B.V.V.Sangha's

Basaveshwar Engineering College

Bagalkote– 587103

Bachelor of Engineering

Scheme of Teaching and Examination For

2022–23 Admitted Batch

Department of Civil Engineering

Abbreviations used in the scheme.

Abbreviations used	Full form
BSC	Basic Science Course
PCC	Professional Core Course
IPCC	Integrated Professional Core Course
AEC	Ability Enhancement Course
PEC	Professional Elective Course
OES	Open Elective Course
HSMC	Humanity Science Management Course
INT	Internship
MC	Mandatory Course
PE	Physical Education
NSS	National Service Scheme
UHV	Universal Human Values

Basaveshwar Engineering College, Bagalkote

B.E–2nd Year Scheme of Teaching and Examinations

(2022-23 Admitted Batch)

III- Semester **Branch: Civil Engineering**

Sl. No.	Course			Teaching Department	Teaching hours and Scheme of Evaluation						
	Category	Code	Title		Lecture	Tutorial	Practical/ Drawing	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P				
1	**BSC**	22UMA302C	Complex Analysis and Integral Transforms	Mathematics	3	0	0	50	50	100	3
2	PCC	22UCV304C	Mechanics of Materials	Civil Engineering	3	0	0	50	50	100	3
3	PCC	22UCV305C	Fluid Mechanics & Hydraulics	Civil Engineering	3	0	0	50	50	100	3
4	PCC	22UCV306C	ConcreteTechnology	Civil Engineering	3	0	0	50	50	100	3
5	PCC	22UCV307C	Building Materials and ConstructionTechnology	Civil Engineering	2	0	0	50	50	100	2
6	PCC	22UCV308C	Engineering Geology	Civil Engineering	1	0	2	50	50	100	2
7	**AEC**	22UCV309C	Building Planning and drawing using Auto Cad	Civil Engineering	2	0	2	50	50	100	3
8	PCC	22UCV310L	Basic materials and concrete testing lab	Civil Engineering	0	0	2	50	50	100	1
9	BSC	22UMA300M	Bridge Course Mathematics-I	Mathematics	3	0	0	50	50	100	0
10	MC	22UHS001M/ 22UHS002M 22UHS003M	NSS/Yoga/PE	Humanities	-	-	-				0
					20	**0**	**6**	**450**	**450**	**900**	**20**

Basaveshwar Engineering College, Bagalkote

B.E–2nd Year Scheme of Teaching and Examinations

(2022-23 Admitted Batch)

IV- Semester **Branch:Civil Engineering**

Sl. No.	Course			TeachingDepartment	Teaching hours and Scheme of Evaluation						
	Category	Code	Title		Lecture	Tutorial	Practical/ Drawing	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P				
1.	**BSC**	22UMA402C	Statistic and Calculus of Variation	Mathematics	3	0	0	50	50	100	3
2.	PCC	22UCV403C	Analysis of Statically Determinate Structures	Civil Engineering	3	0	0	50	50	100	3
3.	PCC	22UCV404C	Soil Mechanics	Civil Engineering	3	0	0	50	50	100	3
4.	PCC	22UCV405C	Transportation Engineering	Civil Engineering	4	0	0	50	50	100	4
5.	PCC	22UCV406C	Surveying	Civil Engineering	3	0	2	50	50	100	4
6.	PCC	22UCV407L	Fluid Mechanics Lab	Civil Engineering	0	0	2	50	50	100	1
7.	PCC	22UCV408L	Geotechnical Engineering lab	Civil Engineering	0	0	2	50	50	100	1
8.	**HSSM**	22UHS424C	UHV-II	Humanities/Civil Engg.	1	0	0	50	50	100	1
9	BSC	22UMA400C	Bridge Course Mathematics-I	Mathematics	3	0	0	50	50	100	0
10	MC	22UHS001M/ 22UHS002M 22UHS003M	NSS/Yoga/PE	Humanities	-	-	-				0
					20	**0**	**6**	**450**	**450**	**900**	**20**

Basaveshwar Engineering College, Bagalkote

B.E–3rd Year Scheme of Teaching and Examinations

V Semester (2022-23 Admitted Batch) **Branch: Civil Engineering**

Sl. No.	Course			Teaching Department	Teaching hours and Scheme of Evaluation						
	Category	Code	Title		Lecture	Tutorial	Practical/ Drawing	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P				
1.	PCC	22UCV501C	Water Treatment and Supply Engineering	Civil Engineering	3	0	0	50	50	100	3
2.	PCC	22UCV502C	Analysis of Statically Indeterminate Structures	Civil Engineering	3	0	0	50	50	100	3
3.	PCC	22UCV503C	Foundation Engineering	Civil Engineering	3	0	0	50	50	100	3
4.	PEC	22UCV5X4E	Professional Elective Course-I	Civil Engineering	3	0	0	50	50	100	3
5.	OEC	22UCV5X5N	Open Elective Course-I	RespectiveDepartment	3	0	0	50	50	100	3
6.	PCC	22UCV506L	Environmental Engineering Lab	Civil Engineering	0	0	2	50	50	100	1
7.	PCC	22UCV507L	Transportation Engineering Lab	Civil Engineering	0	0	2	50	50	100	1
8.	**HSSM**	22UBT523C	Environmental Studies	Biotechnology	1	0	0	50	50	100	1
9	AEC	22UHS521C	Quantitative Aptitude and Professional Skills	Humanities	2	0	0	50	50	100	2
10	MC	22UHS001M/ 22UHS002M 22UHS003M 22UHS004M	NSS/Yoga/PE/Music	Humanities	-	-	-				0
					18	**0**	**4**	**450**	**450**	**900**	**20**

Professional Elective Course -I					Open Elective- 1				
Code	Title	L	T	P	Code	Title	L	T	P
22UCV511E	Alternative Building Materials and Technologies	3	0	0	22UCVXXXN	Groundwater Hydrology	3	0	0
22UCV512E	Traffic Engineering	3	0	0	22UCVXXXN	Remote Sensing and GIS	3	0	0
22UCV513E	Air pollution and control	3	0	0	22UCVXXXN	Process Economics and Plant Design	3	0	0
22UCV514E	Ground Improvement Techniques	3	0	0	22UCVXXXN	Sustainable Development	3	0	0
22UCV515E	Advanced Surveying	3	0	0	22UCV531N	Air Pollution and Control	3	0	0
22UCV516E	Masonry Structures	3	0	0	22UCV536N	Green Building Technology	3	0	0

Basaveshwar Engineering College, Bagalkote

B.E–3rd Year Scheme of Teaching and Examinations

(2022-23 Admitted Batch)

VI Semester **Branch :Civil Engineering**

Sl. No.	Course			Teaching Department	Teaching hours and Scheme of Evaluation						
	Category	Code	Title		Lecture	Tutorial	Practical/ Drawing	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P				
1.	PCC	22UCV601C	Design of RC Structures	Civil Engineering	3	0	0	50	50	100	3
2.	PCC	22UCV602C	Water Resources Engineering	Civil Engineering	2	0	0	50	50	100	2
3.	PCC	22UCV603C	Estimation and Costing	Civil Engineering	3	0	0	50	50	100	3
4.	PCC	22UCV604C	Wastewater Engineering	Civil Engineering	2	0	0	50	50	100	2
5.	PEC	22UCV6X5E	Professional Elective Course-II	Civil Engineering	3	0	0	50	50	100	3
6.	OEC	22UCV6X6N	OpenElectiveCourse-II	Respective Department	3	0	0	50	50.	100	3
7.	PCC	22UCV607L	Software Application Lab	Civil Engineering	0	0	2	50	50	100	1
8.	Project	22UCV608P	Mini Project	Civil Engineering	0	0	4	50	50	100	2
9	HSS	22UHS600C	Indian Knowledge System	Humanities	1	0	0	50	50	100	1
10	MC	22UHS001M/ 22UHS002M 22UHS003M 22UHS004M	NSS/Yoga/PE/Music	Humanities	-	-	-				0
					18	**0**	**6**	**450**	**450**	**900**	**20**

ProfessionalElectiveCourse-II					OpenElective–II				
Code	Title	L	T	P	Code	Title	L	T	P
22UCV615E	Highway Geometric Design	3	0	0	22UCVXXXN	Energy efficient buildings	3	0	0
22UCV625E	Numerical Techniques in Civil Engg	3	0	0	22UCV637N	Disaster Management and Mitigation	**3**	**0**	**0**
22UCV635E	Geomorphology	3	0	0	22UCV633N	Public Health Engineering	3	0	0
22UCV624E	Advance Concrete Technology	3	0	0	22UCVXXXN	Occupational Health and Safety	3	0	0
22UCV625E	Irrigation Engineering	3	0	0					

Basaveshwar Engineering College, Bagalkote

B.E–4th Year Scheme of Teaching and Examinations

(2022-23Admitted Batch) (2025-26 Academic Year)

VII - Semester **Branch: Civil Engineering**

Sl. No.	Course			Teaching Department	Teaching hours and Scheme of Evaluation						
	Category	Code	Title		Lecture	Tutorial	Practical Drawing	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P				
1	PCC	22UCV701C	Design of Steel Structures	Civil Engineering	3	0	0	50	50	100	3
2.	PEC	22UCV71XE	Professional Elective Course - III	Civil Engineering	3	0	0	50	50	100	3
3.	PEC	22UCV72XE	Professional ElectiveCourse-IV	Civil Engineering	3	0	0	50	50	100	3
4.	Project	22UCV704P	Project Work	Civil Engineering	-	-	-	50	50	100	12
5.	AEC	22UHS711C	Research Methodology and IPR	Humanities	3	0	0	50	50	100	3
					12	**0**	**0**	**250**	**250**	**500**	**24**

Professional Elective Course -III					Professional Elective Course -IV				
Code	Title	L	T	P	Code	Title	L	T	P
22UCV711E	Advanced Design of RC Structures	3	0	0	22UCV721E	Design of Pre-stressed Concrete Structures	3	0	0
22UCV712E	Industrial Wastewater treatment	3	0	0	22UCV722E	Deep Foundations	3	0	0
22UCV713E	Soil Dynamics and Earthquake Engineering	3	0	0	22UCV723E	Solid Waste Management	3	0	0
22UCV714E	Railway and Airport Engineering	3	0	0	22UCV724E	Pavement Design	3	0	0
22UCV715E	Design of Irrigation Structures	3	0	0	22UCV725E	Matrix Methods of Structural Analysis	3	0	0

Basaveshwar Engineering College, Bagalkote

B.E–4thYear Scheme of Teaching and Examinations

(2022–23Admitted Batch) (2025-26 Academic Year)

VIII –Semester **Branch: Civil Engineering**

Sl. No.	Course			Teaching Department	Teaching hours and Scheme of Evaluation						
	Category	Code	Title		Lecture	Tutorial	Practical/ Drawing	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P				
1.	INT	22UCV801I	Research/Industrial Internship	NP	-	-	-	50	50	100	10
2.	AEC	22UCV802O	MOOCs*	NP	3	0	0	50	50	100	3
3.	OEC	22UCV803O	MOOCs*	NP	3	0	0	50	50	100	3
					6	**0**	**0**	**250**	**250**	**500**	**16**

22UCV701C	Design of Steel Structures	03-Credits (3:0:0)
Hrs/Week : 03		CIE Marks:50
Total Hours: 40		SEE Marks:50

UNIT - I — **10 Hrs**

Introduction: Advantages & Disadvantages of steel structures, Loads & Load combinations, Limit State method of design, section classification.

Plastic behavior of structural steel: Introduction, Plastic theory, plastic hinge concept, plastic collapse load, condition of plastic analysis, theorem of plastic collapse, methods of plastic analysis, plastic analysis of continuous beam.

UNIT – II — **10 Hrs**

Bolted Connections: Introduction, Behavior of bolted joints, design strength of ordinary black bolts, simple connections, moment resistant connections, beam to beam connections.

Welded Connections: Introduction, advantages of welding, types and properties of welds, types of joints, weld symbols, weld specifications, effective area of welds, design of fillet welds, moment resistant connections, continuous beam to beam connections.

UNIT - III — **10 Hrs**

Design of Compression members: Introduction, failure modes, Behavior of compression member, sections used for compression members, effective length, design of compression members, Columns including built up sections Laced and Battened systems, slab base connections.

UNIT - IV — **10 Hrs**

Design of Tension members: Introduction, Types of tension members, factors affecting the strength of tension member, design of tension member with bolted and welded connections.

Design of Flexural members

Introduction, beam types, section classification, design of laterally supported and unsupported beams.

Reference Books:

1. N. Subramanian, Design of Steel Structures, Oxford Publications, 2008
2. Ramachandra, Design of Steel Structures, Standard Book House, New Delhi, 2016.
3. Duggal, S. K, Design of Steel Structure, Tata McGraw Hill Publications, 2017.
4. Punmia, B. C, Comprehensive Design of Steel Structures, Laxmi Publications, 2015.
5. Karve, Design of Steel Structures (Limit State Method), Structures Publications, Pune.
6. Bhavikatti S.S, Design of Steel Structures (Limit State Method), I K International Publishing house Pvt. Ltd, 2012
7. Negi, Design of Steel Structures, Tata McGraw Hill Publications, New Delhi, 2nd Edition, 2017.

CODE BOOKS

IS-800-2007, Steel tables (to be supplied in examinations)

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any FOUR Full questions are to be answered choosing at least one from each unit.

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

1. Analyze types of loads and their combinations along with an approach to plastic analysis in designing the steel sections with limit state approach.
2. Demonstrate different types of bolts and welds with their connections.
3. Design the compression members along with different built up sections like lacings and battens.
4. Design tension members and flexural members their connections.

CO MAPPING WITH PO'S AND PSO'S

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11		PSO 1	PSO 2	PSO 3
CO 1	3	3	3	--	--	2	--	3	--	--	--		--	2	--
CO 2	3	3	3	--	--	2	--	3	--	--	--		--	2	--
CO 3	3	3	3	--	--	2	--	3	--	--	--		--	2	--
CO4	3	3	3	--	--	2	--	3	--	--	--		--	2	--
AVG.	3	3	3	--	--	2	--	3	--	--	--		--	2	--

22UCV704P	Project Work	Credits: 12
L:T:P		CIEMarks:50
Total Hours/Week:		SEEMarks:50

Project Work

1) CIE- 50 Marks

CIE Marks to be awarded by Project Coordinator/ Faculty In-charge Departmental Committee (DC) will conduct the CIE examination.

2) SEE – 50 Marks

SEE Marks to be awarded by PEC members Project Evaluation Committee (PEC) will conduct the SEE examination.

3) Consolidated marks will be signed by Projector Coordinator and HOD

DC MEMBERS:

i) HOD or his Nominee

ii) Project Coordinator

PEC MEMBERS:

i) Internal Examiner

ii) External Examiner

iii) HOD/ Nominee

Subject Code: 22UCV711E	Advanced Design of RC Structures	Credits:03
L: T:P-3:0:0		CIE Marks:50
Total Hours/Week:3		SEE Marks:50

UNIT-I	10Hrs

Design of combined footing:

a) Slab and Beam type - Equal loading.
b) Slab and Beam type - Unequal loading

UNIT–II	10Hrs.

Design of Retaining Wall (RW):

a) Cantilever Retaining Wall
b) Counter fort Retaining Wall.

UNIT–III	10Hrs.

Portal Frames:(Single Bay and Single Storey)

a) Fixed Base
b) Hinge Base

UNIT–IV	10Hrs.

Design of Water Tanks:(Resting on Ground)

a) Circular tanks (Flexible Base)
b) Rectangular tanks

Reference Books*

1. Unnikrishnan and Devadas Menon, Design of reinforced concrete structures, PHI, New Delhi. 2013.
2. Karve S.R. and Shah V.L, Limit state theory and design of reinforced concrete, Vidyarthi prakashan, Pune. 2017.
3. A.K.Jain,Limit state method of design,Nemchand and Bros,Roorisee.Jan2012.
4. Parkand Paulay,Reinforced Concrete,John Wiley & Sons.1975.
5. Kongand Evans.Reinforced and prestressed concrete,ELBS,London
6. H.J.Shah,Reinforced concrete Vol.I,Charotor Publishing House,Anand.Jan2016.
7. IS: 456-2000, SP-24, SP-16. IS: 3370 Part I, II III and IV
(Note: Use of IS:456-2000 is permitted and SP-16 to be used in design of columns only)

Course Outcomes

After completion of the course students will be able to:

1. Students will analyze and design the combined footing.

2. Students will understand the design and solving technique of retaining walls.
3. Students will analyze and design the portal frames.
4. Students will design water tanks.

Course Articulation Matrix (CAM)

Sl. No.	Course Outcomes (CO's)	Program outcomes (PO's)											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	1	2	3
01	CO1	3	1	2	1	1	3	3	1	-	-	1	2	3	1
02	CO2	3	2	2	2	2	2	3	2	1	-	2	3	2	2
03	CO3	3	1	2	2	-	3	3	2	3	3	3	1	2	2
04	CO4	3	3	3	1	1	3	3	2	2	1	3	2	1	1

22UCV712E	Industrial Wastewater Treatment	Credits: 03
L:T:P – 3:0:0		CIE Marks:50
Total Hours/Week:03		SEE Marks:50

UNIT-I	10 Hrs.
Effects of industrial waste water on receiving water bodies, Effect of organic wastes on the DO profile of the stream, Streeter Phelps model, oxygen sag curve and numerical there upon. Receiving water quality protection measures – receiving water quality standards and stream quality control, Sample-Grab, composite and integrated samples, stream sampling. Economics of industrial waste water treatment systems primary/secondary benefits, intangible benefits, Quantification of benefits, Relationship of treatment cost to benefits.	
UNIT–II	**10 Hrs.**
Waste minimizing techniques– Volume reduction, Strength reduction, Neutralization, Equalization and Proportioning, Removal of suspended, colloidal, inorganic and organic dissolved solids. Treatment and disposal of sludge solids, Sludge characteristics, Sludge volume and solids content relationship	
UNIT–III	**10 Hrs.**
Manufacturing process, waste water characteristics, treatment and disposal of waste water of following industries: Dairy, Distillery, Sugar, Textile, Paper and pulp, Pharmaceutical, Fertilizer.	
UNIT–IV	**10 Hrs.**
Effects of industrial waste water on sewage treatment plants, Limiting values for discharge into municipal sewer systems, Joint treatment of industrial and domestic waste water, Membrane filter, electro dialysis and bioremediation techniques of waste water treatment. Radioactive waste treatment, Environmental auditing, Regulatory norms for waste water treatment, present scenario of waste water treatment in India	

Reference Books *

1. Nemerow N. N., Liquid waste of industry theories, practices and treatment, Addison Willey, New York, 1971.
2. Azad N. S., Industrial waste water management handbook, Mc Graw Hill book, co. New York.
3. Ross R. D., Industrial waste disposal, Reinhold environmental series, New York, 1968
4. Eckenfelder, W.W., “Industrial Water Pollution Control”, McGraw-Hill, 1999.

Course Outcomes**

Students will be able to

1. Assess the impact of industrial waste discharges on the water quality of stream and take the necessary measures to protect the water quality.
2. Analyze the economics of industrial wastewater treatment vis -a- vis water quality of the stream for its best designated uses.
3. Implement the modern technical tools like waste minimization, strength reduction etc, in efficient and cost-effective practice.
4. Demonstrate the understanding of green environment and practicing the environmentally friendly processes for the manufacture of various industrial products and also implementing the state-of-art technologies for wastewater treatment.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	2	2	-	-	-	-	-	**1**	**2**	**2**	
CO2	3	2	3	-	2	1	-	-	-	-	-	**1**	**2**	**2**	
CO3	3	2	3	-	3	-	-	-	1	-	-	**1**	**2**	**2**	
CO4	2	1	1	-	2	1	-	-	1	-	-	1	**2**	**2**	

22UCV713E	Soil Dynamics and Earthquake Engineering	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	10 Hrs.
Historical development of soil dynamics and its importance. Effects of vibrations on foundations. Types of dynamic loads encountered in civil engineering. Occurrence of earthquakes, Types of seismic waves & their properties, and their uses in subsoil exploration. Propagation of wave in elastic medium. Problems on computation of wave velocities. Location of epicentre, Magnitude of earthquake.	
UNIT–II	**10 Hrs.**
Vibration Theory: Degrees of freedom; Vibration of Single degree of freedom systems, Undamped and damped free and forced vibrations; Natural frequency and resonance & its effects.	
UNIT–III	**10 Hrs.**
Liquefaction of soils: Occurrence of liquefaction and its significance in geotechnical engineering; factors affecting liquefaction; liquefaction analysis; measures for reducing the damage to structures due to liquefaction	
UNIT–IV	**10 Hrs.**
Vibration Isolation: Introduction, Active and Passive Isolation and methods of vibration isolation. **Dynamic Soil Properties:** Laboratory methods and field testing techniques.	

Reference Books *

1. Das B. M. and Ramana G. V. (2011) "Principles of Soil Dynamics", 2nd Edition, CENGAGE Learning, USA.
2. Day R. W. (2002) "Geotechnical Earthquake Engineering Handbook". McGraw Hill, NewYork.
3. Kameshwar Rao, (1998) "Vibration Analysis and Foundation Dynamics", Wheeler Publishing.
4. Kramer S. L. (1996) "Geotechnical Earthquake Engineering", Prentice Hall International Series.
5. Prakash S. (1981) "Soil Dynamics", McGraw Hill Book Co., New York.
6. Okamoto, S.(1973), "Introduction to Earthquake Engineering", John Wiley & Sons, New York.
7. Richarts F. E., Hall Jr. J. R. and Woods R. D. (1970) "Vibrations of Soils and Foundations", Prentice Hall International Series.
8. Barkan D. D. (1962) "Dynamics of Bases and Foundations", McGraw Hill Book Co., New York.

Course Outcomes**

After completion of the course student will be able to

1. Acquire basic knowledge of soil dynamics and earthquake engineering.
2. Apply theory of vibrations to solve dynamic soil problems.
3. Analyse the potential of soil for liquefaction and apply mitigation techniques against it.
4. Analyse vibration isolation and apply mitigation techniques against them. Calculate the dynamic properties of soils using laboratory and field tests.

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	2	-	-	-	-	-	-	3	-	3	-
CO2	3	3	3	2	-	-	-	-	-	-	2	-	3	-
CO3	3	3	3	2	-	-	-	-	-	-	2	-	3	-
CO4	3	1	3	2	-	-	-	-	-	-	2	-	3	-

22UCV714E	**Railway and Airport Engineering**	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10 Hrs.**
Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way, - Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings (Explanation & Sketches of Right- and Left-hand turnouts only).	
UNIT–II	**10 Hrs.**
Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.	
UNIT–III	**10 Hrs.**
Airport Planning: Air transport characteristics, airport classification, airport planning: objectives, c o m p o n e n t s , layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.	
UNIT–IV	**10 Hrs.**
Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.	

Reference Books *

1. Y.H. Huang, Pavement Analysis and Design, Prentice Hall, New Jersey, 2003.
2. R. Horonjeff and F.X. Mckelvey, Planning andDesign of Airports, McGraw Hill, New York, 1994. **3**. S.C. Sexena and S.P. Arora, A Text Book of Railway Engineering, Dhanpat Rai & Sons, New Delhi, 1998.
4. W.W. Hay, Railroad Engineering, Wiley, New York, 1988.

Course Outcomes**

After completion of the course student will be able to

1 . Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbour, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunnelling activities.

***Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	1			**2**		2					**1**	**1**		
CO2		1											**1**	
CO3	1		1											**1**
CO4		1		**2**		2		**1**					**1**	

22UCV715E	Deign of Irrigation Structures	Credits:3
L:T:P-3: 0: 0		CIEMarks:50
Total Hours/Week:4		SEEMarks:50

UNIT-I	10Hrs.

Irrigation engineering: Necessity, benefits and ill effects of irrigation, Types of Irrigation, Techniques of water distribution in the farm, quality of irrigation water, Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor.

Water requirement of crops: consumptive use, duty, delta and base period, and problems, factors affecting and methods to improve duty,

UNIT-II	10Hrs.

Canals: Classifications, Regime theory, Design of canals cross sections by Lacey's Method, canal gradient considerations, design of canal gradient, Design of lined canal by Chezy method, most economical canal cross sections with design considerations,

UNIT–III	10Hrs.

Cross Drainage Works; Design of Aqueduct, super pass, flumes by Mitra and Chaturvedi method, RCC SLAB CULVERT with deck slab, Design of wier,

UNIT-IV	10Hrs.

Reservoirs: Investigation for reservoir site, storage zones, determination of storage Economical height of dam by area elevation curve (Graphical method)

Gravity dams: Forces acting on gravity dam, Profile of gravity dam, Analytical method of Stability analysis and problems, Drainage gallery. Design of gravity dam

Earthen dams: Types, Construction, Causes of failure of earthen dams, Seepage control measures, design of earthen dam, Pheratic line and filter bed considerations in the design, stability analysis of earthen dam cross section.
Spillways: Different types of spill ways

After completion of the course student will be able to

1. After completion of this course students will be able to:
2. Understand components of hydrological cycle, measure and quantify precipitation, evaporation and infiltration.
3. Estimate runoff and generate hydrographs.
4. To be able to compute duty, delta and frequency of irrigation, and design canal cross sections.
5. Determine storage capacity of reservoirs & understand basics of gravity and earthen dams & spillways.

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Reference Books *

1. s.k.Garg , " Irrigation Engineering and Hydraulic Structures", , Laxmi Publications, New Delhi, 2005.

2. H. M. Raghunath, Hydrology, New age international publishers, 2006.

3. G. L. Asawa, Irrigation Engineering, New Age international publications, 2005.

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	2	2	2	1	-	-	-	-	-	-	2	2	2
CO 2	3	3	2	2	2	2	-	-	-	-	-	-	2	2	2
CO 3	3	3	2	2	2	3	-	-	-	-	-	-	2	2	2
CO 4	3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
Average	**3**	**2.5**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

22UCV721E	DESIGN OF PRE-STRESSED CONCRETE STRUCTURES	Credits: 3
L:T:P-3:0:0		CIE Marks: 50
Total Hours/Week: 4		SEE Marks:50

UNIT I	10Hrs

Materials: High strength concrete and steel, stress-strain characteristics and properties.

Basic Principles of Prestressing : Fundamentals, Load balancing concept, stress concept, centre of thrust, pre-tensioning and post-tensioning systems, tensioning methods and end anchorages.

UNIT II	10Hrs

Analysis of sections for flexure: Stresses in concrete due to prestress and loads, stresses in steel due to loads, cable profile.

Losses of prestress: Various losses encountered in pretensioning and post tensioning methods, determination of jacking force.

UNITIII	10Hrs

Deflections: Prediction of short term and long term deflections of un-cracked members.

Limit State of collapse and serviceability: I.S. code recommendations-ultimate flexural and shear resistance of sections, shear reinforcement, Limit state of serviceability-control of deflections and cracking.

UNIT IV	10Hrs

Design of End blocks: Transmission of Prestressing pre-tensioned members, transmission length, and anchorage stress in post-tensioned members, bearing stress and bearing tensile stress in end block, Methods, I.S. code provision for the design of end block reinforcement.

Design of Beams: Design of pretensioned and post-tensioned symmetrical sections, permissible stress, design of Prestressing forceandeccentricity.

REFERENCE BOOK*

1. N.KrishnaRaju,Prestressed Concrete Design, McGrawHill Publications, 6th edition, 2018.
2. P. Dayaratnam, Prestressed Concrete Design, Medtech publishers, 7th edition,2017.
3. N. Rajgopalan, Prestressed Concrete Design, Narosa Publishers 2nd edition,2010.
4. E.G. Nawy, Prestressed Concrete Design, Pearson publication, 2nd edition,1995.

COURSEOUTCOMES**

1. Students will remember and recall materials used in PSC, their characteristics and basic principles of prestressing including pretensioning and posttensioning constructions.
2. Students will apply basic engineering principles to evaluate stresses due to loads in concrete and steel under flexure and shear.
3. Students will understand concepts and analyze the different losses and evaluate losses of prestress and deflections.
4. Students will understand the concepts and apply them to evaluate / estimate the ultimate resistance capacity of PSC members in flexure and shear.

COURSE ARTICULATION MATRIX

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	2	2	1	2	1	1	1	2	2	3	3	2
CO2	3	3	2	3	1	2	1	2	2	2	2	3	2	2
CO3	3	3	3	3	2	2	1	1	2	2	2	2	2	3
CO4	3	3	3	2	2	2	2	3	2	2	2	2	3	3
Average														

22UCV722E	DEEP FOUNDATIONS	Credits:3
L: T: P-3:0:0		CIEMarks:50
Total Hours/Week:3		SEEMarks:50

UNIT-I	10 Hours

Introduction to Foundation Engineering: Necessity, classification, Shallow Vs Deep foundation.
Pile Foundation: Pile classification based on their friction, composition and Method of installation. Axial load carrying capacity of single pile by different methods: By use of Static bearing capacity equations and dynamic formulae. Pile load tests and Negative skin friction.

UNIT–II	10 Hours

Pile group: Group efficiency, Problems related to load on each pile: Pile group with vertical and inclined piles (Culman's graphical method- no problems). Laterally loaded vertical piles: Pile resistanceanddeflectionunderlateralloads,elasticmethodandUnder-reamedpiles:construction stages.

UNIT–III	10 Hours

Well Foundations & Caissions: Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.
Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.

UNIT–IV	10 Hours

Foundations on expansive soils: Introduction, Definition, Identification, Mineral Structure, Index properties of expansive soils, Swell potential and swell pressure, Free swell, CNS layer, foundation treatment for structures in expansive soil.
Machine Foundations: Introduction, Types of Machine foundations, basic definitions, degree of freedom of a block foundaiton, general creteria for design of machine foundation.

Reference Books*

1. B. C. Punmia, Ashok. K. Jainand Arun. K. Jain (2017), Soil Mechanics and Foundation Engg. (17th edition) Laxmi Publications Co., New Delhi.
2. Gopal Ranjan and A.S.R. Rao (2022), Basic and Applied Soil Mechanics (4th Edition), New Age International(P) Ltd., New Delhi.
3. Davis and poulus(1980), Pile Foundation Analysis and Design, John iley & Sons Inc.
4. P. Purushotham Raj **(**2013), Soil Mechanics and Foundation Engineering (2nd Edition), Dorling kidersley, pvt, Ltd**.**
5. Dr. C. Venkataramaiah (2010), Geotechnical Engineering (4th edition), New age Publications.
6. Dr.P.C.Varghese (2005), Foundation Engineering, Prentice Hall ofIndia.

Course Outcomes**

1. Understand the necessity and classification of foundations, and differentiate between shallow and deep foundations based on geotechnical considerations and structural requirements.
2. Analyze laterally loaded pile behavior, evaluate group efficiency, and explain under-reamed pile construction and applications.
3. Explain the types, components, and construction methods of well foundations, caissons, and drilled piers and evaluate the causes and remedies for tilts and shifts.
4. Understand expansive soil behavior and machine foundation types, design criteria, treatments, and dynamic considerations.

COURSE ARTICULATION MATRIX:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO 1	3	3	3	2	-	-	-	-		-	-	2	3	2
CO 2	3	3	3	2	-	-	-	-	-	-	-	2	3	2
CO 3	3	3	3	2	-	-	-	-	-	-	-	2	3	2
CO 4	3	1	3	3	-	-	-	-	-	-	-	2	2	2

22UCV723E	Solid Waste Management	Credits: 03
L:T:P – 3:0:0		CIE Marks:50
Total Hours/Week: 03		SEE Marks:50

UNIT-I	10 Hrs.
Solid Waste: Definition and scope, Necessity and importance, Sources, Classification, Integrated Solid Waste Management (ISWM), Hierarchy of waste management options, 4 R's - reduce, recover, recycle and reuse, Physical, Chemical and Biological characteristics of municipal solid waste (MSW), Generation rates and methods, Chemical composition, Numerical problems. Functional elements: Flow chart, Waste generation, Storage, Collection, Transfer and transport, Processing and recovery, Disposal. **Collection, Transfer and Transport:** Collection equipment, systems of collection - hauled container system, stationary container system, numerical problems; Transfer stations, Bailing and Compacting	
UNIT–II	**10 Hrs.**
Separation and Processing Technologies: Size reduction, Size separation, Density separation, Magnetic & Electric Field separation, Densification (Compaction), Design of Material Recovery Facilities (MRFs), Numerical problems. Thermal Treatment Processes: Combustion Systems (Mass-Fired Combustion Systems, RDF-Fired Combustion Systems, Fluidized Combustion Systems, Hear recovery sytems, Water wall Combustion Systems, Waste heat boiler) Pyrolysis Systems, Gasification Systems, Environmental Control Systems, Energy Recovery Systems	
UNIT–III	**10 Hrs.**
Disposal methods: Types, Selection of suitable site, Ocean disposal, Feeding to hogs, Merits and demerits of various disposal methods. **Open dumping:** Environmental implications of open dumping, Construction debris - management & handling, Rag pickers and their role **Sanitary land filling:** Definition, methodology, Types - trench, area, ramp, pit methods, Basic steps involved, Site selection, Prevention of site pollution, Landfill remediation, Geo-technical considerations, Densification - earthen, Geo-membrane, Geo-synthetics and Geo-textiles	
UNIT–IV	**10 Hrs.**
Operational aspects of Landfills: Daily cover, Final cover, Leachate disposal, Ground water monitoring, Leachate and its treatment, Gas collection and re-circulation systems,Post-closure environmental monitoring. **Treatment of other wastes:** E-Waste Management, Hazardous waste management and Bio-medical waste.	
Reference Books *	
1. George Tchobanoglous, Hilary Theisen, Samuel A. Vigil, Integrated Solid Waste Management-Engineering Principles and Management Issues, McGraw-Hill, International Editions, 1993. 2. Ramachandra T.V., Management of Municipal Solid Waste, The Energy and Resources Institute, TERI, ISBN: 9788179931875, 9788179931875, 2006 3. Peavy and Tchobanoglous, Environmental Engineering, McGraw-Hill International Editions, 1985.	
Course Outcomes**	

After completion of the course student will be able to

1. Design Appropriate treatment component for municipal and certain industrial effluents

2.Evaluate the operational problems of treatment units and apply the solutions in water and wastewater treatment plant.

3. Construct appropriate treatment schemes to remove certain pollutants present in water or wastewater

4. Construct the alternative sludge processing techniques apply the knowledge in nutrient removal from the wastewater

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	3		2						2	2	2	
2	1	2	2	2		2						2	2	2	
3	2	2	1	2		1						2	2	2	
4	3	2	2	1		2						2	2	2	
Average															

22UCV724E	**Pavement Design**	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10 Hrs.**

Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.

UNIT–II	**10 Hrs.**

Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above. Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, 2012 problems on above.

UNIT–III	**10 Hrs.**

Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements.

UNIT–IV	**10 Hrs.**

Stresses in Rigid Pavement: Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above. Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars.

Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements.

Reference Books *

1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R Kadiyali and Dr.N.B. Lal, "Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang, "Pavement Analysis and Design", University of Kentucky
4. Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons.
5. Subbarao's, "Principles of Pavement Design" .
6. R Srinivasa Kumar, "Pavement Design", University Press.
7. Relevant recent IRC codes

Course Outcomes**

After completion of the course student will be able to

1. Systematically generate and compile required data for design of pavement (Highway & Airfield).

2. Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.

3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.

4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements

***Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	2	3	2	-	2	2	-	-	-	-	-	**1**		
CO2	3	2	3	-	2	1	-	-	-	-	-		**1**	
CO3	3	2	3	-	3	-	-	-	1	-	-	**1**		
CO4	2	1	1	-	2	1	-	-	1	-	-			**1**

22UCV725E	MATRIX METHODS OF STRUCTURAL ANALYSIS	Credits: 03
L:T:P-3: 0:0		CIE Marks:50
Total Hours/Week:3		SEE Marks:50

UNIT-I	10 Hrs.

Definitions and Concepts: Comparison of classical, matrix and approximate methods of structural analysis, System approach versus Element approach, degrees of freedom, coordinate systems, stiffness and flexibility coefficients, Flexibility and stiffness methods.

Flexibility Method: Introduction, element flexibility matrix, Principle of contragradience, construction of member and structure flexibility matrix, determination of member forces. Procedure for analysis of indeterminate structures: analysis of continuous beams and plane frames.

UNIT–II	10 Hrs.

Flexibility Method Continued: Analysis of indeterminate structures: analysis of plane trusses.

Stiffness Method: Introduction, element stiffness matrix, Principle of contragradience, construction of member and structure stiffness matrix, determination of member displacements. Procedure for analysis of indeterminate structures: continuous beams.

UNIT–III	10 Hrs.

Stiffness Method continued: Analysis of indeterminate structures: plane frames and Plane trusses.

UNIT–IV	10 Hrs.

Direct Stiffness Method: Introduction, transformation of variables, transformation of stiffness matrix for member of truss and continuous beams. Global stiffness matrix,
Boundary conditions, computation of internal forces, analysis of plane trusses and continuous beams.

Reference Books *

1. S. Rajasekaran and G. Sankarasubramanian - Computational Structural Mechanics, PHI Learning, 2023.
2. Kassimali Aslam – Matrix Analysis of Structures, Cengage Learning Custom Publishing, Boston USA, 2011.
3. William Weaver Jr. and James M. Gere– Matrix Analysis of Framed Structures, CBS Publishers and distributors, New Delhi, 2018.
4. Neville A M and Ghali A- Structural Analysis: A Unified Classical and Matrix Approach, CRC Press, 2009.

Course Outcomes**

After completion of the course student will be able to

CO1: *Explain* the definitions, basic concepts, and differences between classical and matrix methods, including force and displacement methods, as well as system and element approaches. *Analyze* and *evaluate* member forces for continuous beams and plane frames using the force transformation method.

CO2: *Apply* the flexibility matrix method to determine member forces in trusses. *Explain* the fundamental concepts related to the stiffness matrix method. *Evaluate* member forces for continuous beams using the displacement transformation method.

CO3: *Apply* the displacement transformation method to *analyze* and *evaluate* member forces in plane frames and trusses.

CO4: *Illustrate* the core concepts of the direct stiffness method. *Apply* the method to *evaluate* member forces in plane trusses and continuous beams.

*Books to be listed as per the format with decreasing level of coverage of syllabus
** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	2									2	2	3
CO2	3	3	2	2									2	2	3
CO3	3	3	2	2									2	2	3
CO4	3	3	2	2									2	2	3

22UCV801I	Research / Industrial Internship	Credits: 10
L:T:P -		CIEMarks:50
Total Hours/Week:		SEEMarks:50

Research Internship/ Industry Internship Guidelines

1. **Student's Diary/ Daily Log**

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed by the internal guide, immediately after the completion of the internship. It will be evaluated based on the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

2. Internship Report

The Internship report will be evaluated based on following criteria:

- Originality.
- Adequacy and purposeful write-up.
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience.
- Practical applications, relationships with basic theory and concepts taught in course.

3. Evaluation through Seminar Presentation/Viva-Voce at the Institute

The student will give a seminar based on his/her training/internship report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Report.

Scheme of Evaluation for Research Internship /Industry Internship

The students pursuing the course of Research Internship /Industry Internship shall submit the diary recordings of day-to-day activities and monthly report to the concerned guide. Student should report progress achieved in the course and seek guidance to proceed with the internship. The interns should provide all the details to the guide, so that he/she can discuss with the employer to make the internship successful. The intern should constantly update the guide about the progress of the internship. The guide should know the interns internship tasks, duties, responsibilities, and potential projects. The hardcopy or softcopy of the diary maintained by the interns must be signed at least once in a month by the guide. Illustrations, drawings, photos, forms, samples, classified materials, etc., are to be included in the report only after obtaining the consent of the concerned authorities and should indicate the source of all such material. The final report, should also be submitted to the place where internship was carried out. The report should avoid a tone that is predominantly cynical or unduly critical of the internship provider or of those with whom the student intern worked. The content of the report must be of interns own work.

The guide must issue a recommendation letter to state whether the intern,

(i) Exceeded the expectations of the internship.

(ii) Met the expectations of the internship.

(iii) Did not meet the expectations of the internship.

(iv) Did work to a satisfactory level.

(v) Did an unsatisfactory internship.

And same should be attached in the report.

Assessment of Continuous Internal Evaluation (CIE)

Assessment of CIE for 100 marks shall be awarded by a committee consisting of the Head/Nominee of the concerned department and two faculty members of the department, one of whom shall be the guide in case of single discipline and guides in case of interdisciplinary. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the interns shall be based on the rubrics (Annex 1).

Assessment of Semester End Evaluation (SEE)

Assessment of SEE for 100 marks shall be awarded as per the rubrics (Annex 2) by a committee consisting of the Head of the concerned department and two faculty members of the department, one of whom shall be the guide in case of single discipline and guides in case of interdisciplinary.

Single discipline: Contribution to the internship and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department. Marks shall be awarded based on the evaluation of the diary, report, presentation skill and question and answer session in the ratio 50:25:25.

Interdisciplinary: Contribution to the internship and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to. Marks shall be awarded based on the evaluation of the diary, report, presentation skill and question and answer session in the ratio 50:25:25.

22UHS753C	RESEARCH METHODOLOGY&IPR (Common to All Branches)	Credits: 02
Hrs/Week: 2:0:0		**CIE Marks:** 50
Total Hours: 26Hrs		**SEE Marks:** 50

Course Objectives:

1. To understand the basics of research and its types.
2. To learn the concept of Literature Review, Technical Reading, Attributions and Citations.
3. To learn Ethics in Engineering Research.
4. To Integrate Intellectual Property Rights with engineering sciences to cater to R&D requirements.

UNIT -I	5Hrs

Introduction to Engineering Research

Fundamentals of Research: Meaning, objectives, and motivation in engineering research.

Types of Engineering Research: Basic, applied, and translational research; identifying and solving Worthwhile problems.

Research Ethics: Ethics in engineering research and practice, types of research misconduct, and ethical issues in authorship.

UNIT - II	5 Hrs

Literature Review and Citations

Technical Reading & Analysis: Methods for reviewing literature, analyzing priorart, and synthesizing new and existing knowledge.

Bibliographic Databases: Web of Science, Google, Google Scholar, effective search strategies.

Conceptualizing Research: Critical and creative reading, taking notes, reading mathematical models, algorithms, and datasheets.

Citations & Acknowledgments: Attribution, citation styles, impact of keywords, citing datasets, and knowledge dissemination.

UNIT - III	8Hrs

Intellectual Property Rights (IPR) & Patents:

Introduction to Intellectual Property: Concepts of property and rights, forms of IPR, role in research and economic development, IP governance, and global innovation indicators.

Patents: Definition, objectives, criteria for patentability, software/business method patents, infringement, compulsory licensing, and government use of inventions.

Patent Process: Prior art search strategies, patent databases (free and paid), drafting specifications and claims, filing requirements, jurisdiction, opposition procedures, and renewal.

Filing Requirement of patent: Patent Application Forms. Work flow chart in obtaining Patents, Jurisdiction of Filing Patent Application. Pre-grant & Post-grant Opposition. Forms to be submitted, filing mechanism through Individual patent office and PCT route. Need for a Patent Attorney/AgentRevocation. Term of Patent, Patent renewal and Fee Structure National Bodies

Dealing with Patent Affairs. Utility Models

UNIT - IV	8Hrs

Copyrights, Trademarks, Industrial Design & GI

Copyrights: Nature, subject matter, authorship, digital copyright, fair use, infringement, enforcement, and international agreements.

Trademarks: Meaning, functions, distinctiveness, registration, non-conventional marks, infringement, and domain name issues.

Industrial Design: Definition, registration process in India, infringement, and case laws.

Geographical Indications (GI): Acts, laws, ownership rights, registered GIs in India, protection,

certification marks, enforcement, and registration process.

IP Organizations & Policies: Overview of IP schemes, national programs, and regulatory bodies in India.

Case Studies & Applications

Patents: Case studies on Curcuma (Turmeric), Neem, and Basmati patents.

Copyright & Trademark Disputes: Interesting Copyrights Cases, Case studies (e.g., Coca-Cola vs. Bisleri, Apple vs. Samsung).

Course Outcomes:

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

CO1: Integrate research methodology in engineering sciences in relevant trades.

CO2: Exhibit reflective thinking in problem solving exercises.

CO3: Identify criteria to fit one's own intellectual work in particular form of IPRs and able to apply statutory provisions and procedure to protect different forms of IPRs at National and international level.

CO4: Develop skill of making search using modern tools and techniques and also student is able to become patent agent by cracking patent agent exam.

Course Outcomes	Programme Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-		-	-	-	
CO2	-	2	2	-	1	2	2	3	-	2	-	2
CO3	-	-	-	-	-	3	2	2	-	2	-	1
CO4	-	-	-	-	3	-	-	-	1	1	-	2