India.
4. "Computer Forensics and Investigations", Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, Cengage Learning.
5. "Hacking Exposed Computer Forensics", Chris, Philipp, TMH.
6. "Incident Response & Computer Forensics", Kevin Mandia, Chris Prosise, TMH.
7. "Real Digital Forensics: Computer Security & Incident Response", Richard Bejtlich, Keith Jones, Curtis W. Rose, Pearson Higher Education
8. "The Official CHFI Study Guide(Exam 312-49)", Dave Cleiman et al., Syngress.
9. "Computer Evidence Collection and Preservation", Brown, Laxmi Publications.

AI 473 (PEC): PE-II(b): COMPUTER VISION

Cr. Hrs. 4 (3+ 1 + 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1	Implement fundamental image processing techniques required for computer vision.
CO2	Understand image formation process.
CO3	Perform shape analysis, extract features and generate 3D Models from Images.
CO4	Implement video processing, motion capturing and 3D Vision.
CO5	Develop applications using computer vision techniques.

UNIT-I

Image processing, computer vision and computer graphics, levels in computer vision, applications, document image analysis, biometrics, object recognition, tracking, medical image analysis, content-based image retrieval, video data processing.

UNIT – II

Image formation models :monocular imaging system, radiosity, radiance, irradiance, color, orthographic and perspective projection, camera model and camera calibration, binocular imaging systems, multiple views geometry, structure determination, photometric stereo, depth from defocus, construction of 3d model from images.

UNIT – III

Image representation and processing, continuous and discrete processing methods, edge detection, regularization theory, optical computation, motion estimation techniques, structure from motion, stereo vision, contour based representation, region based representation, deformable curves andsurfaces, snakes and active contours, level set representations, fourier and wavelet descriptors, medial representations, multi resolution analysis.

UNIT-IV

Applications of computer vision: object detection and recognition face detection, face recognition, eigen faces, active appearanceand 3d shape models of faces, surveillance, foreground and background separation, particle filters,chamfer matching, tracking and occlusion, combining views from multiple cameras.

Text Books/References

1. “Computer Vision – A Modern Approach.”, D. Forsyth and J. Ponce, Prentice Hall.
2. “Introductory Techniques for 3D Computer Vision.” E. Trucco, Prentice Hall.
3. “Digital Image Processing “, R.C. Gonazlez, Addison Wesley.
4. “Feature Extraction and Image Processing for Computer Vision”, Mark Nixon , Academic Press.
5. “Computer Vision – Models, Learning and Inference”, Simon J. D. Prince, Cambridge.

6. "Computer Vision – Algorithms and Applications", Richard Szeliski, Springer.

AI 473 (PEC): PE-II(c): HUMAN COMPUTER INTERACTION

Cr. Hrs. 4 (3 +1+ 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1 Understand fundamental design and evaluation methodologies of human computer interaction.
CO2 Demonstrate knowledge of human computer interaction design concepts and related methodologies.
CO3 Apply theories and concepts associated with effective work design to real-world application.
CO4 Design, implement and evaluate effective and usable graphical computer interfaces.

UNIT-I

Introduction: historical evolution of the field, interactive system design, concept of usability - definition and elaboration, hci and software engineering, gui design and aesthetics, prototyping techniques.

UNIT – II

Model-based Design and evaluation: basic idea, introduction to different types of models, goms familyof models (klm and cmn- goms), fitts' law and hick-hyman's law, model-based design case studies.
Guidelines in HCI:shneiderman's eight, golden rules, norman's seven principles, norman's model of interaction, nielsen's ten heuristics with example of its use heuristic evaluation, contextual inquiry, cognitive walkthrough

UNIT – III

Empirical research methods in HCI: introduction (motivation, issues, research question formulation techniques), experiment design and data analysis (with explanation of one-way ANOVA)

UNIT-IV

Task modeling and analysis: hierarchical task analysis (hta), engineering task models and concur task tree (ctt), introduction to formalism in dialog design, design using fsm (finite state machines)state charts and (classical) petri nets in dialog design
Introduction to CA: CA types, relevance of CA in IS design Model Human Processor (MHP), OOP-Introduction OOM- Object Oriented Modeling of User Interface Design

Text Books/References

1. " Human Computer Interaction", Dix Finlay Abowd Beale
2. "The Human-Computer Interaction Handbook: Fundamentals,Evolving Technologies, and Emerging Applications", Julie A. Jacko, Andrew Sears..
3. "Human-Computer Interaction: An Empirical Research Perspective", I. Scott MacKenzie..

AI 473 (PEC): PE-II(d): NATURAL LANGUAGE PROCESSING

Cr. Hrs. 4 (3 +1+ 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1 Understand approaches to syntax and semantics in NLP.

CO2 Understand various methods for statistical approaches to machine translation.

CO3 Build models which extract information from textual unstructured data.

CO4 Understand and implement topic modelling and probabilistic models for information extraction.

Unit – I

Introduction to Text Mining: Basics of Text Mining, Natural Language Content Analysis, CoreText Mining Operations, Associations, Using Background Knowledge for Text Mining, Domain Ontologies, Domain Lexicons. Text Mining Pre-processing Techniques, Task Oriented Approaches, NLP Tasks, Tokenization, Part-of-Speech Tagging, Syntactical Parsing and ShallowParsing.

Unit – II

Extracting features, relations from text: finding implicit features, finding opinion phrases and their polarity, context-specific word semantic orientation, analysis of word and documentfrequency, tf-idf, zipf's law, bind tf_idf function, subsequence kernels for relation extraction,capturing relation patterns with a string kernel.

Unit – III

Text categorization and clustering: applications of text categorization, document representation, knowledge engineering approach to text categorization, machine learning approach to text categorization, evaluation of text classifiers. clustering tasks in textanalysis, clustering algorithms and clustering of textual data.

Unit – IV

Relationships between words: tokenizing by n-gram, counting and filtering n-gram, analysing bigrams to provide context in sentiment analysis, visualizing a network of bigrams using graph, counting and correlating pairs of words with the widyr package, counting and correlating among sections, examining pairwise correlation.

Topic modelling and probabilistic models for information extraction: latent dirichlet allocation, word topic probabilities, per-document classification, by-words assignments,alternative lda implementations. hidden markov models, stochastic context free grammar, conditional random fields, parallel learning algorithms.

Text Books/References

1. "Text Mining with R-A Tidy Approach", Julia Silge, David Robinson, O'Reilly
2. "Text Analysis with R for Students of Literature", Matthew L. Jockers, Springer.
3. "Natural Language Annotation for Machine Learning", James Pustejovsky, Amber Stubbs,O'Reilly.
4. "Natural Language Processing with Text Mining", Steve R. Poteet, Springer.
5. "The Text Mining Handbook: Advanced Approaches inAnalysing Unstructured Data", James Sanger, Ronen Feldman, Cambridge.

AI 473 (PEC): PE-II(e): INTRODUCTION TO VIRTUAL & AUGMENTED REALITY

Cr. Hrs. 4 (3 +1+ 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1 Understand the requirements of modern augmented and virtual reality systems.

CO2 Understand the capabilities and limitations of the algorithms and techniques that make virtual and augmented reality possible.

CO3 Build augmented and virtual reality applications to suit a wide variety of needs.

Unit – I

Introduction, Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (XR), VR Headsets,VR companies, AR Companies, XR Headsets, XR Companies, the difference between VR, AR and XR.

Unit – II

Virtual Reality: Introduction, Field of View, Degree of Freedom, 3 I's in VR, Keyboard & mouse, Motion Controllers in VR, Classic components of VR system, Hand tracking, Eye tracking, InputDevices, Output Devices, Exploring Consumer-Grade VR, VR Hardware, Recognizing the current issues with VR, Movement in VR, Health Effects.

Unit – III

Augmented Reality: Introduction, Brief history, Examples of AR, AR headsets, AR glasses, Adding sound, Multimodal display, Visual Perception, Spatial Display Model, Hand tracking, Motion Controllers in AR, Tracking of AR, Field of view, Exploring Consumer-Grade AR, AR Hardware.

Unit – IV

Applications of AR and VR: Creation & Applications of AR and VR, SDK and Games Engine, Selecting, 3D Modeling, Extended Reality in Marketing, Application of AR and VR in different industries, Exploring VR Use Cases, Exploring AR Use Cases, Assessing the future of VR, Assessing the future of AR.

Text Books/References

1. "Virtual & Augmented Reality For Dummies", Paul Mealy,
2. "Virtual Reality", Steven M. LaValle, Cambridge University Press,
3. "Augmented Reality: Principles & Practice", Schmalstieg / Hollerer, Pearson Education India.

AI 473 (PEC): PE-II(f): SOFT COMPUTING

Cr. Hrs. 4 (3 +1+ 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1 Understand soft computing techniques
CO2 Explore neural network applications
CO3 Explore fuzzy logic applications
CO4 Explore genetic algorithm and hybrid soft computing approaches applications

Unit – I

INTRODUCTION: artificial neural network: introduction, characteristics, learning methods, taxonomy, evolution of neural networks, basic models, important technologies, applications. fuzzy logic: introduction, crisp sets, fuzzy sets, crisp relations and fuzzy relations: cartesian product of relation, classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. genetic algorithm, introduction, biological background, traditional optimization and search techniques, genetic basic concepts.

Unit – II

NEURAL NETWORKS: McCulloch-Pitts neuron, linear separability, hebb network, supervised learning network: perceptron networks, adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN, associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory

network –unsupervised learning networks: Kohonen self organizing feature maps, LVQ, CP networks, ART network.

Unit – III

FUZZY LOGIC: membership functions: features, fuzzification, methods of membership value assignments, defuzzification: lambda cuts, methods, fuzzy arithmetic and fuzzy measures: fuzzy arithmetic, extension principle, fuzzy measures, measures of fuzziness, fuzzy integrals, fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules, decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems, overview of fuzzy expert system, fuzzy decision making.

Unit – IV

GENETIC ALGORITHM: genetic algorithm and search space, general genetic algorithm, operators, generational cycle, stopping condition, constraints, classification, genetic programming, multilevel optimization, real life problem, advances in GA HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS: neuro-fuzzy hybrid systems, genetic neuro hybrid systems, genetic fuzzy hybrid and fuzzy genetic hybrid systems, simplified fuzzy artmap, applications: a fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach

Text Books/References

1. "Principles of Soft Computing", S.N.Sivanandam and S.N.Deepa, Wiley India Pvt Ltd.
2. "Neuro-Fuzzy and Soft Computing", J.S.R.Jang, C.T. Sun and E.Mizutani, PHI / Pearson Education.
3. "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", S.Rajasekaran and G.A.Vijayalakshmi Pai, Prentice-Hall of India Pvt. Ltd.
4. "Fuzzy Set Theory: Foundations and Applications", George J. Klir, Ute St. Clair, Bo Yuan, Prentice Hall.
5. "Genetic Algorithm in Search Optimization and Machine Learning", David E. Goldberg, Pearson Education India.
6. "Neural Networks Algorithms, Applications and Programming Techniques", James A. Freeman, David M. Skapura, Pearson Education India.
7. "Neural Networks Comprehensive Foundation", Simon Haykin, Second Edition, Pearson Education.
8. "Fuzzy Logic Engineering Applications", Timothy J.Ross, McGraw Hill, New York.
9. "Fundamentals of Neural Networks", Laurene Fauseett, Prentice Hall India, New Delhi.

AI 473 (PEC): PE-II(g): COMPUTER GRAPHICS

Cr. Hrs. 4 (3+1 + 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1	Understand the role of computer graphics, different graphics systems and their applications.
CO2	Understand and implement various algorithms for scan conversion and filling of basic objects.
CO3	Demonstrate and implement different basic geometric transformation including composite transformation techniques on graphical objects.
CO4	Understand and analyze various three dimensional geometric and modelling transformations.
CO5	Demonstrate and implement clipping and view-ports object representation for images.

Unit – I

Introduction to computer graphics, application areas, display devices, raster scan, random scan, color monitor, display file, frame buffer, 3-D display technique, input devices, hard copy devices.

Unit – II

Points, lines, plane and coordinate, character vector, circle generation algorithm, antialiasing techniques, representation of polygons, Interfacing and filling polygon, 2-D transformation, translation, rotation, scanning, shearing, reflection, composite transformation, raster transformations.

Unit - III

Windows, multiple windowing, view port, viewing transformation, clipping algorithm for points, line using Sutherland and Cohen, polygon, text clipping. Segment and segment operations. Interactive graphics, user dialogue, input modes, interactive picture construction techniques, curves and curved surface, interpolation and approximation curve, continuity of curve.

Unit - IV

Concept of 3-D, representation of 3-D object, 3-D transformation, translation, rotation, reflection, scaling. parallel perspective, isometric projections. 3-D clipping sutherland and cohen algorithm. hidden lines and surface removal techniques. back face, Z-buffer, painter algorithm.

Text Books/References

1. "Computer Graphics: C Version", D. Hearn and M.P. Baker 2nd Ed, Pearson Education.
2. "Interactive Computer Graphics", James D. Foley; Andries Van Dam; Steven K. Feiner; John F. Hughes, Addison Wesley.

AI 474 (PEC): PE-III(a): INFORMATION SECURITY

Cr. Hrs. 4 (3+1 + 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1	Identify common network security vulnerabilities/attacks.
CO2	Understand and design cryptographic algorithms of different types and modes.
CO3	Understand and implement symmetric, asymmetric cryptographic and Digital Signature algorithms.
CO4	Understand and use different Authentication Mechanisms and Internet Security Protocols.
CO5	Understand and identify the key aspects of Cyber Crime and Cyber law.

Unit - I

Need for security, security approaches, principle of security, Types of attacks, Cryptography Techniques: Plain Text and Cipher text, Substitution techniques, Transposition techniques, Encryption & decryption, symmetric & asymmetric cryptography, Diffie-Hellman Key Exchange, steganography, key range and key size, possible types of attacks.

Unit – II

Computer- based Symmetric key Cryptography Algorithms: Algorithms types and modes, overview of symmetric key cryptography, data encryption standards (DES), Advance encryption standards (AES), Shannon's theory of confusion and diffusion. Computer- based Asymmetric key Cryptographic Algorithms: RSA algorithms, MD5 Digital Signature.

Unit – III

Public Key Infrastructure (PKI): Digital Certificates, private key management- Distribution of Public Keys, Distribution of Secret keys using Public Key Cryptosystems, Authentication: password, authentication tokens, certificate based authentication, biometric authentication, Kerberos. Internet Security Protocols: Secure socket layer (SSL), Secure hyper text transfer protocol (SHTTP), Time stamping protocol (TSP), Secure electronic transaction (SET), electronic money, E-Mail Security, Single Sign on (SSO).

Unit – IV

Introduction to Cyber Crime and Cyber law: Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Digital Forensics, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT. Intellectual property rights (IPR), Legal System of Information Technology, Firewall, Social Engineering, Mail Bombs, Bug Exploits, SQL injection.

Text Books/References

1. "Cryptography and Network Security", Atul Kahate, Tata McGraw- Hill Publishing Company Ltd.
2. "Cryptography and Network Security", William Stallings, Pearson Asia.
3. "Cyber Security Essentials", James Graham Richard Howard Ryan Olson, CRC press.
4. "Cyber Security", Nina Godbole, Sunit Belapure, Wiley India, New Delhi.
5. http://meity.gov.in/content/information-technology-act - INDIA IT ACT.

AI 474 (PEC): PE-III(b): BUSINESS INTELLIGENCE

Cr. Hrs. 4 (3+1 + 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1 Understand the fundamentals of business intelligence and analytics.

CO2 Understand and analyze predictive and descriptive analytics

CO3 Understand prescriptive analytics model-based decision making. Use analytics concepts like data mining, exploratory and statistical techniques

CO4 Understand big data and future directions for business analytics.

UNIT-I

Decision making and analytics: an overview of business intelligence, analytics, and decision support, foundations and technologies for decision making. descriptive analytics data warehousing, business reporting, visual analytics, and business performance management

UNIT – II

Predictive analytics-data mining, techniques for predictive modeling, text analytics, text mining, and sentiment analysis web analytics, web mining, and social analytics. data analytics life cycle, discovery, data preparation, pre-processing requirements, data cleaning, data integration, data reduction, data transformation, data discretization and concept hierarchy generation, model planning, model building, communicating results & findings, operationalizing, introduction to OLAP. real-world applications, data visualization: definition, new direction in data visualization, gis, gis vs gps

UNIT – III

Prescriptive analytics model-based decision making: optimization and multi-criteria systems, modeling and analysis: heuristic search methods and simulation, automated decision systems and expert systems, knowledge management and collaborative systems

UNIT-IV

Big data and future directions for business analytics, big data and analytics, business analytics: emerging trends and future impacts. data analytics, business analytics, erp and business intelligence, bi applications in crm, bi applications in marketing, bi applications in logistics and production, role of bi in finance, bi applications in banking, bi applications in telecommunications, bi applications in fraud detection, bi applications in retail industry.

Text Books/References

1. "Business intelligence and analytics: systems for decision support", Ramesh Sharda, Dursun Delen and Efraim Turban., Pearson/Prentice Hall.
2. "Business Intelligence: The Savvy Manager's Guide", David Loshin, MK Publication.
3. "Business Intelligence for Dummies", Swain Scheps, WILEY.

4. "Data Mining for Business Intelligence", Galit Shmueli, Nitin R. Patel, Peter C. Brue, WILEY.

AI 474 (PEC): PE-III(c): DATA PREPARATION & ANALYSIS

Cr. Hrs. 4 (3 +1+ 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1 Gain knowledge to identify the data parsing and transformations and understand the difference between data and information with formats.
CO2 Explain the basic concept of data cleaning for valuable information with a minimum consistency checking.
CO3 Understand statistical exploratory analysis with hypothesis generation.
CO4 Design visualizations for exploratory analysis and understand the concept of correlations and connections for geo located data.

Unit – I

Data Gathering and Preparation: data formats, parsing and transformation, scalability and real-time issues.

Unit – II

Data Cleaning: consistency checking, heterogeneous and missing data, data transformation andsegmentation

Unit – III

Exploratory Analysis: descriptive and comparative statistics, clustering and association,hypothesis generation

Unit – IV

Visualization: designing visualizations, time series, geolocated data, correlations andconnections, hierarchies and networks, interactivity

Text Books/References

1. "Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining", Glenn J. Myatt
2. "Data Preparation for Data Mining (The Morgan Kaufmann Series in Data ManagementSystems)", Dorian Pyle
3. "Principles of Data Wrangling: Practical Techniques for Data Preparation", Tye Rattenbury,Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel, Connor Carreras.
4. "Introduction to Data Mining", Pang-Ning Tan, Michael Steinbach.
5. "Data Mining: Concepts and Techniques", Jiawei Han

AI 474 (PEC): PE-III(d): SOFTWARE DEFINED NETWORKS

Cr. Hrs. 4 (3+1 + 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1 Explain the key benefits of SDN by the separation of data and control planes.
CO2 Interpret the SDN data plane devices and Openflow Protocols.

CO3 Implement the operation of SDN control plane with different controllers.
CO4 Apply techniques that enable applications to control the underlying network using SDN.
CO5 Describe Network Functions Virtualization components and their roles in SDN.

Unit – I

SDN Background and Motivation: Evolving network requirements-The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking, SDN and NFV-Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives.

Unit – II

SDN Data plane and OpenFlow: SDN data plane: Data plane Functions, Data plane protocols, Openflow logical network Device: Flow table Structure, Flow Table Pipeline, The Use of MultipleTables, Group Table- OpenFlow Protocol.

SDN Control Plane: SDN Control Plane Architecture: Control Plane Functions, Southbound Interface, Northbound Interface, Routing, ITU-T Model- OpenDaylight-REST- Cooperation and Coordination among Controllers.

Unit – III

SDN Application Plane: SDN Application Plane Architecture: Northbound Interface, Network Applications, User Interface- Network Services Abstraction Layer: Abstractions in SDN, Frenetic-Traffic Engineering Measurement and MonitoringSecurity- Data Center Networking- Mobility and Wireless.

Unit – IV

Network Functions Virtualization: Background and Motivation for NFV- Virtual Machines- NFV Concepts: Simple Example of the Use of NFV, NFV Principles, High-Level NFV Framework, NFV Benefits and Requirements- NFV Reference Architecture: NFV Management and Orchestration.

Text Books/References

1. "Foundations of Modern Networking", William Stallings, Pearson Ltd.
2. "Software Defined Networks: A Comprehensive Approach", Paul Goransson and ChuckBlack, Morgan Kaufmann Publications.
3. "SDN - Software Defined Networks", Thomas D. Nadeau & Ken Gray, O'Reilly.

AI 474 (PEC): PE-III (e): GRAPH THEORY

Cr. Hrs. 4 (3 +1+ 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1 Understand and analyze the basic concepts of graph theory and apply them to implement Euler and Hamiltonian graphs and solve travelling salesman problem.
CO2 Apply and analyze the use of tree data structure; basic properties of cut sets and cut vertices and its applications.
CO3 Understand and analyze the applications of various graphs like planar graph, dual graph with their attributes and representations.
CO4 Understand and analyze various coloring, covering and partitioning problems with their applications and representations.

Unit - I

Introduction: Graph, application of graph, finite & infinite graphs, incidence & degree, isolated vertex, pendant vertex & null graph, *Paths & Circuits*: isomorphism, sub-graphs, walks, paths, Circuits, connected

graphs, disconnected graphs, & components, Euler graphs, operation on graphs, Hamiltonian paths & circuits, travelling salesman problem.

Unit - II

Trees: Properties of trees, pendent vertices in a tree, distance & centers in a tree, rooted & binary trees, on counting trees, spanning trees, fundamental circuits, finding all spanning trees of a graph, spanning trees in a weighted graphs. *Cut sets & cut vertices*: Cut- sets, properties of cut-sets, cut sets in a graph, fundamental circuits and cut – sets, connectivity & Separability, networks flows, 1- isomorphism, 2- isomorphism.

Unit - III

Planar & Dual graphs: Planar graphs, kuratowski's two graphs, different representation of planar graphs, detection of planarity, geometric dual, Combinatorial Dual, *Matrix representation of graph*: Incidence Matrix, circuit matrix, cut-set matrix, path matrix, adjacency, matrix.

Unit - IV

Coloring, covering & partitioning: Chromatic number, chromatic partitioning, chromatic polynomial, matching, covering, the four color problem, Directed graphs: types of digraphs, binary relations, Euler digraphs, trees with directed edges, fundamental circuits in digraphs, adjacency matrix of a digraph, Acyclic digraph and Decyclization.

Text Books/References

1. "Graph Theory", Narsingh Deo, Prentice- hall of India Pvt. Ltd.
2. "Procedural Elements of Computer Graphics", Rogers, McGraw Hill
3. "Computer Graphics", Asthana, Sinha, Addison Wesley

AI 474 (PEC): PE-III (f): REAL TIME SYSTEMS

Cr. Hrs. 4 (3+1 + 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1	Understand concepts of real time systems and its application in digital control, high-level control and signal processing.
CO2	Understand and analyze various attributes of processes and resources as well as the implementation of various real time task scheduling approaches.
CO3	Analyze clock-driven and priority driven scheduling algorithms for periodic tasks.
CO4	Understand and analyze the implementation of algorithms for scheduling aperiodic and sporadic jobs in terms of bandwidth and resource utilization.

Unit - I

Real time application: Digital Control, High – Level control, Signal Processing. Hard versus Soft Real time system: Jobs & Processors, Release times, Deadlines, Timing constraints, hard & soft timing constraints, Hard Real Time Systems, Soft Real Time Systems.

Unit - II

Reference Model: Processors & Resources, Temporal Parameters, Periodic Task Model, Precedence Constraints and Data Dependency, Functional Parameters, Resources Parameters, Scheduling Hierarchy. Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven approach, Dynamic Versus Static System, Effective Release Time and Deadlines, Optimality of the EDF and the LST Algorithms, Off Line versus Online Scheduling.

Unit - III

Clock – Driven Scheduling: Static, Timer Driven Scheduler, Cyclic schedules, Cyclic Executive, Scheduling Sporadic Jobs, Generalization, Algorithm for Static Schedules, Pros & Cons of Clock – Driven Scheduling.

Priority - Driven Scheduling of Periodic Tasks: Fixed Priority versus Dynamic Priority Algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM Algorithms, Sufficient Schedulability Conditions for the RM and DM algorithms, Practical Factors.

Unit - IV

Scheduling A periodic and Sporadic Jobs in Priority – Driven Systems: Deferrable Servers, Sporadic servers, Constant Utilization, Total Bandwidth, and Weighted Fair – Queuing Servers, Slack Stealing in Deadlines driven Systems, Slack Stealing in Fixed Priority Systems, Scheduling of Sporadic Jobs. Resources and Resource Access Control: Effects of Resources Contention and resource Access Control, Non-preemptive Critical Sections, Basic Priority – Inheritance Protocol, Basic priority – Ceiling Protocol, Stack – Based, Priority – Ceiling (Ceiling Priority) Protocol, preemption Ceiling Protocol, Accesses of Multiple – Unit Resources, Concurrent Accesses to Data Objects.

Text Books/References

1. "Real Time Systems", Jane W. S. Liu., Pearson Education.
2. "Real Time Systems", Krishna C. M., McGraw Hill Publication.

AI 474 (PEC): PE-III (g): OBJECT ORIENTED ANALYSIS AND DESIGN

Cr. Hrs. 4 (3+1 + 0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

CO1	Understand and be able to differentiate how the object-oriented approach differs from the traditional approach to systems analysis and design.
CO2	Understand and analyze the importance of modeling and how the Unified Modeling Language (UML) represents an object-oriented system using a number of different modeling views.
CO3	Understand and Construct various UML models including use case diagrams, class diagrams, interaction diagrams, state chart diagrams, activity diagrams, and implementation diagrams using the appropriate notation.
CO4	Apply the Rational Software Suit for the construction of UML models and expressing the appropriate notation associated with each model.

Unit - I

Introduction: Object oriented approach, Object oriented themes, and Object oriented methodologies, Overview of OOL, Object classes; Meta Types, Object Oriented Methodologies, the Uniform Approach Modeling; Need of Modeling, Static and Dynamic Models, Functional Models. Object Modeling: Modeling concepts, Modeling techniques, Objects and classes, Links and association, multiplicity, Advanced link and association concepts, Generalization and inheritance, Grouping constructs, Aggregation, Abstract classes, Generalization *as* an extension and restriction, Multiple inheritance, Metadata, Candidate key, Constraints, Homomorphism, problems on object modeling and Advanced Object Modeling, Advantages of Object Modeling

Unit -II

Analysis: Problem Analysis, Problem Domain Classes, Identity classes, Object of Real World Problems using use case analysis and Recording Analysis. Dynamic Modeling: Events, Modeling scenarios, Mapping Events to Object, Interface, Discovering attributes scenarios and event trace diagrams, Modeling simple collaboration, Modeling Logical Database schema, Activity Diagram, Modeling workflow, Advanced Dynamic Modeling concepts, Relation of object and dynamic models.

Unit - III

Class and State Diagram: Test scenarios, Interfaces, classes, Methods, Stress Testing, System Testing, Scalability Testing, and Regression Testing, Behavioral Modeling, State Chart diagrams, operations,

Nested state diagrams, concurrency. Functional Modeling: Functional models, Data Flow Diagrams, Specifying Operations, Relation of functional to object and dynamic models, Problems on functional modeling.

Unit - IV

Design: Architectural Design, Refining the Model, Refactoring, Coupling and cohesion. Ownership of the attribute and the operations Process and Threads, Classes visibility, user interface, Subsystem interfaces. Deployment Diagram: Modeling source codes, Physical Database, Modeling in AC/S system, Distributed system and embedded systems. Case Study: Designing a static and dynamic model using diagram for Banking System, Student Information System, Examination System, Air Ticket Reservation System and Inventory System etc.

Text Books/References

1. "Object Oriented Modeling and Design with UML", James Rumbaugh, Pearson Education.
2. "Object Oriented Analysis and Design with Applications", Grady Booch, Pearson Education.

****OPEN ELECTIVE**

Note: The students have to take one open elective out of the list given except the subjects offered by their own branch.

CE 478a (OE) URBAN WASTE MANAGEMENT

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1	Demonstrate knowledge of Problems & National & global scenario of solid waste management.
CO2	Demonstrate knowledge of solid waste seperation, collections, transfer and transport.
CO3	Analysis of solid waste & chemical characteristic of refuse.
CO4	Understand composting and incineration.
CO5	Understand sanitary land filling.
CO6	Monitor effects of solid waste on environment.

Unit -I

General: Problems associated with Solid Waste Disposal. National & global scenario of solid waste management.
Generation of Solid Waste: Objectives of solid waste management, Classification of solid waste. Activities associated with generation of solid waste, quantity of waste generation, factors affecting solid waste generation.

Unit -II

Types of Solid Waste: Sources of solid waste. Food & biodegradable waste, recyclable waste. hazardous waste.
*Waste Collections, Transfer and Transport***:** Storage of waste at source & source separation of waste. Primary collection of waste, secondary storage of waste. Waste storage depot. Transportation of waste..

Unit-III

Analysis of Solid Waste: Need for physio-chemical analysis of municipal solid waste. Physical characteristic of refuse : specific weight & category analysis.
Chemical Characteristic of Refuse: Determination of moisture content, volatile solid, pH, carbon, nitrogen, phosphorus, potassium & calorific value.
Composting & incineration, their advantages & disadvantages.

Unit-IV

*SanitaryLandFilling:*Introduction, approach to design of sanitary land filling. Typical component of land-fill cover. Various guide lines for design of land-fill. Trench of municipal solid waste disposal. Environmental quality monitoring at land-fill site. Recommendation for problems of municipal solid waste.

Practical: As per theory syllabus.

Suggested Books & References

1. G. Techobanogious, H. Theisen& R. Blassen, 'Solid Waste Engineering, Principles and Management Issues', McGraw Hills, Book Co. New York.
2. C.L. Mentell, 'Solid Waste Management, 'John Whely, New York.
3. Bhide&Sundrashen, 'Solid Waste Management in Developing Countries'.

CE 478b (OE) GROUND IMPROVEMENT TECHNIQUES

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1	Ground Improvement Techniques & Methods of soil stabilization.
CO2	Understand soil cements stabilization.
CO3	Stabilize dune sand by lime fly ash
CO4	Demonstrate knowledge of Soil Bituminous stabilization and Thermal stabilization.
CO5	Understand Granular column and soil reinforcement.
CO6	Demonstrate knowledge of Dynamic compaction.

Unit -I

Ground Improvement Techniques: Shallow and deep techniques. Soil stabilization; Purpose, mechanical mixing of different types of soils, grading land plasticity charcteristics,.

Soil Lime Stabilisation: Base exchange, Pozzolinic reaction, curing, Types of soils, stabilised, density, effect on consistency properties. Effect of lime on liquid limit, plastic limit, plasticity index and shrinkage limit. Relationship of strength with curing period & density.

Unit -II

*SoilCement Stabilisation:*Soilcement stabilisation, Mechanism of soilcement stabilisation. Various theories; Modified soil cement & plastic soil cement. Effect of density, curing period and surface area on strength.

Soil Fly-Ash Stabilisation: Soil-lime fly ash stabilisation, principles of pozzolanic reaction. Proportions used in practice. Stabilisation of dune sand by lime fly ash.

Unit-III

Soil Bituminous Stabilisation: Soil bituminous stabilization Intimate mix theory & plug theory. Effect of mixing, moisture, aerating, density & compaction.

Thermal Stabilisation: Theory of thermal stabilisation, Electroosmotic drainage. Double layers, 'Ke' electro osmotic coefficient of permeating, Full scale field test, Electro osmotic chemical hardening Field construction methods and equipment.

Dynamic compaction of soil Equipments used, tests performed in field, Pre compression and Vertical Drains.

Unit -IV

Granular Columns: Methods of construction, bearing capacity of composite soil. Empirical methods/charts, Theory of determination of settlement of composite soil. Vibro-flotation &vibro-compaction.

*Soil Reinforcement:*Geosynthetics, Geomembrane,

Practicals : As per theory syllabus.

Suggested Books & References

1. Purushotham, P. Raj, 'Ground improvement Techniques'.
2. Venkaramiah, C., 'Ground Improvement'.
3. Madhav, M.R., 'Development in Reinforcement of Ground and Slopes'.

MI 478 (a) (OE) ENGINEERING GEOLOGY

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of course, the students will be will able to:

Identify the structure of earth; Distinguish between different rocks and their properties; Select sites for different structures in different zones and Explore subsurface using different techniques

Unit-I

General Geology: Subdivision of Geology. Importance of Geology in Civil Engineering. Internal Structure of the Earth, physical properties of minerals, weathering and erosion. Geological work of wind, river and ocean. Stratigraphic aspects of rocks for civil engineers. Geological Time Scale, rock provinces.

Unit-II

Petrology: Origin & classification of rocks. Texture & Structures of Igneous, Sedimentary and Metamorphic Rocks. Engineering Properties of rocks. Rocks and dimensional stones as a construction material. Suitability of rocks for different Civil Engineering purposes. Structural Geology: Causes & Classification of fold, fault, joints & unconformities. Outcrop pattern. Recognition of structure from rock outcrops.

Unit- III

Natural Disasters and Geological Investigations (in reference to Civil Engineering): Earthquake, its causes, intensity scale and seismic zone of India. Site selection for dam, tunnels, multistoried buildings, reservoirs and bridge structures Improvement Techniques: Sites improvement techniques practiced in different civil engineering projects. Introduction to drilling methods.

Unit-IV

Geophysical Methods for Subsurface Exploration: Electrical resistivity, Seismic refraction & Ground Penetrating Radar method of civil engineering importance. Remote Sensing: Introduction and applications in Civil Engineering. Image acquisition, image interpretation (visual and digital, digital terrain model, airborne lithological identification). Remote sensing software used in civil engineering interpretation.

Practical: As per theory part

Text Books/References

1. Goodman, R. E., 'Engineering Geology - Rock in Engineering Construction', John Wiley and Sons.
2. Parbin Singh, 'Text Book Engineering Geology'.
3. Blyth, F.G. and De Freitas, M.H., 'A Geology for Engineers', (7th Edition), Edward Arnold.
4. N.Chenna Kesavulu, 'Text Book of Engineering Geology'.
5. Leggot R.F., 'Geology for Engineers'.
6. Kryinine & Judd, 'Engineering Geology and Geo-techniques'.
7. John Pitts, 'Manual of Geology for Civil Engineers'.
8. Tony Waltham, 'Foundations of Engineering Geology

MI 478 (b) (OE) EARTH MOVING MACHINERY

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of course, the students will be will able to:
Understand construction and working of various heavy earth moving machinery, pumping system used in mines, maintenance aspects

UNIT-I

Construction and operation of blast hole drills, rippers, shovels, hydraulic excavators, scraper, dragline, dumpers, wheel loaders, dozers, graders, surface miners, BWE, spreader, stacker & reclaimer.
High capacity belt conveyors – constructional detail and selection procedures; High angle conveyor, Cable belt conveyor;

UNIT-II

Aerial rope ways – classification, layout and constructional features.
Classification, application and constructional features of crushers, breakers and feeders; In pit crushers
Compressors: Basic theory, classification and application of compressors used in mines; Construction and operation of centrifugal and axial flow compressors; Performance characteristics of compressors; Selection of compressors for mining application.

UNIT-III

Centrifugal Pumps: Principle of operation; theoretical and actual head, construction of impeller, multistage centrifugal pumps, axial thrust balancing, performance characteristics, parallel and series operations of pumps, capacity, selection of mine pumps; Pumping system layout for mines
Construction and operation of slurry, submersible, air lift and mono pumps; installation and maintenance of pumps

UNIT-IV

Recent trends and development of surface mining equipment: Automation and control in HEMM. Selection criteria of open cast mining equipment. Safety aspects related to open cast mining equipment: Fire protection system used in HEMM.
Faults and their rectification in HEMM and their maintenance.

Practical: As per theory syllabus

Text Books/References

1. Surface Mining Technology– S. K. Das;Geeta Book Stores
2. Elements of Mining Technology– D. J. Deshmukh; Vidyasewa Prakashan
3. Mine, Pumps, Haulage & Winding– S. Ghatak; Coalfield Publishers, Asansol
4. Conveying machines; Part I & II – A. Spivakovsky, V. Dyachkov; Mir Publishers, Moscow
5. Recent Development of Heavy earth Moving machineries – A. De, Lovely Prakashan
6. Moving the Earth – Nicholes
7. On and with the Earth – J. Singh

8. Drilling Technology Handbook– C. P. Chugh

MI 478 (c) (OE) TUNNELING ENGINEERING

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:
Understand various methods of tunneling, use of latest numerical techniques for tunnel design, stability analysis and ground control measures with various steel support and rock reinforcement, maintenance of tunnels, provision of facilities such as ventilation, illumination etc in tunnels.

UNIT-I

Introduction to tunneling; geological concept of tunneling. Influence of geological aspects on design & construction of tunnels.

UNIT-II

Tunnelling Methods: Conventional and special Drill & blast roadway drivage machines, tunnel boring machines (TBM)

UNIT-III

Stresses and displacements associated with excavating tunnels, Ground control or treatment in tunneling and drivages. Design of Supports of Tunnels; Steel supports, rock enforcements, new Australian tunneling methods (NATM)

UNIT-IV

Design of Tunnels: Rock conditions, RMR, Q-system, RSR, rock mass behavior, stress strain behavior, and stress analysis of tunnels. Maintenance: Dewatering, ventilation and illumination drivages tunnels. Numerical techniques: Introductory use of FLAC, PLAXIS etc

Practical: As per theory

Text Books/References

1. Richards E. Bullock – Tunnelling and Underground Construction Techniques
2. Stack Barbara – Hand Book of Mining and Tunnelling Machinery, John Wiley & Sons.
3. R.V. Proctor – Rock Tunneling with Steel Supports
4. J. Johnsen – Modern Trends in Tunneling and Blast Design.

ME478(a) (OE) ENTREPRENEURSHIP AND INDUSTRIAL MANAGEMENT

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcomes:	**Upon completion of this course the students will be familiar with:**
CO1:	Selection and development of a small or medium business idea
CO2:	Make and Implement project proposals and reports to hunt for venture capital etc.

CO3	Market competition and innovation in products and processes.
CO4:	Develop managerial skills to achieve goals, & Plan and implement projects applying management techniques.
CO5:	Understand social responsibility as a modern management concept.

UNIT-1

Entrepreneurship: - Definition and Meaning; Characteristics of Entrepreneurship / Traits of an Entrepreneur; Functions of Entrepreneurship - Job Creation, Innovation, Inspiration, Economic Development; Types of Entrepreneurship, Entrepreneurship and Intrapreneurship, Entrepreneurship Strategy

The Business Plan: Creating and Starting the Venture: The Marketing Plan, The Financial Plan, Sources of Capital; Legal Issues for the Entrepreneur: Patents, Trademarks, Copyrights, Trade Secrets, Licensing, Product Safety and Liability, Insurance; Contracts, Advertising, Supply Chain Management, Retail & FDI

Proposals & risks: Project Report Preparation (Feasibility, Cost Estimation, CVP Analysis, Detailed Project Report, Concept of Risk and decision making, Risk Management-SWOT etc

UNIT-2

Entrepreneurship and Innovation: The Innovation Concept, Importance of Innovation for Entrepreneurship, Source of Innovation for Opportunities, The Innovation Process, Product life cycle, new product development process, mortality curve, Creativity and innovation in product modification/ development

Entrepreneurship and Economic Development: Role of Entrepreneurship in Modern Economy, Managers Vs Entrepreneurship**:** Characteristic of Managers, Characteristic of Entrepreneurs, Similarities and differences between Managers and Entrepreneurs

UNIT-3

Industry, Commerce and Business: Types of ownership in the organization- Definition, characteristics, Merits & Demerits; Single ownership, Partnership, Cooperative Organizations, Joint Stock Companies, Government owned, Differences between Management and Administration, Leadership Models.

Industry Size & Current schemes: Micro, Small, Medium- Industry; Registration Process, Current Promotional Schemes for new Enterprise

UNIT-4

Function of Management: Planning- Types of Planning - Strategic Plan, Tactical Plan and Operation Plan; Organizing- Definition and Meaning, Types of Organizing; Staffing- Definition and Meaning, Types of Staffing – Internal & External, The Basic Steps in the Staffing Process; Directing (Leading)- Definition and Meaning; Controlling- Definition and Meaning, Relationship between Planning and Controlling.

Social Responsibility: Social Obligation, Social Responsiveness and Social Responsibility, Managerial Ethics

Practical: As per theory

Text Books/References

1. Entrepreneurship Development and Management, A. K. Singh, Jain Book Agency (JBA) publishes, New Delhi
2. Small Scale Industries and Entrepreneurship, Vasant Desai, Himalaya 2008
3. Industrial Engineering and Management, O.P.Khanna, Dhanpat Rai and Sons, Delhi
4. Industrial Management and Entrepreneurship, V. K. Sharma, Scientific Publishers, New Delhi.
5. Entrepreneurship, Roy Rajeev, Oxford Latest Edition.

ME478(b) (OE) BIO-ENERGY SYSTEMS DESIGN

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcomes:	**Upon completion of this course the students will be familiar with:**
CO1:	Classifybioenergy fuels and their conversion technologies.
CO2:	Describe the knowledge for operation of biomass gasifier, biomass pyrolysis and biogas plant.

CO3	Design system for biomass gasification, pyrolysis and biogas production.
CO4:	Demonstrateproduction of biodiesel and bioethanol, and their application power generation and transportation.
CO5:	Demonstrate socio-economic aspects and cost-economics analysis of biomass conversion technologies.

Unit – 1

Introduction: Introduction to bio-energy from, classification of biomass as fuel – Agro based, Forest, residue. Bio-energy systems/Conversion devices – Incinerators, gasifiers, digestors.Design objectives for sustainable bio-energy systems.Bio-mass bricketing machine.

Biomass conversion processes, Thermo chemical conversion, Direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion.

Unit – 2

Bio-mass Combustion: Basics of combustion, Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit – 3

Bio-mass Gasification: Working principle, Gasifiers – Fixed bed system – Downdraft and updraft gasifiers,Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Bio-mass Pyrolysis: Pyrolysis – types, slow, fast; Manufacture of charcoal: methods -yields and application; Manufacture of pyrolytic oils and gases, yields and applications.

Unit – 4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status, Design and constructional features; Biomass resources and their classification for biogas.

Review of mechanical Design: Materials of Construction, corrosion damage, testing and inspection.

System modelling: Basics and its mathematical model, Use of Software in system design. Economicsanalysis of bio-energy systems.

Practical: As per theory

Text books/ References:

1. PrabirBasu, Biomass Gasification, Pyrolysis and Torrefaction: Practical Design and Theory, Academic Press, Elsevier, 2018.
2. John Rezaiyan, Nicholas P. Cheremisinoff, Gasification Technologies, Taylor & Francis, 2005.
3. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
4. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
5. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
6. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

ME478(c) (OE) ENERGY CONSERVATION AND MANAGEMENT

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcomes:	**Upon completion of this course the students will be familiar with:**
CO1:	To understand the basic knowledge ofdifferent terms & principles of energyconservation,audit and management
CO2:	To understand efficient heat utilization, saving andrecovery in different thermal system
CO3	To prepare energy audit report fordifferent energy conservation instances
CO4:	To Evaluate the energy saving &conservation in different mechanical utilities

Unit - 1

Energy Scenario: Commercial and Non-Commercial Energy, Primary Energy Resources, Commercial Energy Production, Final Energy Consumption, Energy Needs of Growing Economy, Long Term Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy and Environment: Air Pollution, Climate Change, Energy Security, Energy Conservation and its Importance, Energy Strategy for the Future, Energy Conservation Act-2001 and its Features.

Unit - 2

Energy Management & Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques- Simple pay back period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracts and role of ESCOs.

Unit - 3

Energy Monitoring and Targeting: Defining monitoring & targeting, Elements of monitoring & targeting, Data and information-analysis, Techniques -energy consumption, Production, Cumulative sum of differences (CUSUM).

Global Environmental Concerns: United Nations Framework Convention on Climate Change (UNFCC), Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon Fund (PCF), Sustainable Development.

Unit - 4

Energy Efficiency in Thermal Utilities and systems: Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas, Boilers: Types, combustion in boilers, performances evaluation, analysis of losses, Condensate and flash steam recovery system, identifying opportunities for energy savings, Cupola, non-ferrous melting, Induction furnace, performance evaluation of a furnace, hot air generators, Feed water treatment, blow down, energy conservation opportunities, Furnaces: Classification, general fuel economy measures in furnaces, excess air, heat distribution, Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation, Steam System: Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, Steam utilization, Performance assessment more details, installation, Temperature control, draft control, waste heat recovery. Forging furnace heat balance, Thermic fluid heaters, super critical boilers, Thermo-compressor, steam pipe insulation, condensate pumping, steam dryers

Cogeneration: Definition, need, application, advantages, classification, saving potentials. Heat balance, steam turbine efficiency, tri-generation, micro turbine. Heat Exchangers: Types, networking, pinch analysis, multiple effect evaporators, condensers, distillation column, etc. Waste Heat Recovery: Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential. Insulation and Refractories: Insulation-types and application, economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractories, heat loss. Cold insulation. Heating, ventilation, air conditioning (HVAC) and Refrigeration System: Factors affecting Refrigeration and Air conditioning system performance and savings Opportunities. Vapor absorption refrigeration system: Working principle, types and comparison with vapor compression system and saving potential, heat pumps and their applications, section on ventilation system, ice bank system, and performance assessment of window and split room air conditioners, Star labeled pumps, cold storage refrigeration, and humidification system.

Practical: As per theory

Text Books/References:

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press
3. Bureau of Energy Efficiency Reference book: No.1, 2, 3 4
4. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience publication
5. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation dited byE J Wilson and D Gerard, Blackwell Publishing
6. Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill Publication, 1994

EC 478(a) (OE) INTELLECTUAL PROPERTY RIGHTS

Cr. Hrs. 3(3+0+ 0)

L T P

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcomes:

The student will be able to

CO1: Understand the concept of Intellectual Property Rights and Patents.

CO2: Understand the concept of Trademark and its related Statutory authorities.

CO3: Apprehend the idea of Copyright and registerability of a design.

CO4: Understand International IPR, Case laws and World intellectual property organization.

UNIT-I

Introduction: Concept of IPR, Historical development , kinds of IPR, brief description of patent, trademark, copyright ,industrial design, importance of IPR, IPR authorities.

PATENTS :Introduction, Indian Patent Act 1970 &2002, Protectable subject matter--patentable invention, Procedure for obtaining patent, Provisional and complete specification Rights conferred on a patentee, transfer of patent, Revocation and surrender of patents, Infringement of patents, Action for infringement, Patent agents, Patent in computer programs.

UNIT-II

Trademark: Introduction, Statutory authorities, principles of registration of trademarks, rights conferred by registration of trademarks, Infringement of trademarks and action against infringement, procedure of registration and duration, licensing in trademark.

UNIT-III

Copyright: Introduction, Author and ownership of copyright, rights conferred by copyright ,term of copyright, assignment/licence of copyright, Infringement of copyright ,remedies against infringement of copyright, registration of copyright, copyright enforcement and societies

Industrial design: The design act-2000, registerability of a design, procedure of registration of a design, piracy of a registered design, Case law on designs.

UNIT-IV

International IPR & case laws: World intellectual property organization, WCT, WPPT, TRIPS, Copyright societies, international IPR dispute resolution mechanism. Case laws.

Text Books/References

1. Law Relating to Intellectual property, fourth edition by B.L.Wadehra .Universal law publishing co. pvt. Ltd, 2007.
2. Intellectual property: Patents, copyright, trademarks and allied rights. Fifth edition by W.R. Cornish. Sweet & Maxwell publisher, 2003
3. Law and practice of intellectual property in India by VikasVashishth, 2006
4. Patents ,copyrights, trademarks and design by B L Wadhera, 2014
5. Dr. B. L. Wadhera, "Intellectual Property Law Handbook". Universal Law Publishing2002.

EC 478 (b) (OE) E-COMMERCE

Cr. Hrs. 3(3+0+ 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcomes:

The student will be able to

CO1: Understand the concept of Electronic Commerce and its need.

CO2: Understand the idea of Network Infrastructure for E- Commerce.

CO3: Apprehend the notion of security issues on web and importance of Firewall.

CO4: Understand Electronic Payments, SET protocol and E- Commerce Law.

UNIT-I

Introduction: Definition of Electronic Commerce, E-Commerce: technology and prospects, incentives for engaging in electronic commerce, needs of E-Commerce, advantages and disadvantages, framework, Impact of E-commerce on business, E-Commerce Models

UNIT-II

Network Infrastructure for E- Commerce: Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, and FRAME RELAY). Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile Information device.

UNIT-III

Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.

UNIT-IV

Electronic Payments: Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda

Text Books/References

1 Goel, Ritendra "E-commerce", New Age International,2007
2 Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison- Wesley. 1996
3 Vinod Kumar Garg and Venkita krishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI 2004

EE 478(a) (OE) Knowledge Based System

Cr. Hrs. 3 (3+0 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

COURSE OUTCOME –

CO1: Know-how of Artificial neural networks.
CO2: Proficiency in learning techniques of artificial neural networks.
CO3: Know-how of fuzzy control techniques.
CO4: Capability to Adaptive Fuzzy control design.

UNIT I

Artificial Neural Networks: Neural Networks- an overview, Introduction to Artificial Neural Networks (ANN), Historical Development of Neural Networks, Biological Neural Networks, Comparison Between Artificial and Biological Neural Network. Basic Building Blocks of ANN: Network Architecture, , Activation Function,

UNIT II

Fundamental Models of Artificial Neural Networks: Introduction, McCulloch-Pitts Neuron Model. Learning Rules: Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule (Widrow-Hoff Rule or Least Mean Square (LMS) Rule), Back Propagation Rule

UNIT III

Fuzzy Logic: Fuzzy logic concepts and application areas, classical and fuzzy Sets, fuzzy relation and membership functions, fuzzification and defuzzification methods, fuzzy rule base system.

UNIT IV

Neural Network and Fuzzy Logic application in load forecasting, fault detection, economic load dispatch, voltage and reactive power control, load flow and electric drive control.

Text Books/References :

1. S N Sivanandanm, S Sumathi and S N Deepa. Introduction to Neural Networks Using MATLAB- Tata McGraw- Hill Publishing Company Limited.
2. J.M. Zurada. Introduction of artificial neural systems - Jaico Publication House.
3. D. Driankov, H. Hellendoorn and M Rein frank. An introduction to fuzzy control - Narosa Publication House, 2nd reprint.

EE 478 (b) (OE) Advanced Power Converters

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

COURSE OUTCOME –

CO1: Competency in Single-Switch Isolated Converters design**.**

CO2: Proficiency in Dynamic Analysis of DC-DC Converters

CO3: Know-how of resonant converter.

CO4: Know-how of Multilevel Converters**.**

UNIT I

Single-Switch Isolated Converters: Requirement for isolation in the switch-mode converters, Forward and flyback converters, Push-Pull Converters Power circuit and steady-state analysis,.

UNIT II

Dynamic Analysis of DC-DC Converters: Formulation of dynamic equation of buck and boost converters, averaged circuit models, linearization technique, small-signal model and converter transfer functions.

UNIT III

Resonant Converters: Classification of Resonant converters-Basic resonant circuits- Series resonant circuit-parallel resonant circuits- Resonant switches. Concept of Zero voltage switching.

UNIT IV

Multilevel Converters: Basic concept, classifications, working principle, applications.

Text Books/References:

1. Switched Mode Power Conversion, Course Notes, CCE, IISc, 2004.
2. Issa Batarseh, 'Power Electronic Circuits', John Wiley, 2004.
3. Philip T Krein,' Elements of Power Electronics ',Oxford Press.
4. Fundamentals of Power Electronics – Robert Erickson and Dragon Maksivimovic,
5. Springer Publications. Power Electronics–IssaBatarseh- John Wiely
6. Elements of Power Electronics - Philip T.Krein – Oxford University Press

EE 478(c) (OE) Power Electronics in Renewable Energy Systems

Cr. Hrs. 3 (3+0 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

COURSE OUTCOME –

CO1: Learning of Basics Renewable Energy Systems.

CO2: Proficiency in Dynamic modelling of Power Electronics converter.

CO3: Know-how of power electronics in Wind Power Plants.

CO4: Know-how of power electronics in Solar PV.

UNIT I

Basics Renewable Energy Systems : Modern power electronics technology for the integration of renewable energy sources. challenges for grid integration,energy needs of India and energy consumption patterns, worldwide potentials of these sources.

UNIT II

P**ower electronics converters**: various topologies of power electronics converters (PECs), power electronics converters (PEC) classifications, Dynamic modelling of Power Electronics converter

UNIT IIl

Power electronics in Wind Power Plants: Grid interconnection requirements for wind farms, integration issues, operational issues, grid integration issues in India, wind power integration standards, super grid strategy, Applications of PEC in wind power plants, Modern PEC in wind power plants.

UNIT IV

Solar Photo Voltaic (PV) Technology: Solar cell characteristics, parameters of solar cell and its equivalent circuit, PV Module and arrays, perturb and observe maximum power point tracking (MPPT) technique, components of PV system, design of a standalone PV system. solar constant, solar radiation at the earth's surface, solar radiation geometry, solar radiation measurements, estimation of average solar radiation. Solar Thermal Systems: Types of collectors, collection systems and efficiency.

Text Books/References:

1. Wind power plants and projects developments, Joshua Earnest and T Wizelius, PHI, New Delhi, 2011.

2. Handbook of renewable energy technology, World Scientific, Siongapore, 2011.

REE 478(OE); RENEWABLE ENERGY TECHNOLOGIES

Cr. Hrs. 3 (2+0 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:
This course is undertaken to introduce basic aspects of renewable energy supply presenting fundamental characteristics of the resource base (solar, wind energy, bio energy, etc.) and principles of related technical systems (photovoltaic, wind, biomass power generation, etc.). In a further step an economic analysis of supply technologies will be undertaken. Students will learn to acquire a basic understanding of issues related to renewable energy supply systems.

UNIT 1

Conventional and Alternative Energy Sources: Effect on environment of fossilfuels, nuclear energy and hydroelectric power. Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization.

UNIT 2

Solar Energy: Solar thermal and Photovoltaic System for power generation. Flat platecollectors & Focusingcollectors. Solar water and air heaters, solar distillation, solar cooker, drying of materials, application in industries.

UNIT 3

Wind Energy: Nature and potential, wind mill types, their merits and demerit. Wind farms. Brief description of geothermal energy, ocean thermal energy, tidal and wave energy.

UNIT 4

Biomass: Nature and potential, different bio conversion techniques, biogas, biodiesel. Power generation from biomass (gasification &dendro thermal) and fuel cell technology.

Practical

1. To study solar drying system.
2. To study solar water heating system.
3. To study box type solar cooker.
4. To study solar distillation system.
5. To study different biogas plants.
6. To study wind energy conversion systems.
7. To study downdraft biomass gasifier for thermal application.

Suggested Readings

1. G.D. Rai. Non Conventional Energy Sources, 2013, Khanna Publishers.
2. Twidell, J., & Weir, T. (2015). *Renewable energy resources*. Routledge.
3. Basu, Prabir. *Biomass gasification and pyrolysis: practical design and theory*. Academic press, 2010.
4. Rathore N. S., Kurchania A. K., Panwar N. L.;Non Conventional Energy Sources, Himanshu Publications, 2000.

Department of Soil and Water Engineering

SWE478(OE) AERIAL PHOTOGRAPHY, RS and GIS

Cr. Hrs. 3 (2 +0+ 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:
Familiarize with aerial photographs and its interpretation. Developing skill of use of various hardware and software in use of satellite data, GPS technology. Development of resource mapping and planning studies using RS and GIS.

UNIT I

Aerial photography- aerial photograph, their classification, map v/s aerial photograph, photogrammetry and its application. Elements of aerial photo interpretation, aerial photo interpretation and its use.

UNIT II

Remote sensing- definition, electromagnetic radiations,Interactions with the Atmosphere,Passive v/s Active Sensing, Characteristics of Images, Satellite and Sensors-Satellite Characteristics, Resolution, Multi-spectral Scanning, Thermal Imaging, Satellite missions, microwave sensing, Image Analysis- Visual interpretation, Digital image processing, image, Enhancement and Classification

UNIT III

GIS- definition, basic components, data types- spatial, non- spatial, GIS data modeling, vector and raster representation, GIS data base management, GIS data file management

UNIT IV

GIS data input and editing- data input methods, scanning, digitization, GPS data, data editing, errors and data reduction, Data analysis- format conversion, spatial measurement, overlay analysis and data output

Practical

1. Study of aerial photographs under mirror stereoscope.
2. Preparation of stereo model of aerial photograph.
3. Land use/cover studies through aerial photograph.
4. Use of optical scanners and digitizers. U
5. Use of GPS in mapping and GIS data input, satellite data product.
6. Familiarization with image processing and GIS software's and their applications.

Suggested Readings

1. K.K. Rampal. (1999) Hand Book of Aerial Photography and Interpretation, Concept Publishing Company, New Delhi
2. M. A. Reddy (2002) Remote Sensing and Geographical Information Systems, B.S. Publications, Hyderabad
3. Lillisand and Kiefer (1987) Remote sensing and Image Interpretation, John Weiley and sons

Department of Farm Machinery and Power Engineering

FMP 478(OE):MACHINERY FOR LAND DEVELOPMENT

Cr. Hrs. 3 (2 +0 + 1)			
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will have the knowledge of different earth moving machineries used for land development operation.

Unit-I

Land leveling-Criteria for land leveling, plane profile and inspection, engineering fundamentals related to earth-moving machinery.

Unit-II

Earth moving and excavation machines classification and application of bulldozers, advantage and disadvantage, straight and angle bulldozers, moving earth with bulldozers and estimation of output of a bulldozer numerical problems. Land clearing equipments, Power shovel: Construction and operation of power shovel size selection of power shovel factors affecting the output of a power shovel.

Unit-III

Scraper: Types, construction and operation of scrapers, size of the scraper, cycle time production rates of scrapers, numerical problems, load-growth curve and estimation of output of a scraper.

Dragline: Types of dragline, size basic parts and operation of a dragline, output of a dragline, estimation of output, effect of different factors on output, numerical problems.

Clam shell: Basic parts and operation of a clam shell, application, size and output of a clam shell.

Motor grader: Construction and operation of motor grader, application, basic adjustment parameters of major grader, output of motor grader,

Unit-IV

Trenching machines: types, construction and operation of wheel and ladder type trenching machines, selection of suitable equipment for excavating trenches and production rates of trenching machines.

Practical

1. Study of various components of bulldozers
2. Study of various components of Scraper:
3. Study of various components of Dragline
4. Study of various components of Clam shell
5. Study of various components of Scraper: Motor grader
6, Study of various components of Scraper: Trenching machines

Suggested Readings

1. R.L. Peurifoy. Construction, Planning, Equipment and Methods.
2. Mahesh Verma. Construction equipment and its planning and application.
3. Jagman Singh. Heavy construction, planning, equipment and methods.
4. A.M. Michael. Irrigation theory and practices.

Department of Processing and Food Engineering

PFE 478(OE):PACKAGING MATERIALS AND METHODS

Cr. Hrs. 3 (2 +0+ 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will be able to acquaint with various packaging materials, various aspects of packaging methods and technology.

Unit-I

Factors affecting package material, Packaging, requirement, importance and scope, frame work of packaging strategy, environmental considerations, Packaging systems, types: flexible and rigid; retail and bulk; levels of packaging.

Unit-II

Different types of packaging materials, their key properties and applications, metal cans, plastic packaging, different types of polymers used in packaging and their barrier properties. Manufacture of plastic packaging materials; glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, modification of barrier properties and characteristics of paper/ boards.

Unit-III

Labeling on packages, shrink and cling packaging, vacuum and gas packaging; active packaging, factors affecting the choice of packaging materials, disposal and recycle of packaging waste, printing and labeling; lamination.

Unit-IV

Package testing, testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper, glass containers, metal containers.

Practical

1. Identification of different types of packaging materials.
2. Determination of tensile / compressive strength of given material/package.
3. Vacuum packaging of agricultural produces.
4. Determination of tearing strength of paper board.
5. Measurement of thickness of packaging materials.
6. To perform grease-resistance test in plastic pouches.
7. Determination of bursting strength of packaging material.
8. Determination of water-vapour transmission rate.
9. Shrink wrapping of various horticultural produce.
10. Testing of chemical resistance of packaging materials.
11. Determination of drop test of food package and visit to relevant industries.

Suggested Readings

1. Coles R., McDowell D. and Kirwan, M.J. 2003. Food Packaging Technology, Blackwell Publishing Co.
2. Gosby, N.T. 2001. Food Packaging Materials, Applied Science Publication
3. John, P.J. 2008. A Handbook on Food Packaging, Narendra Publishing House,
4. Mahadevia, M., Gowramma, R.V. 2007. Food Packaging Materials, Tata McGraw Hill
5. Robertson, G. L. 2001. Food Packaging and Shelf life: A Practical Guide,Narendra Publishing House.
6. Robertson, G. L. 2005. Food Packaging: Principles and Practice, Second Edition, Taylor and Francis Pub.