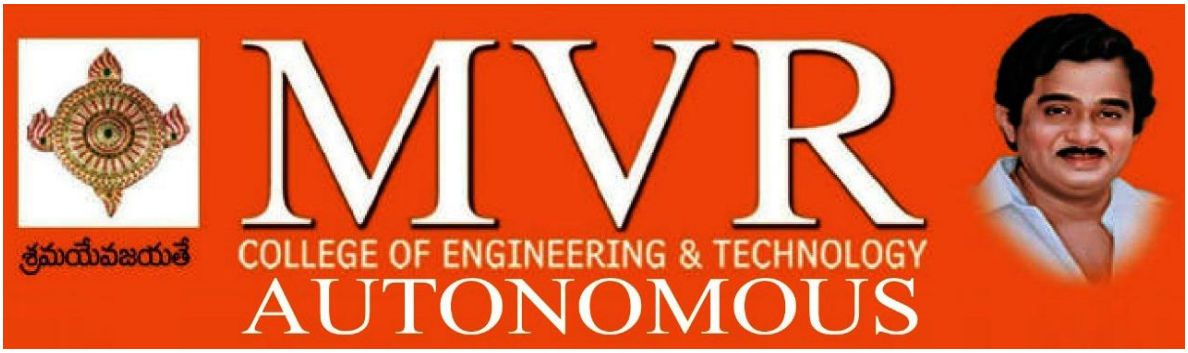

4 YEAR COURSE STRUCTURE AND SYLLABUS

For UG RM 21 REGULATION

B. TECH – CIVIL ENGINEERING

(Applicable for batches admitted from 2021-2022)

DEPARTMENT OF CIVIL ENGINEERING

MVR COLLEGE OF ENGINEERING AND TECHNOLOGY

PARITALA – 521 180 , Andhra Pradesh, India

I-YEAR COURSE STRUCTURE

I YEAR – I SEMESTER

S.NO	SUBJECT CODE	SUBJECT NAME	L	T	P	CREDITS
1	21HS1101	Linear Algebra & Differential Equations	3	0	0	3
2	21BS1102	Engineering Physics	3	0	0	3
3	21BS1103	English	3	0	0	3
4	21ES1106	Basic Electrical and Electronics Engineering	3	0	0	3
5	21ES1109	Engineering Graphics	1	0	4	3
6	21HS1151	Engineering Physics Lab	0	0	3	1.5
7	21BS1152	Engineering Physics Virtual Lab	0	0	2	0
8	21BS1153	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5
9	21ES1157	English Communications Skills Lab	0	0	3	1.5
10	21MC1101	Constitution of India	0	0	2	0

Total credits=19.5

I YEAR-II SEMESTER

S.NO	SUBJECT CODE	SUBJECT NAME	L	T	P	CREDITS
1	21BS1201	Numerical Methods & Vector Calculus	3	0	0	3
2	21BS1202	Engineering Chemistry	3	0	0	3
3	21ES1204	Building Material Construction	3	0	0	3
4	21ES1208	Engineering Mechanics	3	0	0	3
5	21ES121B	Programming For Solving using-C	3	0	0	3
6	21BS1251	Engineering Chemistry Lab	0	0	3	1.5
7	21ES1254	CAD Lab	0	0	3	1.5
8	21ES1257	C – Programming Lab	0	0	3	1.5
9	21MC1201	Environmental Studies	0	0	3	0

Total credits=19.5

II-YEAR COURSE STRUCTURE

II YEAR – I SEMESTER

S.NO	SUBJECT CODE	SUBJECT NAME	L	T	P	CREDITS
1	21BS2101	Transform Techniques	3	0	0	3
2	21CE2101	Fluid Mechanics	3	0	0	3
3	21CE2102	Strength of Materials-I	3	0	0	3
4	21CE2103	Surveying	3	0	0	3
5	21CE2104	Engineering Geology	3	0	0	3
6	21CE2151	Strength of Materials Lab	0	0	3	1.5
7	21CE2152	Engineering Geology Lab	0	0	3	1.5
8	21CE2153	Surveying Field Work-I Lab	0	0	3	1.5
9	21CE2154	Skill Oriented Course-I	1	0	2	2
10	21MC2101	Essence of Indian Traditional Knowledge	2	0	0	0

Total credits=21.5

II YEAR – II SEMESTER

S.NO	SUBJECT CODE	SUBJECT NAME	L	T	P	CREDITS
1	21BS2202	Complex Variable and Statistical methods	3	0	0	3
2	21CE2201	Hydraulics and Hydraulic Machines	3	0	0	3
3	21CE2202	Strength of Materials-II	3	0	0	3
4	21CE2203	Managerial Economics and Financial Analysis	3	0	0	3
5	21MB2201	Concrete Technology	3	0	0	3
6	21CE2251	Concrete Technology Lab	0	0	3	1.5
7	21CE2252	Surveying Field Work-II Lab	0	0	3	1.5
8	21CE2253	Fluid Mechanics and Hydraulic Machinery Lab	0	0	3	1.5
9	21CE2254	Skill Oriented Course-II	1	0	2	2

Total credits=21.5

III-YEAR COURSE STRUCTURE

III YEAR – I SEMESTER

S.NO	SUBJECT CODE	SUBJECT NAME	L	T	P	CREDITS
1		***Professional Core course:*** Structural Analysis	3	0	0	3
2		***Professional Core course:*** Design And Drawing Of Reinforced ConcreteStructures	3	0	0	3
3		Professional Core course: Geotechnical Engineering-I	3	0	0	3
4		**OPEN ELECTIVE-I** I. Python Programming II. Industrial Automation and Robotics III. Principles of Communications	3	0	0	3
5		**PROFESSIONAL-ELECTIVE-I** I. Urban Transportation Planning II. Advanced Structural Analysis III. Highway Engineering	3	0	0	3
6		***Professional Core courses Lab*** Geotechnical Engineering Lab	0	0	3	1.5
7		***Professional Core courses Lab*** Highway Engineering-Lab	0	0	3	1.5
8		***Skill advanced course-I/ soft skill course:*** Python Programming Lab	1	0	2	2
9		***Mandatory Course (AICTE Suggested):*** Professional Ethics And Human Values	2	0	0	0
10		***Summer Internship 2 Months (Mandatory) after second year (to be evaluated during 3rd yr 1st semester)***	0	0	3	1.5

Total credits=21.5

III YEAR –II SEMESTER

S.NO	SUBJECT CODE	SUBJECT NAME	L	T	P	CREDITS
1		***Professional Core courses*** Design And Drawing Of SteelStructures	3	0	0	3
2		***Professional Core courses*** Water Resource Engineering-I	3	0	0	3
3		***Professional Core courses*** Geo-Technical Engineering-II	3	0	0	3
4		**OPEN-ELECTIVE -II** I. OOPs Through JAVA II. Operations Research III. Micro controllers and Applications	3	0	0	3
5		**PROFESSIONAL- ELECTIVE-II** I. Environmental Engineering II.Road Safety Engineering III. Environmental Impact Assessment	3	0	0	3
6		***Professional Core courses Lab*** Advance Staad Pro Lab	0	0	3	1.5
7		***Professional Core courses Lab*** Building Planning And Computer Adied Design Lab	0	0	3	1.5
8		***Professional Core courses Lab*** Enviromental Engineering-Lab	0	0	3	1.5
9		***Skill advanced course-II/ soft skill course/Computational Tools:*** Project Management Software	1	0	2	2
10		**Mandatory course (AICTE):** Employability Skills	2	0	0	0

Total credits=21.5

IV-YEAR COURSE STRUCTURE

IV YEAR – I SEMESTER

S.NO	SUBJECT CODE	SUBJECT NAME	L	T	P	CREDITS
1		***Professional Core courses*** Estimation Specifications & Contracts	**3**	**0**	**0**	**3**
2		**HUMANITIES AND SOCIAL SCIENCE ELECTIVE:** I. Management Science II. Industrial Management III.Resources Management IV.Intellectual Property Rights (Ipr) & Patents	**3**	**0**	**0**	**3**
3		**PROFESSIONAL-ELECTIVE-III** I. Water Resources Engineering-II II. Earth and Rock fill Dams III. Green Technologies	3	0	0	3
4		**PROFESSIONAL-ELECTIVE-IV** I. Air Pollution & Control II. Prestressed concrete structures III. Repair And Rehabilitation Of Structures	3	0	0	3
5		**OPEN ELECTIVE-III** I. Disaster Management II. Embedded and Real Time Systems III. Remote Sensing & GIS	3		0	3
6		**OPEN ELECTIVE-IV** I. Non Conventional Energy Sources II. Construction Technology Management III.3D Printing Technologies	3	0	0	3
7		***Professional Core courses Lab*** RS&GIS Lab	0	0	4	2
8		Industrial/Research Internship (Mandatory) 2Months ***after 3rd d year to beevaluated during 4th yr 1st semester***	**0**	**0**	**6**	3

Total credits=23

IV YEAR –II SEMESTER

S.NO	SUBJECT NAME	L	T	P	CREDITS
1	PROJECT WORK Phase-II	0	0	18	12
	Total Credits				**12**

I- YEAR

DETAILED SYLLABUS

I Year - I Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
LINEAR ALGEBRA & DIFFERENTIAL EQUATIONS					

Course objectives:

•To instruct the concept of Matrices in solving simultaneous linear systems.
•Understanding of formation and solution of ordinary differential equations.
•Knowing the mathematical methods to solve applications of differential equations.
•To familiarize a variety of well-known sequences and series, with a developing intuition about the behaviour of
new ones.

Course Out Comes : At the end of the course, the student will learn

CO1: Apply the knowledge to solve linear system of equations.
CO2: Illustrate the methods of computing Eigenvalues and Eigen vectors
CO3: Able to solve the differential equations related to various engineering fields
CO4: Determine the solutions of linear differential equations of higher order.
CO5: Familiarize with functions of several variables which is useful in optimization

UNIT I: Linear systems of equations

Rank of a matrix by reducing Echelon form and Normal form ,Rank of a matrix, PAQ in normal form, Solving system of homogeneous and non- homogeneous linear equations , Gauss Elimination method, Gauss Jordan method.**Application**: Finding the current in electrical circuits.

UNIT II: Eigen values and Eigen vectors:Eigenvalues and Eigen vectors and properties, Cayley-Hamilton theorem (without proof) **Applications** – Finding the inverse and power of a matrix by Cayley-Hamilton theorem, Reduction to Diagonal form, Quadratic forms and nature of the quadratic forms, Reduction of quadratic form to canonical forms by orthogonal transformation.

UNIT III: Differential equations of first order and first degreeLinear differential equations, Bernoulli's equations, Exact equations and equations reducible to exact form.**Applications**: Newton's Law of cooling– Law of natural growth and decay– Orthogonal trajectories– Electrical circuits.

UNIT IV: Linear differential equations of higher order Solutions of Homogeneous and Non-homogeneous differential equations of higher order with constant coefficients with non-homogeneous term of the type e^{ax} ,sin ax, cos ax, x^n, $e^{ax}V(x)$ and $x^nV(x)$, Method of Variation of parameters.**Applications:** LCR circuit

UNIT V: Partial differentiation:Introduction , Homogeneous function , Euler's theorem, Total derivative, Chain rule, Jacobian , Functional dependence ,Taylor's and MacLaurin's series expansion of functions of two variables. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method.

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. B. V. Ramana,Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India
2. N.P.BALI &Dr.MANISH GOYAL, A Text book of Engineering Mathematics, Lakshmi Publications,9th Edition,2014.

I Year - I Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
ENGINEERING PHYSICS					

Course Objective:

- Knowledge of fundamentals of Physics which helps them in the study of advanced topics of Engineering.
- Develop analytical capability and understand various Engineering concepts.

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

CO1:**Impart knowledge** of Physical Optics phenomenon Polarization and identify these CO1:phenomenons in natural processes.

CO2:**Gain knowledge** of applications of lasers and optical fibers in various fields.

CO3:**Classify** magnetic and dielectric materials and their Engineering applications.

CO4:**Impart** knowledge of architectural acoustics and Study of Ultrasonic

CO5:**Classify** crystal systems and analyze the crystalline structure using various X-ray diffraction techniques.

UNIT-I- Wave Optics (12hrs)

Interference: Introduction-Principle of Superposition – Coherent Sources – Interference in thin films (reflection geometry) – Colors in thin films-Newton's rings-Determination of wave length and refractive index.

Diffraction: Introduction- Fresnel and Fraunhofer diffraction - Fraunhofer Diffraction due to Single slit, double slit, N–slits (Qualitative) - Diffraction Grating – Resolving Power of Grating (Qualitative).

Polarization: Introduction- Types of polarization-polarization by reflection, refraction and Double refraction-Nicol's prism – Half and Quarter wave plates.

Unit-II: Lasers and Fiber optics

Lasers: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Einstein's coefficients – Population inversion – Lasing action - Pumping Schemes – Ruby laser – He-Ne laser - Applications of lasers.

Fiber optics: Introduction –Principle of Optical Fiber-Construction- Acceptance Angle - Numerical Aperture -Classification of Optical Fibers based on refractive index profile and modes- Optical Fiber communication System-Merits & Demerits of Optical fiber communication System.

UNIT III: Magnetic and Dielectric Materials (08hrs)

Magnetic Materials: Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Bohr magneton – Classification of magnetic materials: Dia, para, and Ferro, antiferro & Ferri – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials .

Dielectric Materials: Introduction - Dielectric polarization – Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientation polarizations (qualitative) – Lorentz Internal field – Clausius-Mossotti equation.

Unit-IV: Acoustics and Ultrasonics (10hrs)

Acoustics: Introduction – requirements of acoustically good auditorium– Reverberation – Reverberation time– Sabine's formula - Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedial measures.

Ultrasonics: Introduction - Properties - Production by magnetostriction and piezoelectric methods – Detection - Non Destructive Testing – pulse echo system through transmission and reflection modes - Applications.

Unit-V: Crystallography and X-ray diffraction (08hrs)

Crystallography: Introduction - Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC.

X-ray diffraction: Miller indices – separation between successive (hkl) planes-Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.

Text Books

1. "A Text book of Engineering Physics" by M.N.Avadhanulu, P.G.Kshirsagar - S.ChandPublications, 2019.
2. "Engineering Physics" by D.K. Bhattacharya and Poonam Tandon, Oxford press (2015).
3. "Engineering Physics" by R.K Gaur. and S.L Gupta., - Dhanpat Rai publishers, 2012.

Reference Books

1. Applied Physics by P.K. Palanisamy, Scitech publications (2014).
2. Engineering Physics by M. Arumugam, Anuradha Publication (2014).
3. Physics for Engineers by M.R. Srinivasan, New Age international publishers (2009)

I Year - I Semester	REGULATION-RM21	L	T	P	C
		3	0	0	3
ENGLISH					

Introduction The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from learning about the language to using the language. On successful completion of the compulsory English language course/s in B.Tech., Learners would be able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests.

Course Objectives:

- **Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers**
- **Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials**
- **Help improve speaking skills through participation in activities such as structured talks/oral presentations and role plays**
- **Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized paragraphs, letters and emails.**
- **Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing**
- **To develop and integrate the use of the four language skills i.e. Listening, Speaking, Reading and Writing.**

Course Outcomes:
At the end of the module, the learners will be able to
CO1: Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information.
CO2: employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information.
CO3 recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs. ➢ask and answer general questions on familiar topics and introduce oneself/others.
CO4: Demonstrate proficiency in advanced reading and context oriented writing.
CO5: Develop public speaking abilities by making use of opportunities to speak in class, both informally and formally

Unit 1: 12 Hours

Lesson-1: A Drawer full of happiness from "**Infotech English**", Maruthi Publications.
Objective: To learn the value of togetherness of family and recollecting the previous memories.Outcome: The students will understand the comparison of present and past.

Grammar: Word Forms, Basic Sentence Structure and Word Order, yes and no type questions, Whquestions.
Writing: Punctuation, paragraph writing,Reading: Skimming, Scanning.
Speaking: Self Introduction, and introducing others.Listening: Relevant tasks
Lesson-2: Deliverance by Premchand from "**The Individual Society",** Pearson Publications. (Non-detailed)
Outcome: The students will understand the prejudice of caste system and realize how to treatothers equally.

Unit 2: 10 Hours

Lesson-1: Nehru's letter to his daughter Indira on her birthday from "**Infotech English**", Maruthi Publications.
Objective: To learn the human values and patriotism from elders.
Outcome: The students will learn to work hard and take the model of great freedom fighters thatdedicated themselves for the cause of our nation.
Grammar: Articles,Prepositions
Writing:Summarizing,paraphs
Reading: Identifying ideas
Speaking: Discussions in pairs/small groups on specific topics.
Lesson-2: Bosom Friend by Hira Bansode from "**The Individual Society",** Pearson Publications.(Non-detailed)
Outcome: The students will understand the human values well.

Unit 3: 08 Hours

Lesson-1: Stephen Hawking-Positivity 'Benchmark' from "**Infotech English**", Maruthi Publications.
Objective: To make the learner understand the importance of being positive despite all odds
Outcome: The student will learn to move forward and follow despite all the disadvantages a personmight face.
Grammar: Verbs, Tenses, ConcordWriting: Letter Writing
Reading: Reading between the lines Speaking: Complaining, Apologizing
Listening: Listening for global comprehension
Lesson-2: A Shadow – RK Narayan(Non-detailed) from Modern Trailblazers of Orient BlackSwan.
Outcome: The learner will be in a position to appreciate the art of writing a short story.

Unit -4 10 Hours

Lesson -1: Work Brings Solace from "Sure Outcomes", Orient BlackSwan.
Objective: In this lesson, Abdul Kalam highlights the advantages of work.
Outcome: The student will understand the advantages of work. They will also learn how toovercome their problems and contribute to national development.
Grammar: Degrees of comparisonWriting: Email Writing
Speaking: Describing Objects and Processes.
Lesson-2: Telephone Conversation-Wole Soyinka from "The Individual Society", Pearson Publications.(Non-detailed)
Outcome: The students will understand the ill treatment meted out to Afro-Americans in the

US andlearn
that any kind of discrimination is uncalled for.

Unit 5: 10 Hours

Lesson-1: Stay Hungry-Stay foolish from "**Infotech English**", Maruthi Publications
Objective: In this lesson, students will understand the philosophy of connecting the dots backwards.
Outcome: The students will understand many life lessons that can be picked from the life ofSteve Jobs
Grammar: Reported Speech
Writing: poster presentation
Reading: Reading
ComprehensionSpeaking:
Presentation of a PPT
Lesson-2: Still I Rise by Maya Angelou from "**The Individual Society",** Pearson Publications.(Non-detailed)
Outcome: The students learn about self-respect and confidence.

Text Books:

1. "**Infotech English**", Maruthi Publications. (Detailed)
2. "**The Individual Society",** Pearson Publications.(Non-detailed)
3. "Sure Outcomes", Orient BlackSwan.
4. Modern Trailblazers of Orient Blacks

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students.Routledge,2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking.HeinleyELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP.

I Year - I Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Objectives:

- To learn the basic principles of electrical circuital law's and analysis of networks
- To understand principle of operation and construction details of DC machines
- To understand principle of operation and construction details of transformers, alternator and 3-Phase induction motor
- To study operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
- To learn operation of PNP and NPN transistors and various amplifiers

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

CO1:Analyse various electrical networks.
CO2:Understand operation of DC generators,3-point starter and DC machine testing by Swinburne's Test and Brake test.
CO3:Analyse performance of single-phase transformer and acquire proper knowledge and working of 3-phase alternator and 3-phase induction motors.
CO4:Analyse operation of half wave, full wave bridge rectifiers and OP-AMPs.
CO5:Understanding operations of CE amplifier and basic concept of feedback amplifier .

UNIT – I: Electrical Circuits: (10hrs)

Basic definitions – types of network elements – Ohm's Law – Kirchhoff's Laws – inductive networks – capacitive networks – series – parallel circuits – star-delta and delta-star transformations

UNIT – II: DC Machines: (10hrs)

Principle of operation of DC generator – EMF equation – types of DC machines – torque equation characteristics of DC motors – applications – three point starter – speed control methods of DC motor – Swinburne's Test-Brake test on DC shunt motor

UNIT – III: Transformers: (10hrs)

Principle of operation and construction of single phase transformers – EMF equation – Losses – OC & SC tests – efficiency and regulation

UNIT – IV: AC Rotating Machines: (10hrs)

Principle of operation and construction of alternators – types of alternators Regulation of alternator by synchronous impedance method – principle of operation of synchronous motor – principle of operation of 3-Phase induction motor – slip-torque characteristics – efficiency – applications

UNIT – V: Rectifiers & Transistors: (10 hrs)

PN junction diodes – diode applications (half wave and bridge rectifiers).

PNP and NPN junction transistor, transistor as an amplifier– frequency response of CE amplifier – Basic concepts of feedback amplifier

Text Books:

1. Electrical Technology by Surinder Pal Bali, Pearson Publications.
2. Electronic Devices and Circuits by R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

Reference Books:

1. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group.
2. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications.
3. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications,2nd edition
4. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications,2nd edition
5. Industrial Electronics by G.K. Mittal, PHI

I Year – I Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
ENGINEERING GRAPHICS					

Course Objectives:

C.obj-1: To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.
C.obj-2: To introduce the students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.
C.obj-3: The objective is to make the students draw the projections of the plane inclined to both the planes.
C.obj-4: The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.
C.obj-5: The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Course Outcomes:

CO 1: Student's ability to hand letter will improve, Student's ability to perform basic sketching techniques will improve. Construct polygons ,curves Student's ability to use architectural and engineering scales will increase
CO 2: Students will be able to draw orthographic projections and sections. Students are able to draw lines .and project the line is inclined to both the planes
CO 3: Students are able to draw planes
CO 4: develop the surfaces of geometrical solids
CO 5: visualize geometrical solids in 3D space through exercises in Orthographic Projections, interpret Orthographic ,Isometric and Perspective views of objects.

UNIT – I

Polygons: Constructing regular polygons by general methods, inscribing and describing polygons on circles.
Curves: Parabola, Ellipse and Hyperbola by general methods, cycloids, involutes, tangents & normals for the curves. **Scales:** Plain scales, diagonal scales and vernier scales

UNIT- II

Orthographic Projections: Horizontal plane, vertical plane, profile plane, importance of referencelines, projections of points in various quadrants, projections of lines, lines parallel either to of the reference planes (HP,VP or PP).Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces- HT, VT.

UNIT – III

Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

UNIT IV

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one plane.

UNIT – V

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views. Computer Aided Design, Drawing practice using Auto CAD, Creating 2D&3D drawings of objects using Auto CAD

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications

2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers

2. Engineering Graphics for Degree by K.C. John, PHI Publishers

3. Engineering Graphics by PI Varghese, McGrawHill Publishers

4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

	REGULATION : RM21				
I Year - I Semester	ENGINEERING PHYSICS LAB	L	T	P	C
		0	0	3	1.5
(Any 10 of the following listed 15 experiments)					

Course Objective: Objective of the course is to impart Training Engineering graduates to handle instruments and their usage methods to improve the accuracy of measurements.

Course Outcomes:

CO1: The student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

CO2: Implement the basic principles of Mechanics to measure different physical parameters.

CO3: Enhance the knowledge of Usage of electronic devices in various applications.

SYLLABUS

1. Laser: Determination of wavelength using diffraction grating.
2. Study of variation of magnetic field along the axis of a current carrying circular coil by Stewart & Gee's method
3. Determination of velocity of sound – volume resonator.
4. To determine the energy gap of a semiconductor using p-n junction diode..
5. Determination of dielectric constant using charging and discharging method.
6. Determination of Acceleration due to Gravity and Radius of Gyration- Compound Pendulum.
7. Measurement of resistance of a semiconductor with varying temperature.
8. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum).
9. Determination of numerical aperture and acceptance angle of an optical fiber.
10. Determination of thickness of thin object by wedge method.
11. Determination of radius of curvature of given Plano convex lens by Newton's rings.
12. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
13. Determination of dispersive power of the prism.
14. Sonometer: Verification of laws of string.
15. Melde's experiment experiment-Transverse and Longitudinal modes.

References:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

	REGULATION : RM21				
		L	T	P	C
I Year - I Semester	ENGINEERING- PHYSICS- VIRTUAL LAB	0	0	2	0

Course Objective:

Objective of the course is to impart

- Training Engineering students to prepare a technical document and improving their writing skills.

Course Outcome:

- **Physics Virtual laboratory curriculum in the form of assignment ensures an engineering graduate to prepare a /technical/mini-project/experimental report with scientific temper.**

LIST OF EXPERIMENTS:

- Hall Effect
- Crystal Structure
- Hysteresis
- Brewster's angle
- Magnetic Levitation / SQUID
- Numerical Aperture of Optical fibre
- Photoelectric Effect
- Simple Harmonic Motion
- Damped Harmonic Motion
- LASER – Beam Divergence and Spot size
- B-H curve
- Michelson's interferometer
- Black body radiation

URL: www.vlab.in

I Year -I Semester	REGULATION: RM21	L	T	P	C
		0	0	3	1.5
BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB					

Course Objectives:

- To learn the basic principles of electrical circuital law's and analysis of networks
- To understand principle of operation and construction details of DC machines
- To understand principle of operation and construction details of transformers, alternator and 3-Phase induction motor
- To study operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
- To learn operation of PNP and NPN transistors and various amplifiers

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

CO1: Analyse various electrical networks.
CO2:Understand operation of DC generators,3-point starter and DC machine testing by Swinburne's Test and Brake test.
CO:3Analyse performance of single-phase transformer and acquire proper knowledge and working of 3-phase alternator and 3-phase induction motors.
CO4:Analyse operation of half wave, full wave bridge rectifiers and OP-AMPs.
CO5:Understanding operations of CE amplifier and basic concept of feedback amplifier

UNIT – I: Electrical Circuits: (10hrs)

Basic definitions – types of network elements – Ohm's Law – Kirchhoff's Laws – inductive networks – capacitive networks – series – parallel circuits – star-delta and delta-star transformations

UNIT – II: DC Machines: (10hrs)

Principle of operation of DC generator – EMF equation – types of DC machines – torque equation characteristics of DC motors – applications – three point starter – speed control methods of DC motor – Swinburne's Test-Brake test on DC shunt motor

UNIT – III: Transformers: (10hrs)

Principle of operation and construction of single phase transformers – EMF equation – Losses – OC & SC tests – efficiency and regulation

UNIT – IV: AC Rotating Machines: (10hrs)

Principle of operation and construction of alternators – types of alternators Regulation of alternator by synchronous impedance method – principle of operation of synchronous motor – principle of operation of 3-Phase induction motor – slip-torque characteristics – efficiency – applications

UNIT – V: Rectifiers & Transistors: (10 hrs)

PN junction diodes – diode applications (half wave and bridge rectifiers).

PNP and NPN junction transistor, transistor as an amplifier– frequency response of CE amplifier – Basic concepts of feedback amplifier.

Text Books:

1.Electrical Technology by Surinder Pal Bali, Pearson Publications.

2.Electronic Devices and Circuits by R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

Reference Books:

1.Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group.

2.Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications.

3.Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications,2nd edition

4.Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications,2nd edition

5.Industrial Electronics by G.K. Mittal, PHI

I Year -I Semester	REGULATION: RM21	L	T	P	C
		0	0	3	1.5
ENGLISH COMMUNICATION SKILLS LAB					

Course Objective:

- Top leverl effective communication skills and build confidence.
- To enhance the general conversational skills in different socio-cultural contexts.
- To strengthen their public speaking skills.
- To instill courage to speak with anyone and make them competent enough to express themselves fluently.
- To enable the students to comprehend the speech of people belonging to different backgrounds and regions.
- To make the students understand the power of communication in personal & professional success.

Course outcomes:

By the end of course, the student will be able to**:**

CO1: Improve listening and speaking skills.
CO2: Use functional English.
CO3: Gain fluency in English Language.
CO4: Learn effective communication skills and learn team dynamics.
CO5: Face any interviews to get a suitable job

Methodology:

1. The classes are to be learner-centered where the learners are exposed to much practice sessions of JAM, GDs and Interviews.
2. Integrated skill development methodology has to be adopted with focus on individual language skills as per the tasks/exercise.
3. The teacher is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
4. The teacher is permitted to use lecture method when a completely new concept is introduced in the class.

UNIT I:

Phonetics: Sounds and Symbols (Vowels/Consonants Sounds).

UNIT II:

Stress and Common Errors in Pronunciation.

UNIT III:

Self-Introduction and JAM Session.

UNIT IV:

Requests, Permissions and Directions.

UNIT V:

Group Discussions and Interview Process.

TEXT BOOKS

" Infotech English", Maruthi Publications.
"Sure Outcomes", Orient BlackSwan.

References:

1. Exercises in Spoken English Part 1,2,3,4, CIEFL Oxford University Press.
2. English Pronunciation in use- Mark Hancock, Cambridge University Press

I Year - I Semester	REGULATION : RM21	L	T	P	C
		0	0	2	0
CONSTITUTION OF INDIA					

Course Objectives:

To Enable the student to understand the importance of constitution

- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Courtand high court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative

Course Outcomes:

At the end of the course, the student will be able to have a clear knowledge on the following:

- Understand historical background of the constitution making and its importanc for building a democratic India.
- Understand the functioning of three wings of the government ie., executive legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming goodcitizen of India.
- Analyze the decentralization of power between central, state and local self-governmen
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

CO1. Know the sources, features and principles of Indian Constitution.
CO 2. Learn about Union Government, State government and its administration.
CO 3. Get acquainted with Local administration and Pachayati Raj.
CO4. Be aware of basic concepts and developments of Human Rights
CO5. Gain knowledge on roles and functioning of Election Commiuinty

UNIT I Introduction to Indian Constitution: Constitution meaning of the term, IndiaConstitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

Learning outcomes:After completion of this unit student will

• Understand the concept of Indian constitution
• Apply the knowledge on directive principle of state policy
• Analyze the History, features of Indian constitution
• Evaluate Preamble Fundamental Rights and Duties

UNIT II Union Government and its Administration Structure of the Indian Union:Federalism, CentreState relationship, President: Role, power and position, PMandCouncil of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha,The Supreme Court and High Court: Powers and Functions;

Learning outcomes: After completion of this unit student will

• Understand the structure of Indian government

- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

UNIT III State Government and its Administration Governor, Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

Learning outcomes: After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor, state Secretariat and Chief Minister
- Differentiate between structure and functions of state secretariat

UNIT IV A.Local Administration, District's Administration Head, Role and Importance, Municipalities, Mayor and role of Elected Representative, CEO of Municipal Corporation PachayatiRaj**:** Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy(Different departments), Village level, Role of Elected and Appointed officials, Importance of grass root democracy

Learning outcomes:-After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zillapanchayat block level organisation

UNIT V Election Commission: Election Commission, Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Learning outcomes: After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissiononerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

References:

1) Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt. Ltd.
2) SubashKashyap, Indian Constitution, National Book Trust
3) J.A. Siwach, Dynamics of Indian Government & Politics
4) D.C. Gupta, Indian Government and Politics
5) H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6) J.C. Johari, Indian Government andPolitics Hans
7) J. Raj IndianGovernment and Politics
8) M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9) Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to CivilRights Guarantees in India, Oxford University Press 2012

I Year - II Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3

NUMERICAL METHODS AND VECTOR CALCULUS

Course objectives:

- To understand the basic numerical methods to solve non linear algebraic equations.
- To demonstrate the use of different numerical techniques for carrying out numerical integration
- To Illustrate the types of Integration over the lines, surface and volumes.

Course Out Comes : At the end of the course, the student will learn

CO1: Evaluate the approximate roots of polynomial and transcendental equations by different algorithms.
Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals

CO2: Discuss numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations

CO3: Calculate double integration techniques in evaluating areas bounded by region

CO4: Interpret the physical meaning of different operators such as gradient, curl and divergence

CO5: Estimate the work done against a field, circulation and flux using vector calculus

UNIT I: Iterative methods and Interpolation:

Introduction , Bisection method , Method of false position ,Iteration method , Newton-Raphson method ,Jacobi and Gauss-Seidel methods for solving system of equations numerically. Errors in polynomial interpolation , Finite differences , Forward differences , Backward differences ,Central differences , Relations between operators , Newton's forward and backward formulae for interpolation , Interpolation with unequal intervals , Lagrange's interpolation formula .

UNIT-II:Numerical integration, Solution of ordinary differential equations with initial conditions:

Numerical integration, Trapezoidal rule , Simpson's 1/3rd and 3/8th rule, Solution of initial value problem Taylor's series ,Picard's method of successive approximations , Euler's method ,Modified Euler's method,Runge- Kutta method (fourth order).

UNIT III: Multiple integrals: Double and Triple integrals , Change of order of integration in double integrals , Change of variables to polar coordinates.Applications: Finding Areas and Volumes.

UNIT IV: Vector Differentiation : Gradient , Directional derivative , Divergence , Curl , Scalar Potential,Vector identities ,Laplacian and second order operators.

UNIT V: Vector Integration: Line integral , Work done , Area , Surface and volume integrals .Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof)

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,**Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India
2. **N.P.BALI &Dr.MANISH GOYAL,** A Text book of Engineering Mathematics, Lakshmi Publications,9th Edition,2014.

I Year - II Semester	REGULATION : RM21	L	T	P	C
		0	0	2	0
ENGINEERING CHEMISTRY					

PURPOSE: Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and vmaterial selection, as well as utilizing the available resources.

Course Objectives:

*Importance of usage of Plastics in household appliances and composites(FRP)in aerospace and automotive industries

* Fuels as a source of energy are a basic need of any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc.,and hence are introduced to create awareness on the topics.

*Outline the basics for the construction of electrochemicalcells, batteries and fuelcell .Understand the mechanism of corrosion and how it can be prevented.

*Explain the preparation of Nanomaterials ,Engineering applications of superconductors and liquid Crystals.
*Explain the importance and usage of water as basic material line almost all the industries,interpret drawbacks of staeam boilers

Course Outcomes:

CO1: Evaluate various polymer synthetic methods for applications in Engineering and technological materials.
CO2: Analyse various natural and synthetic fuels based in their properties and applications.
CO3: Apply the concept of electrochemistry to batteries and fuel cells and analyze various types of corrosion, factors effecting corrosion and suitable corrosion control methods.
CO4: Understand the concept of Nano materials, super conductors and apply to engineering materials
CO5: Analyze the quality of the water and formulate suitable water purification methods

UNIT-I:POLYMER TECHNOLOGY 8hrs

Polymerisation:-Introduction-Types of polymerization-addition and condensation polymerization with Examples –Physical and mechanical properties .

plastics:-Thermoplastics and Thermosetting plastics – Compounding - fabrication(compression, injection,blown film and extrusion)-Preparation, properties and applications of PVC, Bakelite and polycarbonates

Elastomers:-Natural rubber-Drawbacks- vulcanization –preparation, properties and applications Buna S, thiokol and polyurethanes) .

Composite Materials: Fibrereinforcedplastics-aramid fibre reinforced plastics,conducting polymers ,biodegradable polymers

UNIT II: FUEL TECHNOLOGY: 10hrs

Fuels:- Introduction – Classification – Calorific value - HCV and LCV –Problems based on Dulong's formula – Coal — Proximate and ultimate analysis – Significance of the analyses – Liquid fuels – Petroleum- Refining – Cracking – Synthetic petrol –Petrol knocking – Diesel knocking - Octane and Cetane ratings – Anti-knock agents – Power alcohol – Bio-diesel – Gaseous fuels – Natural gas, LPG and CNG-Flue gas analysis by orsat's apparatus.

UNIT III: ELECTROCHEMICAL CELLS AND CORROSION 10hr

Single electrode potential, Electro chemical series and uses of this series,Standard Hydrogen electrode, Calomel electrodes.Batteries(Dry Cell,, Lithium ion and zinc air cell)Fuel cells(H_2-O_2 ,CH_3OH-O_2 **Corrosion:-** Definition – Theories of Corrosion (chemical & electrochemical) –galvanic corrosion, differentiation aeration corrosion-Galvanic series,Factors influencing rate of corrosion-Corrosion control methods(cathodicprotection)Protectivecoatings(Surfacepreparation,Cathodiccoatings,anodicoatings,electroplating,electrolessplating(Nickel])Paints(constituents and functions)

UNIT IV: CHEMISTRY OF MATERIALS 10hrs

Nanomaterials:- Introduction , Sol-gel method , characterization by (BrunauerTeller(BET),(scanning electron microscopy[SEM]and (transmission electron microscopy[TEM]with example (TiO_2), Carbon Nano tubes and fullerenes(Types, preparation and applications)

Super conductors:-Type –I, Type II – Characteristics and applications

Green synthesis:-Principles of Greenchemistry- Methods for Green Synthesis-R_4M_4Principles

CEMENT:Constituents of cement, preparation methods, setting and hardening of cement,Deterioration of cement.

UNIT V: WATER TECHNOLOGY 8hrs

Hard water:- Reasons for hardness – units of hardness - determination of hardness –Water harvesting methods- Water for steam generation - Boiler troubles – Priming and Foaming,Scale formation, Boiler corrosion, Caustic embrittlement - Internal treatments - Softeningof Hard water : Zeolite process , Ion exchange process - Reverse Osmosis and Electro Dialysis.

Standard Books:

1. Engineering Chemistry by Jain and Jain; DhanpatRaiPublicating Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.

Reference Books:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
2. Engineering Chemistry by PrasanthRath, Cengage Learning, 2015 edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
4. Applied Chemistry by H.D. Gesser, Springer Publishers
5. Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, UniversityPress,
IIM.

I Year - II Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
BUILDING MATERIALS CONSTRUCTION					

Aim and Objective of this course

1. Initiating the student with the knowledge of basic building materials and their properties.
2. Imparting the knowledge of course pattern in masonry construction and flat roofs and
3. Techniques of forming foundation, columns, beams, walls, sloped and flat roofs.
4. The student is to be exposed to the various patterns of floors, walls, different types of paints and varnishes.
5. Imparting the students with the techniques of formwork and scaffolding.
6. The students should be exposed to classification of aggregates, moisture content of the aggregate.

Course Outcomes (COs)

1.The student should be able to identify different building materials and their importance in building construction

2.The student is expected to differentiate brick masonry, stone masonry construction and use of lime and cement in various constructions

3.The student should have learnt the importance of building components and finishing

4.The student is expected to know the classification of aggregates, sieve analysis and moisture content usually required in building construction.

Syllabus:

Unit - I (Stones, Bricks, Tiles,)

Stones: Properties of building stones – relation to their structural requirements, classification of Stones - stone quarrying – precautions in blasting, dressing of stone,

Bricks: Composition of good brick earth, various methods of manufacturing of bricks

Tiles: Characteristics of good tile – Manufacturing methods, Types of tiles, Uses of materia like Aluminum, Gypsum, Glass and Bituminous materials

Unit– II Masonry:**Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry.Cavity and partition walls.**

Wood: Structure – Properties- Seasoning of timber Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood – Galvanized,Iron, Fiber Reinforced Plastics, Steel, Aluminum

Unit - III Lime and Cement

Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime.

Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance -various tests for concrete.

Unit - IV Building Component

Lintels, arches, vaults, stair cases – types.
Different types of floors – Concrete, Mosaic, and Terrazzo floors, Pitched floor, Roofs: flat roofs. Lean to roof, Coupled Roofs. Trussed Roofs: King post Trusses. And Queen post Trusses. R.C.C Roofs, Madras Terrace and Pre fabricated roofs.

Unit - V Finishing's and Aggregates

Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering.
Paints: Constituents of paint – Types of paints – Painting of new/old wood- Varnish. Form Works and Scaffoldings. Aggregates - Classification of aggregate – Coarse and fine aggregates- particle size and shape and texture – Bond and Strength of aggregate – Specific gravity – Bulk Density, porosity and absorption – Moisture content of Aggregate- Bulking of sand – Sieve analysis.

TEXT BOOKS:

Building Materials, S. S. Bhavikatti, Vices publications House private ltd.
Building Construction, S. S. Bhavikatti, Vices publications House private ltd.
Building Materials, B. C. Punmia, Laxmi Publications privateltd.
Building Construction, B.C. Punmia, Laxmi Publications (p) ltd.

REFERENCE BOOKS

Building Materials, S. K. Duggal, New Age International Publication.
Building Materials, P. C. Verghese, PHI learning (P) l
Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. New Delhi
Building construction, P. C. Verghese, PHI Learning (P) Ltd
Building Materials, Construction and Planning, S.Mahaboob Basha, Anurad.

I Year - II Semester	REGULATION : RM21	L	T	P	C
		4	0	0	3
ENGINEERING MECHANICS					

Course Objectives:

- The students are to be exposed to the concepts of force and friction, direction and its application.
- The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.
- The students are to be exposed to concepts of centre of gravity.
- The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.
- The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.
- The students are to be exposed to concepts of work, energy and particle motion.

Course Outcomes:

CO1:Solve for the resultants of any force system and determine equivalent force system.
CO2:Solve for the resultants of any force system and determine equivalent force system.
CO3:Calculate the centroid, first moment and second moment of area.
CO4:Find the velocity and acceleration of rigid bodies in rectilinear and curvilinear motion.
CO5:Analyze the forces acting on rigid body during translation motion.
Analyze concepts of work, energy and particle motion

UNIT – I

Introduction to Engg. Mechanics – Basic Concepts. Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Friction: Introduction, limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction.

UNIT II

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorm, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium, analysis of plane trusses.

UNIT – III

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT IV

Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics- Work Energy method and applications to particle motion- Impulse momentum method.

UNIT –V

Rigid body Motion: Kinematics and kinetics of translation, Rotation about fixed axis and plane motion,Work Energy method and Impulse momentum method.

TEXT BOOKS:

1.Engg. Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publication

REFERENCES:

1.Engineering Mechanics statics and dynamics – R.C.Hibbeler, 11th Edn – Pearson Publ.
2. Engineering Mechanics, statics – J.L.Meriam, 6th Edn – Wiley India
3. Engineering Mechanics, statics and dynamics – I.H.Shames, – Pearson Publ.
4.Mechanics For Engineers, statics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
5. Mechanics For Engineers, dynamics - F.P.Beer & E.R.Johnston –5th Edn Mc Graw Hill Publ.
6. Theory & Problems of engineering mechanics, statics & dynamics – E.W.Nelson, C.L.Best & W.G. McLean, 5th Edn – Schaum's outline series - Mc Graw Hill Publ.
7.Singer's Engineering Mechanics: Statics And Dynamics, K. Vijay Kumar Reddy, J. Suresh Kumar, Publications
8. Engineering Mechanics, Fedinand . L. Singer, Harper – Collins.
9. Engineering Mechanics statics and dynamics , A Nelson , Mc Graw Hill publication

I Year-II Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
PROGRAMMING FOR SOLVING USING-C					

Course Objectives:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

Course Outcomes: The student will learn

CO1:To write algorithms and to draw flowcharts for solving problems.
CO2:To convert the algorithms/flowcharts to C programs.
CO3:To code and test a given logic in C programming language.
CO4:To decompose a problem into functions and to develop modular reusable code.
CO5:To use arrays, pointers, strings and structures to write C programs.

UNIT - I: Introduction to Programming

Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code , Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments

UNIT – II: Bitwise operations

Bitwise operations: Bitwise AND, OR, XOR and NOT operators
Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do-while loops
I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

UNIT - III: Arrays, Strings, Structures and Pointers:

Arrays: one- and two-dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings Structures: Defining structures, initializing structures, unions, Array of structure Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self- referential structures, usage of self referential structures in linked list (no implementation) Enumeration data type

UNIT - IV: Function and Preprocessor:

Functions: Designing structured programs, Declaring a function, Signature of a function, and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, Preprocessor commands like include, define, undef, if, ifdef, ifndef passing pointers to functions, idea of call by reference, Some C standard functions and libraries.

UNIT V: Strings and File handling:

Strings – Concepts, C Strings, String Input / Output functions, string manipulation functions, string /data conversion. Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files file input / output functions, Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data toexisting files,Writing and reading structures using binary files, Random access using fseek, ftell andrewind functions.

TEXT BOOKS:

Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

REFERENCE BOOKS:

Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PrenticeHall of India

R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)

Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.

Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition

I - II Semester	REGULATION : RM21	L	T	P	C
		0	0	3	1.5
ENGINEERING CHEMISTRY LAB					

Course objectives:

*The experiments introduce volumetric analysis ,Redox titrations and EDTA Titrations.

*A Few instrumental methods of chemical analysis.

Course outcomes:

CO1:At the end of the course ,student will be able to

CO2:The student is exposed to different methods of chemical analysis and use of some commonly employed instruments.They thus acquire some experimental skills.

CO3:Explain the preparation of Nanomaterials ,Engineering applications of superconductors and liquid crystals..

CO4: Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis

Experiments:

1. Determination of HCl using standard Na2CO3 solution.
2. Determination of alkalinity of a sample containing Na2CO3 and NaOH.
3. Determination of Mn+2 using standard oxalic acid solution.
4. Determination of ferrous iron using standard K2Cr2O7 solution.
5. Determination of Cu+2 using standard hypo solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of PH of the given sample.
8. Determination of concentration of acetic acid using sodium hydroxide (pH-metrymethod)
9. Determination of iso-electric point of amino acids using pH-metry method/conductometric method.
10. Determination of the concentration of strong acid vs strong base (by conductometric method).
11. Determination of strong acid vs strong base (by potentiometric method).
12. Determination of Mg+2 present in an antacid.
13. Determination of CaCO3 present in an egg shell.
14. Estimation of Vitamin C.

15. Preparation of nylon-6, 6 and Bakelite (demonstration only).

Of the above experiments at-least 10 assessment experiments should be completed.

I Year - II Semester	REGULATION:RM21	L	T	P	C
		0	0	3	1.5
CAD LAB					

Aim and Objective of this course

To help the student to attain competency in preparation of engineering drawings as per principles of planning using a suitable CAD software through various teaching learning experiences:

Course Outcomes (COs)

CO1. Perform basic commands of any suitable CAD software to draw 2D drawings

CO2. Interpret the conventions, signs and symbols from a given drawing.

List of Experiments:

1 Introduction to Auto CAD

2 Different Software's for CAD

3 Practice Exercises on Auto CAD Software

4 Drawing Plan of a building in Auto CAD

a) Plan of a Single Storeyed building in Auto CAD

b) Plan of a Multi Storeyed building in Auto CAD

5 Drawing Section and Elevation of a building in Auto CAD

a) Section and Elevation of a Single Storeyed building in Auto CAD

b) Section and Elevation of a Multi Storeyed building in Auto CAD

6 Detailing of building components like Doors, Windows, and Roof Trusses

7 Exercises on development of working drawings of buildings in Auto CAD

I Year - II Semester	REGULATION : RM21	L	T	P	C
		0	0	3	1.5
C-PROGRAMMING LAB					

Course Objectives:

Apply the principles of C language in problem solving.

- To design flowcharts, algorithms and knowing how to debug programs.
- To design & develop of C programs using arrays, strings pointers & functions.
- To review the file operations, preprocessor commands.

Course Outcomes:

By the end of the Lab, the student

CO1:Gains Knowledge on various concepts of a C language.
CO2:Able to draw flowcharts and write algorithms.
CO3:Able to design and development of C problem solving skills.
CO4: Able to design and develop modular programming skills.
CO5: Able to trace and debug a program

Exercise 1:

1. Write a C program to print a block H using hash (*), where the H has a height of six characters and width of five and four characters.
2. Write a C program to compute the area of a circle with radius 10 inches.
3. Write a C program to print even numbers from 100 to 350.

Exercise 2:

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3:

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

Exercise 4:

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5:

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

Exercise 6:

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

Exercise 7:

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

Exercise 8:

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

Exercise 9:

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10:

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

Exercise 11:

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12:

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

Exercise 13:

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc ( ) function.

Exercise 14:

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15:

1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to generate 20 random numbers using arrays between 100 to 200.

Exercise 16:

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to concatenate two file

I Year - II Semester	REGULATION:RM21	L	T	P	C
		0	0	3	0
ENVIRONMENTAL SSTUDIES					

Course Objectives: The objectives of the course are to impart:

- Overall understanding of the natural resources.
- Basic understanding of the ecosystem and its diversity.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
- An understanding of the environmental impact of developmental activities.
- Awareness on the social issues, environmental legislation and global treaties.

UNIT I Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – **Sustainability**: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects. Role of information technology in environment and human health. Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT II Natural Resources: Natural resources and associated problems.
Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.
Water resources: Use utilization of surface and ground water – Floods, drought, conflicts over water,dams – benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.
Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.
Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT III Biodiversity and its conservation: Definition: genetic, species and ecosystem diversityclassification - Value of biodiversity: consumptive use, productive use,social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity

UNIT IV Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies,Sustainable Life Studies. Impact of Fire Crackers on Men and his well being. Solid Waste Management: Sources, Classification, effects and control measure of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT V Social Issues and the Environment: Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act - Wildlife Protection Act – Forest Conservation Act-Issues involved in

enforcement of environmental legislation. -Public awareness. Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics. The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:

1) Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
2) Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press
3) Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

Reference Books:

1)|Text Book of Environmental Studies, Deeshita Dave & P. UdayaBhaskar, 3 rded, Cengage Learning.
2) A Textbook of Environmental Studies, ShaashiChawla, TMH, New Delhi
3) Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
4) Perspectives in Environment Studies, AnubhaKaushik, C P Kaushik, New Age International Publishers, 2014

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II Year - I Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
TRANSFORM TECHNIQUES (common to all branches)					

Course objectives:

- To familiarize the techniques in partial differential equations
- To furnish the learners with basic concepts and techniques sat plus two level to lead them into advanced level by handling various real-world application

COURSE OUTCOMES: At the end of the course, the student will learn

CO1:Apply the Laplace transform for solving differential equations.

CO2: Find or compute the Fourier series of periodic signals.

CO3: Know and be able to apply integral expressions for the forwards and inverse Fourier transform to arrange of non-periodic wave forms.

CO4: Identify solution methods for partial differential equations that model physical processes.

CO5: To know the solution of second and higher order partial differential equations.

UNIT I: Laplace Transforms:

Laplace transforms of standard functions – Properties -Shifting theorems – Transforms of derivatives and integrals – Inverse Laplace transforms– Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms

UNIT II : Fourier series:

Introduction – Periodic functions – Fourier series of periodic function –Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series.

UNITIII: Fourier Transforms:

Fourier integral theorem (without proof) –Fourier sine and cosine integrals –Sine and cosine transforms –inverse transforms –Finite Fourier transforms

UNIT IV: PDE of first order:

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

UNIT V: Second order PDE and Applications:

Second order PDE: Solutions of linear partial differential equations with constant coefficient –RHS term of the type e^{ax+by}, $sin(ax+by)$, $cos(ax+by)$, $x^m y^n$,Method of separation of variables.

Application: One dimensional Wave Equation.

TEXT BOOKS:

1. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. B.V.Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc.Graw Hill Education

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10thEdition, Wiley-India.
2. Peter O'Neil Advanced Engineering Mathematics, Cengage.

II Year - I Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
FLUID MECHANICS					

Course Learning Objectives:

- To understand the properties of fluids and fluid statics
- To derive the equation of conservation of mass and its application
- To solve kinematic problems such as finding particle paths and streamlines
- To use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems
- To analyze laminar and turbulent flows
- To understand the various flow measuring devices
- To study in detail about boundary layers theory

Course Outcomes:

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

CO1:Understand the various properties of fluids and their influence on fluid motion and analyse a variety of problems in fluid statics and dynamics.

CO2:Calculate the forces that act on submerged planes and curves.

CO3:Ability to analyse various types of fluid flows.

CO4:Apply the integral forms of the three fundamental laws of fluid mechanics to turbulent and laminar flow through pipes and ducts in order to predict relevant pressures, velocities and forces.

CO5:Able Measure the quantities of fluid flowing in pipes, tanks and channels.

Syllabus:

UNIT I

Introduction: Dimensions and units – Physical properties of fluids - specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law, Hydrostatic law -atmospheric, gauge and vacuum pressures- measurement of pressure. Pressure gauges, Manometers: Differential and Micro Manometers.

Hydrostatics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure.

UNIT – II

Fluid Kinematics: Description of fluid flow, Stream line, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows – Equation of continuity for one, two , three dimensional flows – stream and velocity potential functions, flow net analysis.

Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line - Momentum equation and its application – forces on pipe bend.

UNIT – III

Laminar Flow and Turbulent Flows: Reynold's experiment – Characteristics of Laminar & Turbulent flows, Shear and velocity distributions, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydro-dynamically smooth and rough flows.
Closed Conduit Flow: Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line, variation of friction factor with Reynold's number – Moody's Chart, Pipe network problems, Hazen-Williams formula, Hard-Cross Method,

UNIT – IV

Measurement of Flow: Pitot tube, Venturi meter and Orifice meter – classification of orifices, small orifice and large orifice, flow over rectangular, triangular, trapezoidal and Stepped notches, Broad crested weirs and Ogee weirs.

UNIT – V

Boundary Layer Theory: Boundary layer (BL) – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarman momentum integral equation, laminar and turbulent Boundary layers (no deviations)- BL in transition, separation of BL, Control of BL, flow around submerged objects-Drag and Lift- Magnus effect.

Text Books:

1. Modi P.N and Seth S.M.(2018), "Fluid mechanics", Standard book house, New Delhi
2. A text of Fluid mechanics and hydraulic machines, R.K.Bansal-Laxmi Publications (P) ltd., New Delhi

References:

1. K.Subramanyam, Fluid mechanics and hydraulic machines Mc graw hill education, IIndedition
2. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education.
3. Principle of fluid mechanics and fluid machines III edition, university press

II Year - I Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
STRENGTH OF MATERIALS - I					

Course Learning Objectives:

- To impart preliminary concepts of Strength of Material and Principles of Elasticity and Plasticity Stress conditions and to develop diagrams of variation of various stresses across the length.
- To give concepts of stresses developed in the cross section and bending equations calculation of section modulus of sections with different cross sections
- The concepts above will be utilized in measuring deflections in beams under various loading and support conditions
- To classify cylinders based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to external pressure.

Course Outcomes:

CO1: The student will be able to understand the basic materials behavior under the influence of different external loading conditions and the support conditions
CO2: The student will be able to draw the diagrams indicating the variation of the key performance features like bending moment and shear forces
CO3: The student will have knowledge of bending concepts and calculation of section modulus
CO4: Learn determination of stresses developed in the beams and deflections due to various loading conditions
CO5:The student will be able to assess stresses across section of the thin and thick cylinders to arrive at optimum sections to withstand the internal pressure using Lame's equation.

SYLLABUS:

UNIT – I: Simple Stresses And Strains: Elasticity and plasticity – Types of stresses and strains

– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – stresses in composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

UNIT – II: Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam; S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads.

UNIT – III: Flexural and shear Stresses in beams

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R, Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, I, T Angle sections.

UNIT – IV: Deflection of Beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic curve of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads. Mohr's theorems – Moment area method – application to simple cases of cantilever.

UNIT – V: Thin and Thick Cylinders:

Thin cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.
Thick cylinders: Introduction: Lames theory for thick cylinders, Derivation of Lames formulae, distribution of hoop and radial stresses across the thickness, compound cylinders-distribution of stresses.

TEXT BOOKS:

1. A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S. Chand & Co, NewDelhi
2. Strength of materials by R. K. Bansal, Lakshmi Publications.

REFERENCES:

1. Mechanics of Materials- by R. C.Hibbler, Pearson publishers
2. Mechanics of Solids – E P Popov, Prentice Hall.
3. Strength of Materials by B.S.Basavarajaiah and P. Mahadevappa, 3rd Edition,UniversitiesPress
4. **Mechanics of Structures Vol – I by H.J.Shah and S.B.Junnarkar, Charotar Publishing HousePvt. Ltd.**

II Year - I Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
SURVEYING					

Course Objectives:

The object of the course student should have the capability to:

- Know the principle and methods of surveying.
- Measure horizontal and vertical- distances and angles
- Recording of observation accurately
- Perform calculations based on the observation
- Identification of source of errors and rectification methods
- Apply surveying principles to determine areas and volumes and setting out curves
- Use modern surveying equipment's for accurate results

Course Outcomes:

Course will enable the student to:

CO1: Apply the knowledge to calculate angles, distances and levels

CO2:Identify data collection methods and prepare field notes

CO3:Understand the working principles of survey instruments, measurement errors and correctivemeasures

CO4:Interpret survey data and compute areas and volumes, levels by different type of equipment

CO5: Relate the knowledge to the modern equipment and methodologies

SYLLABUS

UNIT - I

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, surveying accessories. Introduction to Compass, levelling and Plane table surveying. **Measurement of Distances and Directions**

Linear distances- Approximate methods, Direct Methods- Chains- Tapes, ranging, Tapecorrections.

Prismatic Compass- Bearings, included angles, Local Attraction, Magnetic Declination, and dip –W.C.B systems and Q.B. system of locating bearings.

UNIT - II

Leveling- Types of levels, temporary and permanent adjustments, methods of levelling, booking andDetermination of levels, Effect of Curvature of Earth and Refraction.

Contouring- Characteristics and uses of Contours, methods of contour surveying.

Areas - Determination of areas consisting of irregular boundary and regular boundary.

Volumes -Determination of volume of earth work in cutting and embankments for level section,volume of borrow pits, capacity of reservoirs.

UNIT - III

Theodolite Surveying: Types of Theodolites, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometric leveling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Introduction to Omittedmeasurements.

UNIT - IV

Curves: Types of curves and their necessity, elements of simple, compound, reverse curves. Tachometric Surveying: Principles of Tachometry, stadia and tangential methods of Tachometry, Modern Surveying Methods: Principle and types of E.D.M. Instruments, Total station- advantages and Applications. Introduction to Global Positioning System.

UNIT - V

Photogrammetry Surveying:

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.

TEXT BOOKS:

1. Surveying (Vol – 1, 2 & 3), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain -Laxmi Publications (P) ltd., New Delhi.
2. Chandra A M, "Plane Surveying and highersurveying", New Age International Pvt. Ltd.,Publishers, New Delhi.
3. Duggal S K, "Surveying (Vol – 1 & 2), Tata McGraw Hill Publishing Co. Ltd. New Delhi.

REFERENCES:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill.
2. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi

II Year – I Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
ENGINEERING GEOLOGY					

Course LearningObjectives:

The objective of this courseis:

- To introduce the course: Engineering Geology to the Civil Engineering graduates.
- To enable the students, understand what minerals and rocks are and their formation and identification.
- To highlight significance/ importance/ role of Engineering Geology in construction of Civil Engineering structures.
- To enable the student, realise its importance and applications of Engineering Geology in Civil Engineering constructions.

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

CO1:Identify and classify the geological minerals , Measure the rock strengths of various rocks

CO2: Classify and measure the earthquake prone areas to practice the hazard zonation

CO3:Classify, monitor and measure the Landslides and subsidence, Prepares, analyses and interpret the v

Engineering Geologic maps

CO4:Test the geological material and ground to check the suitability of civil engineering project construction.

CO5: Investigate the project site for mega/mini civil engineering projects. Site selection for mega

engineering projects like Dams, Tunnels, disposal sites etc.

UNIT-I:

Introduction: Branches of Geology, Importance of Geology in Civil Engineering with case studies.

Weathering: Weathering of rocks, Geological agents, weathering process of Rock, Rivers and geological work of rivers.

UNIT-II

Mineralogy and Petrology: Definitions of mineral and rock-Different methods of study of mineral and rock. Physical properties of minerals and rocks for megascopic study for the following minerals and rocks. Common rock forming minerals: Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite and Bauxite. Classification, structures, textures and forms of Igneous rocks, Sedimentary rocks, Metamorphic rocks, and their

megascopic study of granite varieties, (pink, gray, green). Pegmatite, Dolerite, Basalt etc., Shale, Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khondalite and Slate.

UNIT-III

Structural Geology: Strike, Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism and their importance in Civil Engineering.

UNIT-IV

Ground Water: Water table, Cone of depression, Geological controls of Ground Water Movement, Ground Water Exploration Techniques.

Earthquakes and Land Slides: Terminology, Classification, causes and effects, Shield areas and Seismic bells, Richter scale intensity, Precautions of building constructions in seismic areas. Classification of Landslides, Causes and Effects, measures to be taken prevent their occurrence at Landslides.

Geophysics: Importance of Geophysical methods, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, Radiometric method and Electrical resistivity, Seismic refraction methods and Engineering properties of rocks.

UNIT-V

Geology of Dams, Reservoirs and Tunnels: Types and purpose of Dams, Geological considerations in the selection of a Dam site. Geology consideration for successful constructions of reservoirs, Life of Reservoirs. Purpose of Tunnelling, effects, Lining of Tunnels. Influence of Geology for successful Tunnelling.

TEXT BOOKS:

1. 'Engineering Geology' by Subinoy Gangopadhay, Oxford University press.
2. 'Engineering Geology' by D. Venkat Reddy, Vikas Publishing House pvt. Ltd, 2013.
3. 'Engineering Geology' by N. Chenn kesavulu, Trinity Press (Laxmi Publications), 2nd Edition, 2014.
4. 'Engineering Geology' by Vasudev Kanithi, University Press.

REFERENCES:

1. 'Engineering Geology for Civil Engineers' by P.C. Varghese, PHI learning pvt. Ltd.
2. 'Geology for Engineers and Environmental Society' by Alan E Kehew, person publications, 3rd edition
3. 'Fundamentals of Engineering Geology' by P.G.Bell, B.S.P. Publications, 2012.
4. 'Engineering Geology' by V.Parthesarathi et al., Wiley Publications
5. 'Environmental Geology' by K.S.Valdiya, McGraw Hill Publications, 2nd ed.

II Year – I Semester	REGULATION : RM21	L	T	P	C
		0	0	3	1.5
STRENGTH OF MATERIALS LAB					

Experiments

1. Tension test on Mild steel bar
2. Bending test on (Steel / Wood) Cantilever beam.
3. Bending test on simply supported beam.
4. Torsion test
5. Hardness test
6. Spring test
7. Compression test on wood or concrete
8. Impact test (Charpy and Izod impact test)
9. Sheartest (on UTM)
10. Verification of Maxwell's Reciprocal theorem on beams.
11. Use of Electrical resistance strain gauges
12. Continuous beam – deflection test.

List of Major Equipment:

1. Universal Testing Machine
2. Torsion testing machine
3. Brinnell's / Rock well's hardness testing machine
4. Setup for spring tests
5. Compression testing machine
6. Izod Impact machine
7. Shear testing machine
8. Beam setup for Maxwell's theorem verification.
9. Electrical Resistance gauges

II Year – I Semester	REGULATION : RM21	L	T	P	C
		0	0	3	1.5
ENGINEERING GEOLOGY LAB					

Course LearningObjectives:

The objective of this courseis:

1. To identify the Megascopic types of Ore minerals & Rock forming minerals.
2. To identify the Megascopic types of Igneous, Sedimentary, Metamorphic rocks.
3. To identify the topography of the site & material selection.

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

CO1: Identify Megascopic minerals & their properties.
CO2: Identify Megascopic rocks & their properties.
CO3 Identify the site parameters such as contour, slope & aspect for topography.
CO4: Know the occurrence of materials using the strike & dip problems.

SYLLABUS:

LIST OF EXPERIMENTS

1. Physical properties of minerals: Mega-scopic identification of

a. Rock forming minerals – Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum, etc…
b. Ore forming minerals – Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc…

2. Megascopic description and identification of rocks.

a) Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc.
b) Sedimentary rocks – Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc.
c) Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite & Biotiteschist, Marble, Khondalite, etc.

3. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc.

4. Simple Structural Geology problems.
5. Bore hole data.

6. Strength of the rock using laboratory tests.
7. Field work – To identify Minerals, Rocks, Geomorphology & Structural Geology.

LAB EXAMINATION PATTERN:

1. Description and identification of FOUR minerals

2. Description and identification of FOUR (including igneous, sedimentary and metamorphic rocks)
3. ONE Question on Interpretation of a Geological map along with a geological section.
4. TWO Questions on Simple strike and Dip problems.
5. Bore hole problems.
6. Project report on geology.

REFERENCES:

1. 'Applied Engineering Geology Practicals' by M T Mauthesha Reddy, New Age International Publishers, 2nd Edition.

2. 'Foundations of Engineering Geology' by Tony Waltham, Spon Press, 3rd edition, 2009.

II Year - I Semester	REGULATION : RM21	L	T	P	C
		0	0	3	1.5
SURVEYING FILED WORK – I Lab					

List of Field Works:

1. Survey by chain survey of road profile with offsets in case of road widening.
2. Survey in an area by chain survey (Closed circuit)
3. Determination of distance between two inaccessible points by using compass.
4. Finding the area of the given boundary using compass (Closed Traverse)
5. Plane table survey; finding the area of a given boundary by the method of Radiation
6. Plane table survey; finding the area of a given boundary by the method of intersection.
7. Two Point Problem by the plane table survey.
8. Fly levelling : Height of the instrument method (differential levelling)
9. Fly levelling: rise and fall method.
10. Fly levelling: closed circuit/ open circuit.
11. Fly levelling; Longitudinal Section and Cross sections of a given road profile.
12. Fly levelling and Fly chaining (complete field work).

Note: Any 10 field work assignments must be completed.

II Year – I Semester	REGULATION : RM21	L	T	P	C
		1	0	2	2
Skill Oriented Course-I					

1. **Topographic survey with contour map (total Statio or DGPS)**

OR

2. **Masonary 3' height with different bonds and different thickness**

II Year - I Semester	REGULATION : RM21	L	T	P	C
		2	0	0	0
ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE					

Course Objectives

The course is introduced

- To get a knowledge in Indian Philosophical Foundations.
- To Know Indian Languages and Literature and the fine arts in India & Their Philosophy.
- To explore the Science and Scientists of Medieval and Modern India

Course Outcomes

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

1. Understand philosophy of Indian culture.

2. Distinguish the Indian languages and literature among difference traditions.

3. Learn the philosophy of ancient, medieval and modern India.

4. Acquire the information about the fine arts in India.

5. Know the contribution of scientists of different eras.

6. The essence of Yogic Science for Inclusiveness of society.

UNIT – I

Introduction to Indian Philosophy:

Basics of Indian Philosophy, culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian culture, Ancient Indian, Medieval India, Modern India.

UNIT – II

Indian Philosophy & Literature:

Vedas Upanishads, schools of Vedanta, and other religion Philosophical Literature. Philosophical Ideas the role of Sanskrit, significance of scriptures to current society, Indian Philosophies, literature of south India. Indian languages and Literature-II: Northern Indian languages & Philosophical & cultural & literature.

UNIT – III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT – IV

Indian Fine Arts & Its Philosophy (Art, Technology & Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in Indian, development of science in ancient, medieval and modern Indian.

UNIT – V

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

Suggested Readings:

REFERENCES:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition'', ISBN: 81246033375,2005
2. "Science in Samskrit", Sanskrit Bharti Publisher,ISBN-13:978-8187276333,2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre'', ISBN 81-7450-494-X,2006
4. S. Narain, "Examination in Ancient India", Arya Book Depot,1993

II Year - II Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
COMPLEX VARIABLES AND STATISTICAL METHODS					

Course Objectives:

- To familiarize the complex variables.
- To make the student capable of evaluating the integrals in complex domains
- To make the student capable of expanding a given function as a series and finding the poles and residues
- To make the student capable of evaluating the integrals in complex domains using residue theorem
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

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

CO1: apply Cauchy-Riemann equations to complex functions in order to determine whether a givencontinuous function is analytic (L3)

CO2: find the differentiation and integration of complex functions used in engineering problems(L5)

CO3: make use of the Cauchy residue theorem to evaluate certain integrals (L3)

CO4:apply discrete and continuous probability distributions (L3) design the components of a classical hypothesis test (L6)

CO5:infer the statistical inferential methods based on small and large sampling tests (L4)

UNIT – I: Functions of a complex variable and Complex integration:

Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonicand conjugate harmonic functions – Milne – Thompson method.

Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula (all without proofs) and problems on above theorems.

UNIT – II: Series expansions and Residue Theorem:

Radius of convergence – Expansion in Taylor's series, Maclaurin's series andLaurent series. Types of Singularities: Isolated – Essential –Pole of order m– Residues – Residue theorem(without proof) – Evaluation of real integral of the types $\int_{-\infty}^{\infty} f(x)dx$ **and** $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$ **.**

UNIT – III: Probability and Distributions:

Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT – IV: Sampling Theory:

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions – Introduction to t,estimate. χ^2 and F-distributions – Point and Interval estimations – Maximum error of

UNIT – V: Tests of Hypothesis:

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level ofsignificance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **Miller and Freund's,** Probability and Statistics for Engineers,7/e, Pearson, 2008.

Reference Books:

1. **J. W. Brown and R. V. Churchill**, Complex Variables and Applications, 9th edition, Mc-Graw Hill, 2013.
2. **S.C. Gupta and V.K. Kapoor**, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
3. **Jay l. Devore,** Probability and Statistics for Engineering and the Sciences, 8th Edition,Cengage.
4. **Shron L.Myers, Keying Ye, Ronald E Walpole,** Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.
5. **Sheldon, M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4thEdition, Academic Foundation,2011

II Year - II Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
HYDRAULICS AND HYDRAULIC MACHINERY					

Course Learning Objectives:

- To study about uniform and non-uniform flows in open channel and also to learnabout the characteristics of hydraulic jump
- To introduce dimensional analysis for fluid flow problems
- To understand the working principles of various types of hydraulic machines andPumps.

Course Outcomes:

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

CO1:Solve uniform and non-uniform open channel flow problems.

CO2:Apply the principals of dimensional analysis

CO3:similitude in hydraulic modeltesting.

CO4:Understand the working principles of various hydraulic machineries

CO5: Understand the working principles of various pumps.

UNIT – I: UNIFORM FLOW IN OPEN CHANNEL:

Types of channels –Types of flows - Velocity distribution – Energy and momentum correction factors – Chezy's, and Manning's formulae for uniform flow – Most Economical sections, Critical flow: Specific energy-critical depth – computation of critical depth.

UNIT II: NON-UNIFORM FLOW IN OPEN CHANNELS: Steady Gradually Varied flow-Dynamic equation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles-direct step method- Rapidly varied flow, hydraulic jump, energy dissipation**.**

UNIT – III: HYDRAULIC SIMILITUDE: Dimensional analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations.

UNIT – IV: BASICS OF TURBO MACHINERY: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle.

UNIT – V:

HYDRAULIC TURBINES – I: Layout of a typical Hydropower installation – Heads and efficiencies - classification of turbines. Pelton wheel - Francis turbine - Kaplan turbine - working, working proportions, velocity diagram, work done and efficiency, hydraulic design, draft tube – theory and efficiency. Governing of turbines-surge tanks-unit and specific quantities, selection of turbines, performance characteristics-geometric similarity-cavitation.

PUMPS:

CENTRAIFUGAL-PUMPS: Pump installation details-classification-work done-Manometric head-minimum starting speed-losses and efficiencies-specific speed, multistage pumps-pumps in parallel and series - performance of pumps-characteristic curves- NPSH- Cavitation.

RECIPROCATING PUMPS: Introduction, classification, components, working, discharge, indicator diagram, work done and slip.

Text Books:

1. Open Channel flow, K. Subramanya, Tata McGraw Hill Publishers
2. Fluid mechanics and hydraulic machines, Rajput, A.K(2018) , S chand ,New Delhi
3. Fluid Mechanics, Modi and Seth, Standard book house.

References:

1. Fluid Flow in Pipes and Channels, G.L. Asawa, CBS
2. Fluid Mechanics and Machinery, C.S.P. OJHA, R. BERNDTSSON and P.N. Chandramouli, Oxford Higher Education.
3. Fluid Mechanics and Machinery, Md. Kaleem Khan, Oxford Higherducation.
4. Fluid mechanics and Hydraulic machines, R.K. Bansal, Laxmi publications ,New Delhi.

II Year – II Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
STRENGTH OF MATERIALS - II					

Course Learning Objectives:

- To give concepts of Principal stresses and strains developed in cross section of the beams on the cross section and stresses on any inclined plane. To impart concepts of failures in the material considering different theories
- To give concepts of torsion and governing torsion equation, and there by calculate the power transmitted by shafts and springs and design the cross section when subjected to loading using different theories of failures.
- To classify columns and calculation of load carrying capacity and to assess stresses due to axial and lateral loads for different edge conditions and to calculate combined effect of direct and bending stresses on different engineering structures.
- Introduce the concept of unsymmetrical bending in beams Location of neutral axis Deflection of beams under unsymmetrical bending.

Course Outcomes:

Upon successful completion of this course,

CO1:The student will be able to understand the basic concepts of Principal stresses
CO2:The student will be able to understand the Torsion of Circular Shafts and Springs
CO3:The student will be able to understand the Columns and Struts
CO4:The student can assess Bending Stresses
CO5:The student can assess Un-symmetrical Bending

SYLLABUS:

UNIT- I Principal Stresses and Strains And Theories of Failures: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Theories of Failures: Introduction – Various Theories of failures like Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory.

UNIT – II Torsion of Circular Shafts and Springs: Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = N\phi/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel.

UNIT – III Columns and Struts: Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula.

UNIT – IV Direct and Bending Stresses: Stresses under the combined action of direct loading and B.M. Core of a section – determination of stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to direct loading and B.M. about both axis.

UNIT – V Unsymmetrical Bending and Shear Centre:-

Un-symmetrical Bending: Introduction – Centroidal principal axes of section – Graphical methodfor locating principal axes – Moments of inertia referred to any set of rectangular axes – Stressesin beams subjected to unsymmetrical bending – Principal axes
– Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis Deflection of beams under unsymmetrical bending.

Shear Centre: Introduction Shear center for symmetrical and unsymmetrical sections (channel, I, T and L sections).

TEXT BOOKS:

1. A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S.Chand & Co, NewDelhi
2. Strength of materials by R. K. Bansal, Lakshmi Publications.

REFERENCES:

1. Mechanics of Materials- by R. C.Hibbler, Pearson publishers
2. Mechanics of Solids – E P Popov, Prentice Hall.
3. Strength of Materials by B.S.Basavarajaiah and P. Mahadevappa, 3rd Edition,Universities Press,
4. Mechanics of Structures Vol – I by H.J.Shah and S.B.Junnarkar, Charotar PublishingHouse Pvt. Ltd.

II Year – II Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS					

Course Learning Objectives:

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Course Outcomes:

CO1: The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product.

CO2:The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.

CO3: The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.

CO4: The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.

CO5: The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

Unit-I

Introduction to Managerial Economics and demand Analysis:

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of

Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting,

Unit – II:

Theories of Production and Cost Analyses:

Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Unit – III:

Introduction to Markets, Theories & Organisation types

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination — Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

Unit – IV:

Introduction to Accounting & Financing Analysis:

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments .

Unit – V:

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(payback period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

TEXT BOOKS:

1. R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

REFERENCES:

1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,

2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition

3. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,

4. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd

5. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd

6. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

II Year – II Semester	REGULATION : RM21	L	T	P	C
		3	0	0	3
CONCRETE TECHNOLOGY					

Course Learning Objectives:

- To learn concepts of Concrete production and behaviour in various environments.
- To learn test procedures for determination of properties ofconcrete.
- To understand durability properties of concrete in various environments.

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1: understand basic concepts of concrete, realize importance of quality ofconcrete.

CO2: familiarize basic ingredients of concrete and their role in concrete and their behaviour inthe field.

CO3:test fresh concrete properties and hardened concreteproperties.

CO4:evaluate ingredients of concrete through lab tests. design concrete mix by ISmethod.

CO5:familiarize basic concepts of special concrete and their production and applications.

understand the behaviour of concrete in variousenvironments.

UNIT I : Ingredients of Concrete :

Portland cement – Chemical composition – Hydration, Setting times, Fineness, Structure – Tests on cement for physical properties – Grades of cements – Admixtures – Mineral and chemical admixtures – accelerators, retarders, air entrainers, plasticizers, super plasticizers, fly ash and silicafume.

Aggregates: Classification – Particle shape & texture – Bond, strength & other mechanical properties – Specific gravity, Bulk density, porosity, adsorption & moisture content – Bulking of sand –Deleterious substance – Soundness – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded and well graded aggregate as per relevant IS code – Maximum aggregate size. Quality of mixingwater.

UNIT – II : Mix Design and Fresh Concrete

Mix Design: Factors affecting mix proportions – Durability of concrete

– Quality Control of concrete – Statistical methods – Acceptance criteria – Concepts Proportioning of concrete mixes by IS method.

Fresh Concrete: Production of Concrete–mix proportion, mixing, placing, compaction, finishing, curing – including various types in each stage. Properties of fresh concrete - Workability – Factors affecting workability – Measurement of workability by different tests, Setting times of concrete, Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete, Ready mixed concrete,Shotcrete.

UNIT – III : Hardened Concrete: Water - Cement ratio – Abram's Law – Gel space ratio

–strength of concrete –Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength – Curing, Testing of Hardened Concrete: Compression tests – Tension tests – Factors affecting strength – Flexure tests –Splitting tests – Non-destructive testing methods – code provisions forNDT.

UNIT – IV : Elasticity, Creep & Shrinkage, Modulus of elasticity, Dynamic modulus of elasticity, Poisson's ratio, Creep of concrete and factors influencing creep, Relation between creep & time, Nature of creep, Effects of creep – Shrinkage –types of shrinkage.

UNIT – V : Special Concretes: Ready mixed concrete, Shotcrete, Light weight aggregate concrete, Cellular concrete, No-fines concrete, High density concrete, Fibre reinforced concrete, Different types of fibres, Factors affecting properties of FRC, Polymer concrete, Types of Polymer concrete, Properties of polymer concrete, High performance concrete–Self compacting concrete, SIFCON, self healing concrete.

Text Books:

1. Concrete Technology, M. S. Shetty. – S. Chand & Company
2. Concrete Technology, A. R. Santhakumar, Oxford University Press, NewDelhi

References :

1. Properties of Concrete, A. M. Neville – Pearson – 5thedition
2. Concrete, Microstructure, Properties and Materials by P.K.Mehta and Moterio,McGraw Hill
3. Concrete Technology, M.L. Gambhir. – Tata Mc. Graw Hill Publishers, NewDelhi

II Year – II Semester	REGULATION : RM21	L	T	P	C
		0	0	3	1.5
CONCRETE TECHNOLOGY LAB					

Course Learning Objectives:

- To study basic properties ingredients of concrete, fresh and hardened concrete properties

Course Outcomes:

Upon successful completion of this course, student will be able to

- Determine consistency and fineness of cement.
- Determine setting times of cement.
- Determine specific gravity and soundness ofcement.
- Determine compressive strength ofcement.
- Determine workability of cement concrete by compaction factor, slump and Vee – Beetests
- Determine specific gravity of coarse aggregate and fine aggregate by Sieve analysis.
- Determine flakiness and elongation index ofaggregates.
- Determine bulking of sand.
- Understand non-destructive testing procedures on concrete.

List of Experiments: At least 10 experiments must be conducted (at least one for each property)

1. Determination of normal Consistency and fineness of cement.
2. Determination of initial setting time and final setting time of cement.
3. Determination of specific gravity and soundness of cement.
4. Determination of compressive strength of cement.
5. Determination of grading and fineness modulus of Coarse aggregate by sieve analysis.
6. Determination of specific gravity of coarse aggregate
7. Determination of grading and fineness modulus of fine aggregate (sand) by sieve analysis.
8. Determination of bulking of sand.
9. Determination of workability of concrete by compaction factor method.
10. Determination of workability of concrete by slump test
11. Determination of workability of concrete by Vee-beetest.
12. Determination of compressive strength of cement concrete and its young's modulus
13. Determination of split tensile strength of concrete.
14. Non-Destructive testing on concrete (for demon

II Year – II Semester	REGULATION : RM21	L	T	P	C

List of Equipment:

1. Standard set of sieves for coarse aggregate and fine aggregate
2. Vicat's apparatus
3. Specific gravity bottle.
4. Lechatlier's apparatus.
5. Slump Test Apparatus.
6. Compaction Factor Test Apparatus.
7. Vee- Bee test apparatus
8. Longitudinal compresso-meter
9. Universal testing Machine (UTM)/Compression Testing Machine(CTM).
10. Rebound hammer, Ultrasonic pulse velocity machine, micro cover meteretc.

Reference:

1) Concrete Manual by M.L.Gambhir.

		0	**0**	**3**	**1.5**

SURVEYING FIELD WORK – II (Lab)

List of Experiments

1.Theodolite Survey: Determining the Horizontal and Vertical Angles by the method of repetition method.

2.Theodolite Survey: Finding the distance between two inaccessible points.

3.Theodolite Survey: Finding the height of far object.

4.Tachometric Survey: Heights and distance problems using tachometric principles.

5.One Exercise on Curve setting.

6.One Exercise on contours.

7.Total Station: Introduction to total station and practicing setting up, leveling up and elimination of parallax error.

8.Total Station: Determination of area using total station.

9.Total Station: Traversing

10.Total Station: Contouring

11.Total Station: Determination of Remote height.

12.Total Station: distance between two inaccessible points.

Note: Any 10 field work assignments must be completed

II Year – II Semester	**REGULATION : RM21**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

List of Experiments

1. Calibration of Venturi meter & Orifice meter
2. Determination of Coefficient of discharge for a small orifice and mouth piece by a constant head and variable head method.
3. Calibration of contracted Rectangular Notch and /or Triangular Notch
4. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
5. Verification of Bernoulli's equation.
6. Impact of jet on vanes
7. Study of Hydraulic jump.
8. Performance test on Pelton wheel turbine
9. Performance test on Francis turbine.
10. Efficiency test on centrifugal pump.
11. Efficiency test on reciprocating pump.

List of Equipment:

1. Venturi meter setup.
2. Orifice meter setup.
3. Small orifice setup.
4. External mouth piece setup.
5. Rectangular and Triangular notch setups.
6. Friction factor test setup.
7. Bernoulli's theorem setup.
8. Impact of jets.
9. Hydraulic jump test setup.
10. Pelton wheel, Francis turbine and Kalpan turbines
11. Centrifugal and Reciprocating pump

II Year – II Semester	REGULATION : RM21	L	T	P	C
		1	0	2	2
SKILL ORIENTED COURSE-II					

1. Environmental Audit and Compliance Report

Or

2. Road safety audit with 1 or 2 KM length

Or

3. Water related leakage field studies

III Year – I Semester	REGULATION : RM21 PROFESSIONAL CORE COURSE	L	T	P	C
		3	0	0	3
STRUCTURAL ANALYSIS					

Course Learning Objectives:

- To give preliminary concepts of assessment of bending moment and shear force in Propped cantilevers, fixed beams and continuous beams due to various loadingconditions.
- To impart concepts of Bending Moment and Shear force for beams with different boundary and loading conditions.
- The procedure for development of slope deflection equations and to solve application to continuous beams with and without settlement of supports.
- The concepts of moving loads and influence lines are imparted for assessmentof maximum SF and BM at a given section when loads of varying spans rolling loads ofPratt and Warren trusses.

Course Outcomes:

Upon successful completion of this course the student will be able to,

CO1.Distinguish between the determinate and indeterminate structures.

CO2.Identify the behavior of structures due to the expected loads, including the moving

loads, acting on the structure.

CO3.Estimate the bending moment and shear forces in beams for different fixity conditions.

CO4.Analyze the continuous beams using various methods -, three moment method, slope deflection method, energy theorems. Analyze the loads in Pratt and Warren trusses when loads of different types and spans are passing over the truss

CO5.Draw the influence line diagrams for various types of moving loads on beams/bridges.

SYLLABUS:

UNIT – I Propped Cantilever and Fixed beams

Propped Cantilevers: Introduction -Degree of Static and Kinematic indeterminacy of Beams, frames and trusses. Analysis of propped cantilevers-shear force and bending moment diagrams-Elastic curve - Deflection of propped cantilever beams.
Fixed Beams – Introduction to statically indeterminate beams with U. D. load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - shear force and Bending moment diagrams-Elastic curve - Deflection of fixed beams including effect of sinking of support, effect of rotation of a support.

UNIT – II Analysis of Continuous beams and Portal Frames

Slope-Deflection Method: Introduction, derivation of slope deflection equation, application to continuous beams with and without settlement of supports. Analysis of Single bay single storey portal frames without sway. Shear force and Bending moment diagrams, Elastic curve.

Moment distribution method: Application to continuous beams with and without settlement of supports. Analysis of Single bay single storey portal frames without sway. Shear force and Bending moment diagrams, Elastic curve.

UNIT III Analysis of Pin-Jointed Plane Frames: Determination of Forces in members of plane pin-jointed (determinate) perfect trusses by (i) method of joints (ii) method of sections and (iii) Method of Tension coefficients. Analysis of various types of cantilever and simply supported trusses by method of joints, method of sections and Tension coefficients**.**

UNIT – IV Moving Loads And Influence Lines: Introduction maximum SF and BM at a given section and absolute maximum S.F. and B.M due to single concentrated load, U. D load longer than the span, U. D load shorter than the span, two point loads with fixed distance between them and several point loads-Equivalent uniformly distributed load-Focal length.
Definition of influence line for SF, Influence line for BM- load position for maximum SF at a section-Load position for maximum BM at a sections, single point load, U.D. load longer than the span, U.D. load shorter than the span- Influence lines for forces in members of Pratt and Warren trusses.

UNIT – V MATRIX METHODS OF ANALYSIS: Introduction to Flexibility and Stiffness matrix methods of analyses using 'system approach' up to three degree of indeterminacy– Analysis of continuous beams including settlement of supports using flexibility and stiffness methods - Analysis of pin-jointed determinate plane frames using flexibility and stiffness methods- Analysis of single bay single storey portal frames using only stiffness method - Shear force and bending moment diagrams - Elastic curve.

Text Books:

1. Structural Analysis by R.C. Hibbeler, Pearson, New Delhi.
2. Basic Structural Analysis, K U Muthu et. al., IK International Publishing house pvt. Ltd.

References:

1. Indeterminate Structural Analysis, K U Muthu et. al., IK International Publishing house pvt. Ltd.
2. Analysis of Structures- Vol. I and II, V. N. Vazirani and M. M. Ratwani, Khanna
3. Publishers, New Delhi.
4. Mechanics of Structures Vol – II by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
5. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt. Ltd.
6. Structural Analysis: A Matrix Appr Approach, G.S.Pandit and S.P.Gupta, Mc Graw Hill Pvt. Ltd.

III Year – I Semester	REGULATION : RM21 PROFESSIONAL CORE COURSE	L	T	P	C
		3	0	0	3
DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES					

Course Learning Objectives:

The objective of this course is:

- Familiarize Students with different design philosophies
- Equip student with design of members in flexural and shear
- Understand bond and torsion
- Familiarize with design of compression members under different types of loading
- Understand different types of footings and design

Course Outcomes:

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

CO1.Work on different types of design methods
CO2. Carryout analysis and design of flexural members and detailing
CO3.Design structures subjected to shear, bond and torsion
CO4.Design different type of compression members
CO5.Design different type of footings

SYLLABUS:

UNIT –I Design Methods

Working stress method: Elastic theory: design constants, modular ratio, neutral axis depth and moment of resistance - balanced, under-reinforced and over-reinforced sections. Design of singly and doubly reinforced beams, IS Code Provisions.
Limit State Design: Basic statistical principles –Characteristic strength – Characteristic loads - Partial load and safety factors – stress-strain curves for HYSD bars and MS bars. Assumptions – stress block parameters – Moment of Resistance.

All units i.e. from unit II to unit V are to be taught in Limit State Design.

UNIT –II Design for Flexure and Shear: Design of singly reinforced beams- effective depth- Moment of Resistance- Doubly reinforced and flanged (T) beams- Minimum depth - Minimum and Maximum Flexural Tension Reinforcement - Design of Flanged Sections (T & L) - Effective width of flange - Analysis and Design Problems.
Design for Shear and Torsion: Analysis and design of sections for shear and torsion – bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing.

UNIT – III Slabs and Serviceability: Classification of slabs, design of one - way slabs, one waycontinuous slab using IS Coefficients (Conventional) –Design of two - way slabs - simply supported slabs and slabs with various edge conditions using IS Coefficients. Design of Stair case Limit state of serviceability: Deflection, cracking and IS code provisions for beams and slabs.

UNIT – 1V Design of Compression members: Effective length, Braced and un-braced columns – IS Code provisions, Design of short and long columns under axial loads, uniaxial bending and biaxial bending (Demonstration using SP 16)

UNIT –V

Footings: Types of footings – Design of isolated footings – pedestal, square, rectangular and circular footings subjected to axial loads, uni-axial bending moment.

NOTE: All the designs to be taught in Limit State Method Following plates

should be prepared bythe students.

1. Reinforcement detailing of T-beams, L-beams and continuous beams.
2. Reinforcement detailing of columns and isolated footings.
3. Detailing of one-way, two-way and continuous slabs and waist-slab staircase.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. Part A consists of two questions inDesign and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

Text Books:

1. Limit State Design, A. K.Jain, Nem Chand Brothers
2. Reinforced Concrete Structures, N. Krishna Raju & R. N. Pranesh, and New Age Publications.
3. Structural Design and Drawing by N.Krishna Raju, Universities Press

References:

1. R C C Design, B.C Punmia, A. K. Jain and A. K Jain. Lakshmi Publications
2. Reinforced Concrete Structures, S. Unnikrishna Pillai &Devdas Menon, Tata C.Graw Hill,NewDelhi.
3. Design of Reinforced concrete Structures, N.Subrahmanian, and Oxford University Press.
4. Limit state design of reinforced concrete structures by P C Varghese, PHI Learning pvt. Ltd.

III Year – I Semester	REGULATION : RM21 PROFESSIONAL CORE COURSE	L	T	P	C
		3	0	0	3
GEOTECHNICAL ENGINEERING-I					

Course Learning Objectives:

The Objectives of this course are:

1. To enable the student to determine the index properties of the soil and classify it.
2. To impart the concept of seepage of water through soils and determine the discharge of water through soils.
3. To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
4. To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

Course Outcomes:

Upon the successful completion of this course

CO1. The student must know the definition of the various quantities related to soil mechanics and establish their inter-relationships.

CO2. The student should be able to know the methods of determination of the various index properties of the soils and classify the soils.

CO3. The student should be able to know the importance of the different engineering properties of the soil such as compaction, permeability and determine themin the laboratory.

CO4. The student should be able to know the importance of consolidation and shear strength and determine themin the laboratory.

CO5. The student should be able to apply the above concepts in day-to-day civil engineering practice.

SYLLABUS:

UNIT – I

Introduction: Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass- volume relationship –Relative density

Index Properties of Soils: Grain size analysis – consistency limits and indices – Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.

UNIT –II

Permeability: Soil water – capillary rise – One dimensioned flow of water through soils – Darcy's law- permeability – Factors affecting –laboratory determination of coefficient of permeability – Permeability of layered systems.

Geostatic Stresses: Total, neutral and effective stresses –quick sand condition Seepage: 2-D flow and Laplace's equation-Seepage through soils–Flow nets: Characteristics and Uses**.**

UNIT – III

Stress Distribution In Soils: Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes– Newark's influence chart stress distribution method.

UNIT – IV

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties.

Consolidation: Compressibility of soils –e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (c_v) - Over consolidated and normally consolidated clays.

UNIT – V

Shear Strength of Soils: Basic mechanism of shear strength -Mohr – Coulomb Failure theories –Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination.

1. TEXT BOOKS:

1. Gopal Ranjan and A.S.R.Rao, "Basic and Applied Soil Mechanics", New Age InternationalPublishers.
2. V.N.S.Murthy, "Soil Mechanics and Foundation Engineering", CBS publishers
3. M.Palani Kumar, "Soil Mechanics", PHI Learning

REFERENCES:

1. D.W.Taylor, "Fundamentals of Soil Mechanics", Wiley.
2. Holtz and Kovacs, "An introduction to Geotechnical Engineering" Prentice Hall
3. Donald P. Coduto, Man-chu Ronald Young and William A. Kitch.

III Year – I Semester	REGULATION : RM21 OPEN ELECTIVE-I	L	T	P	C
		3	0	0	3
I . PYTHON PROGRAMMING					

Course Objectives: The Objectives of Python Programming are

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops& functions
- To be familiarized with general coding techniques and object-oriented programming

Course Outcomes:

- Develop essential programming skills in computer programming concepts like data types,containers
- Apply the basics of programming in the Python language
- Solve coding tasks related conditional execution, loops
- Solve coding tasks related to the fundamental notions and techniques used in object- oriented programming

SYLLABUS:

UNIT I

Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input From the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Data Types and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.

Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

UNIT II

Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and if else Statement ,Conditional Iteration, The While Loop ,Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.

UNIT III

List and Dictionaries: Lists, Defining Simple Functions, Dictionaries, Design with Function: Functions as Abstraction Mechanisms, Problem Solving with Top Down Design,Design with

Recursive Functions, Case Study Gathering Information from a File System, Managing a Program's Namespace, Higher Order Function., Modules: Modules, Standard Modules, Packages.

UNIT IV

File Operations: Reading config files in python, Writing log files in python, Understandingread functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(),Manipulating file pointer using seek, Programming using file operations . Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming usingOopssupportDesign with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism

UNIT V

Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions,User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions.GraphicalUser Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, CodingSimple GUI-Based Programs, Other Useful GUI Resources.Programming: Introduction to Programming Concepts with Scratch.

Text Books

1) Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
2) Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference Books:

1) Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
2) Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

e-Resources:

https://www.tutorialspoint.com/python3/python_tutorial.pdf

III Year – I Semester	REGULATION : RM21 OPEN ELECTIVE-I	L	T	P	C
		3	0	0	3

I I. INDUSTRIAL AUTOMATION AND R OBOTICS

Course Objectives:

COB1: To give students practice in applying their knowledge of mathematics, science, and Engineering and to expand this knowledge into the vast area of robotics.
COB2: The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning
COB3: Mathematical approach to explain how the robotic arm motion can be described.
COB4: The students will understand the functioning of sensors and actuators

Course Outcomes:

After successful completion of the course, the students should be able to
CO1. Identify the need of Robotics & Automation
CO2. Explain various components used in Industrial Robotics
CO3. Apply D-H convention to estimate kinematics of manipulator.
CO4. Analyze how to plan the trajectory for the robot and various robot programming methods
CO5. Develop robots for different manufacturing applications

SYLLABUS:

UNIT-I

INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – Need of Automation, Advantages & Disadvantages of automation, – classification by coordinate system and control system.

UNIT-II

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, Types of Gripper Mechanisms, Considerations in Gripper selection and design.

UNIT- III

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.
MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT- IV

General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.

UNIT-V

ROBOT ACTUATORS AND FEED BACK COMPONENTS: Actuators: Pneumatic, Hydraulic actuators, Comparison of Electruc, Hydraulic and pneumatic devices, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.
ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection, Introduction to Drones

Text Books:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.
3. Drones The Ultimate Guide/ Casey Publishing- Gray candle publishing.

References:

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall Principles of Heat Transfer – Frank Kreith, RM Manglik & MS Bohn, Cengage learning publishers.
3. Robot Analysis and Control / H. Asada and J.J.E. Slotine / BSP Books Pvt.Ltd. 4. Introduction to Robotics / John J Craig / Pearson Edu.

III Year – I Semester	REGULATION : RM21 OPEN ELECTIVE-I	L	T	P	C
		3	0	0	3

III. PRINCIPLES OF COMMUNICATIONS

Course Objectives:
This course will enable students to:
1. Understand the fundamentals of Signals and operations on analog signals.
2. Understand the fundamentals of Analog communication systems.
3. Understand the concepts in Angle modulation for the design of communication systems
4. Learn pulse modulation and sampling techniques
5. Learn various digital Modulation techniques used in Communication systems.

Course Outcomes:
At the end of the course, students will be able to:
CO1. Classify various types of signals and perform various operations on signals.
CO 2. Analyze the performance of analog modulation schemes in time and frequency domains.
CO 3. Analyze the performance of angle modulated signals.
CO 4. Analyze pulse amplitude modulation, pulse position modulation, pulse code modulation.
CO 5. Analyze various Digital Modulation Schemes.

SYLLABUS:

UNIT - I [12 Hrs]
Introduction to signals: Definition of Signals and Systems, Classification of Signals, Classification of Systems. Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling.

UNIT – II [12 Hrs]
Amplitude Modulation: Introduction to communication system, Need for modulation, Amplitude Modulation - Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, square law Modulator, Switching modulator, Detection of AM Waves; Square law detector, Envelope detector.

UNIT - III [12 Hrs]
Angle Modulation: Angle Modulation fundamentals, Frequency Modulation - Modulation index, Narrowband FM, Wideband FM, FM Modulator- Reactance Modulator FM demodulation- Slope detector, Phase Modulation, Frequency Modulation verses Amplitude Modulation.

UNIT-IV [12 Hrs]
Signal Sampling: Sampling, Sampling Theorem, Nyquist rate, Multiplexing Techniques
Analog Pulse Modulation: Pulse Amplitude Modulation, PulseWidth Modulation, Pulse Position Modulation.

UNIT - V [12 Hrs]

Elements of Digital Communication: Block diagram of Digital Communication, Advantages, Generation and reconstruction of PCM and DPCM.

Text books:

1. Principles of Communication Systems – H Taub & D. Schilling, GautamSahe, TMH, 2007, 3rdEdition.
2. Louis E. Frenzel, Principles of Electronic Communication Systems, 3rd Edition. Tata Mcgraw Hill.
3. K. Sam Shanmugam "Digital and Analog Communication Systems", Wiley India Edition, 2008.

References:

1. Communication Systems – B.P. Lathi, BS Publication,2006.
1. Principles of Communication Systems - Simon Haykin, John Wiley,2ndEdition.
2. Electronics & Communication System – George Kennedy and Bernard Davis,TMH 2004.
3. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH,2007.
4. Wayne Tomasi, Electronic Communications Systems, 5th Edition, Pearson Education.

III Year – I Semester	REGULATION : RM21 PROFESSIONAL ELECTIVE-I	L	T	P	C
		3	0	0	3

I. URBAN TRANSPORATION PLANNING

Course Learning Objectives:

The objectives of this course are:

1. To appreciate urban transportation problems and procedures for travel demand estimation

2. To appreciate data collection techniques for OD data.

3. To estimate trip generation, trip distribution, mode choice and traffic assignment.

4. To develop alternative urban transport network plans.

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

a. Estimate travel demand for an urban area

b. Plan the transportation network for a city

c. Identify the corridor and plan for providing good transportation facilities.

d. Evaluate various alternative transportation proposals.

SYLLABUS:

UNIT –I

Urban Transportation Problems & Travel Demand: Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach; Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

UNIT -II

Data Collection and Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

UNIT –III

Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models.

UNIT –IV

Mode Choice Analysis: Mode Choice Behaviour, Competing Modes, Mode Split Curves, Aggregate and Disaggregate Approaches; Discrete Choice Analysis, Choice sets, Maximum Utility, Probabilistic Models: Binary Logit, Multinomial Logit Model – IIA property; Aggregation. Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment.

UNIT –V

Corridor Identification, Plan Preparation & Evaluation: Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis; Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Pivot Point Analysis, Environmental and Energy Analysis; Case studies.

TEXT BOOKS:

1. 'Introduction to Urban System Planning' by Hutchinson, B.G., McGraw Hill.

2. 'Transportation Engineering - An Introduction' by Khisty C.J., Prentice Halls

3. 'Fundamentals of Transportation Planning' by Papa Costas, Tata McGraw Hill

REFERENCES:

1. 'Urban Transportation Planning: A Decision Oriented Approach' by Mayer M and Miller E, McGraw Hill

2. 'Introduction to Transportation Planning' by Bruton M.J., Hutchinson of London.

3. 'Metropolitan Transportation Planning' by Dicky, J.W., Tata McGraw Hill

4. 'Traffic Engineering and Transportation Planning' by Kadiyali L.R., Khanna Publishers, New Delhi.

III Year – I Semester	REGULATION : RM21 PROFESSIONAL ELECTIVE-I	L	T	P	C
		3	0	0	3

II. ADVANCED STRUCTURAL ANALYSIS

COURSE OUTCOMES:

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

CO1. Understand the basic concepts in structural analysis.

CO2. Analyse the statically indeterminate structures and displacement methods.

CO 3. Analyse the matrix concepts and matrix analysis of structures.

CO 4. Analyse the concepts of matrix analysis of structures with axial elements.

CO 5. Analyse the matrix analysis of beams and grid plane and space frames.

SYLLABUS:

UNIT – I (10H)

Basic concepts in structural analysis: Structure (structural elements, joints and supports, stability, rigidity and static indeterminacy, kinematic indeterminacy); loads (direct actions, indirect loading); response (equilibrium, compatibility, force-displacement relations);levels of analysis; analysis of statically determinate structures(trusses, beams, frames); applications of principle of virtual work and displacement-based and force-based energy principles; deriving stiffness and flexibility coefficients.

UNIT – II (10H)

A**nalysis of indeterminate structures:** Force methods: Statically indeterminate structures (method of consistent deformations; theorem of least work). Displacement Methods: Kinematically indeterminate structures (slope-deflection method; moment distribution method).

UNIT – III (10H)

Matrix concepts and Matrix analysis of structures: Matrix; vector; basic matrix operations; rank; solution of linear simultaneous equations; eigen values and eigen vectors. Introduction; coordinate systems; displacement and force transformation matrices; Contra-gradient principle; element and structure stiffness matrices; Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches.

UNIT – IV (10H)

Matrix analysis of structures with Axial Elements: Introduction: Axial stiffness and flexibility; stiffness matrices for an axial element (two dof), plane truss element (four dof) and space truss element (six dof); One-dimensional axial structures: Analysis by conventional stiffness method (two dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method; Plane trusses: Analysis by conventional stiffness method four dof per element) and reduced element stiffness method (single dof);Analysis by flexibility method; Space trusses: Analysis by conventional stiffness method (six dof per element) and reduced element stiffness method (single dof).

UNIT – V ` (10H)

Matrix analysis of beams and grids: Conventional stiffness method for beams: Beam element stiffness (four dof); generation of stiffness matrix for continuous beam; dealing with internal hinges, hinged and guided-fixed end supports; accounting for shear deformations; Reduced stiffness method for beams: Beam element stiffness (two dof); dealing with moment releases, hinged and guided-fixed end supports; Flexibility method for fixed and continuous beams: Force transformation matrix; element

Flexibility matrix; solution procedure flexibility matrix; solution procedure (including support movements); Stiffness method for grids: Introduction; torsional stiffness of grid element and advantage of torsion release; analysis by conventional stiffness method using grid element

with six dof; analysis by reduced stiffness method (three dof per element);

UNIT – VI (10H)

Matrix analysis of plane and space frames: Conventional stiffness method for plane frames: Element stiffness (six dof); generation of structure stiffness matrix and solution procedure; dealing with internal hinges and various end conditions; Reduced stiffness method for plane frames: Element stiffness (three dof); ignoring axial deformations; dealing with moment releases, hinged and guided fixed end supports; Flexibility method for plane frames: Force transformation matrix; elementflexibility matrix; solution procedure (including support movements); Ignoring axial deformations; Stiffness method for space frames: Introduction; element stiffness matrix of space frame element with 12 dof and 6 dof; coordinate transformations; analysis by reduced stiffness method (six dof per element)

Text Books:

1. Devdas Menon,"Advanced Structural Analysis", Narosa Publishing House, 2009.

2. Asslam Kassimali,"Matrix Analysis of Structures", Brooks/Cole Publishing Co., USA, 1999.

3. Amin Ghali,Adam M Neville and Tom G Brown,"Structural Analysis:A Unified Classical and Matrix Approach",SixthEdition, 2007, Chapman & Hall.

Reference Books:

1. Timoshenko & Young "Theory of Structure" Tata Mc Grew Hill.

2. Reddy, CS, "Basic Structural Analysis", Tata McGraw Hill.

3. Jain, OP and Jain, BK, "Theory & Analysis of Structures". Vol.I & II Nem Chand.

4. Vazirani & Ratwani et al , "Analysis of Structures", Khanna Publishers

5. NPTEL

III Year – I Semester	REGULATION : RM21 PROFESSIONAL ELECTIVE-I	L	T	P	C
		3	0	0	3

III. HIGHWAY ENGINEERING

Course Learning Objectives:

The objectives of this course are:

To impart different concepts in the field of Highway Engineering.

- To acquire design principles of Highway Geometrics and Pavements
- To learn various highway construction and maintenance procedures.

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

CO1: Plan highway network for a given area.

CO2: Determine Highway alignment and design highway geometrics

CO3: Design Intersections and prepare traffic management plans

CO4: Judge suitability of pavement materials and design flexible and rigid pavements

CO5: Construct and maintain highways.

SYLLABUS:

UNIT I

Highway Planning and Alignment: Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans – First, second, third road development plans, road development vision 2021, Rural Road Development Plan – Vision 2025;Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings andReports.

UNIT – II Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment-Design of Super elevation andExtra widening- Design of Transition Curves-Design of Vertical alignment-Gradients- Vertical curves.

UNIT – III Traffic Engineering: Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents- Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road

markings; Types of Intersections;At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method**.**

UNIT – IV, Highway Materials: Subgrade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Testsfor Road Aggregates – Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Requirements – Marshall Method of Mix Design.

UNIT – V, Design Of Pavements: Types of pavements; Functions and requirements of different components of pavements; Design Factors Flexible Pavements: Design factors – Flexible Pavement DesignMethods – CBR method – IRC method – Burmister method – Mechanistic method – IRC Method for Low volume Flexible pavements. Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method –Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.

Highway Construction and Maintenance: Types of Highway Construction – Earthwork; Construction ofEarth Roads, Gravel Roads, Water Bound Macadam Roads, Bituminous Pavements and Construction of Cement Concrete Pavements. Pavement Failures, Maintenance of Highways, pavement evaluation, strengthening of existing pavements**.**

TEXT BOOKS:

1. Highway Engineering, Khanna S. K., Justo C. E. G and Veeraragavan A, Nem Chand Bros., Roorkee.

2. Traffic Engineering and Transportation Planning, Kadiyali L. R, Khanna Publishers, New Delhi.

REFERENCES:

1. Principles of Highway Engineering, Kadiyali L. R, Khanna Publishers, New Delhi

2. Principles of Transportation Engineering, Partha Chakroborthy and Animesh Das, PHI Learning PrivateLimited, Delhi

3. Highway Engineering, Paul H. Wright and Karen K Dixon, Wiley Student Edition, Wiley India (P) Ltd.,New Delhi

4. Transportation Engineering - An Introduction, JotinKhisty C, Prentice Hall, Englewood Cliffs, New Jersey.

5. Traffic & Highway Engineering by Nicholas J. Garber, Lester A. Hoel, Fifth Edition, published in 2015,CENGAGE Learning, New Delhi.

6. Transportation Engineering and Planning, Papacostas C.S. and P.D. Prevedouros, Prentice Hall of IndiaPvt.Ltd; New Delhi.

7. Highway Engineering, Srinivasa Kumar R, Universities Press, Hyderabad

8. Practice and Design of Highway Engineering, Sharma S. K., Principles, S. Chand & Company PrivateLimited, New Delhi.

III Year – I Semester	REGULATION : RM21 PROFESSIONAL CORE COURSE LAB	L	T	P	C
		0	0	3	1.5
GEOTECHNICAL ENGINEERING LAB					

Learning Objectives:

The objective of this course is:

i. To determine the index properties for soil classification – Grain size distribution &Atterberg's limits.
ii. To determine the engineering properties – Permeability, Compaction, consolidation, shear strength parameters& CBR value.
    1. To find the degree of swelling by DFS test.
iii. To impart knowledge of determination of index properties required for classification of soils.
iv. To teach how to determine compaction characteristics and consolidation behavior fromrelevant lab tests; to determine permeability of soils.
v. To teach how to determine shear parameters of soil through different laboratory tests.

SYLLABUS:

LIST OF EXPERIMENTS

1. Specific gravity, G
2. Atterberg's Limits.
3. Field density-Core cutter and Sand replacement methods
4. Grain size analysis by sieving
5. Permeability of soil - Constant and Variable head tests
6. Compaction test
7. Consolidation test (to be demonstrated)
8. Direct Shear test
9. Triaxial Compression test
10. Unconfined Compression test
11. Vane Shear test
12. Differential free swell (DFS)
13. Field Plate Load Test demo
14. Field CBR demo

At least Eight experiments shall be conducted.

LIST OF EQUIPMENT:

1. Casagrande's liquid limit apparatus.
2. Apparatus for plastic and shrinkage limits
3. Field density apparatus for
    a) Core cutter method
    b) Sand replacement method
4. **Set of sieves: 4.75mm, 2mm, 1mm, 0.6mm, 0.42mm, 0.3mm, 0.15mm, and 0.075mm.**
5. Hydrometer
6. Permeability apparatus for

a) Constant head test

b) Variable head test

7. Universal auto compactor for I.S light and heavy compaction tests.
8. Shaking table, funnel for sand raining technique.
9. Apparatus for CBR test
10. 10 tons loading frame with proving rings of 0.5 tons and 5 tons capacity
11. One dimensional consolation test apparatus with all accessories.
12. Triaxial cell with provision for accommodating 38 mm dia specimens.
13. Box shear test apparatus
14. Laboratory vane shear apparatus.
15. Hot air ovens (range of temperature 50^0 - 150^0C)

References:

1. 'Determination of Soil Properties' by J. E. Bowles.
2. **IS Code 2720 – relevant parts.**

III Year – I Semester	REGULATION : RM21 PROFESSIONAL CORE COURSE LAB	L	T	P	C
		0	0	3	1.5
HIGHWAY ENGINEERING –LAB					

Course Learning Objectives:

The objectives of this course are:

1. To test crushing value, impact resistance, specific gravity and water absorption, attrition value, abrasion value, flakiness index and elongation index for the given road aggregates.
2. To know penetration value, ductility value, softening point, flash and fire point, viscosity and stripping for the given bitumen grade.
3. To test the stability for the given bituminous mix
4. To carry out surveys for traffic volume, speed and parking.

Course outcomes:

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

a. Test aggregates and judge the suitability of materials for the road construction
b. Test the given bitumen samples and judge their suitability for the road construction
c. Obtain the optimum bitumen content for Bituminous Concrete
d. Determine the traffic volume, speed and parking characteristics.
e. Draw highway cross sections and intersections.

SYLLABUS:

I. ROAD AGGREGATES:

1. Aggregate Crushing value Test
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption Test
4. Attrition Test
5. Abrasion Test.
6. Shape tests

II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test
6. Viscosity Test.

III. BITUMINOUS MIX:

1. Marshall Stability test.

IV. TRAFFIC SURVEYS:

1. Traffic volume study at mid blocks.
2. Traffic Volume Studies (Turning Movements) at intersection.
3. Spot speed studies.
4. Parking study.

V. DESIGN & DRAWING

1. Earthwork calculations for road works
2. Drawing of road cross sections
3. Rotary intersection design

LIST OF EQUIPMENT:

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers
4. Los angles Abrasion test machine
5. Deval's Attrition test machine
6. Elongation and thickness gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup.
9. Ring and ball apparatus
10. Viscometer.
11. Marshal Mix design apparatus.
12. Enoscope for spot speed measurement.
13. Stop Watches

TEXT BOOKS:

1. 'Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veeraraghavan, Neam Chan Brothers New Chand Publications, New Delhi.
2. Highway Material Testing & Quality Control by Rao Wiley India pvt. Ltd., Noida, New Delhi

REFERENCE BOOKS:

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.

III Year – I Semester	REGULATION: RM21	L	T	P	C
		3	0	0	1.5
PYTHON PROGRAMMING LAB					

Course Objectives: The Objectives of Python Programming are

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops & functions
- To be familiarized with general coding techniques and object-oriented programming

Course Outcomes:

- Develop essential programming skills in computer programming concepts like data types, containers
- Apply the basics of programming in the Python language
- Solve coding tasks related conditional execution, loops
- Solve coding tasks related to the fundamental notions and techniques used in object- oriented programming

List of Experiments:

1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
2) Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
3) Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89.
4) Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.
5) Use a *for* loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.

```
*
**
***
****
```

6) Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
7) Write a program that asks the user for two numbers and prints *Close* if the numbers are within .001 of each other and Not close otherwise.
8) Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
9) Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. Ifthey are not, the program should print an appropriate message and exit.
10) If they are of the samelength, the program should alternate the characters of the two strings. For example, if the user enters *abcde* and *ABCDE* the program should print out *AaBbCcDdEe*.
11) Write a program that asks the user for a large integer and inserts commas into it

according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be 1,000,000.

12) In algebraic expressions, the symbol for multiplication is often left out, as in 3x+4y or 3(x+5). Computers prefer those expressions to include the multiplication symbol, like 3*x+4*y or 3*(x+5). Write a program that asks the user for an algebraic expression and then inserts multiplication symbols where appropriate.

13) Write a program that generates a list of 20 random numbers between 1 and 100.
    (a) Print the list.
    (b) Print the average of the elements in the list.
    (c) Print the largest and smallest values in the list.
    (d) Print the second largest and second smallest entries in the list
    (e) Print how many even numbers are in the list.

14) Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.

15) Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in [1,0,1,1,0,0,0,0,1,0,0] is 4.

16) Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0].

17) Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements,it is much shorter with lists and it is also easier to add new conversions if you use lists.

18) Write a function called *sum_digits* that is given an integer num and returns the sum of the digits of num.

19) Write a function called *first_diff* that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.

20) Write a function called *number_of_factors* that takes an integer and returns how many factors the number has.

21) Write a function called *is_sorted* that is given a list and returns True if the list is sorted and False otherwise.

22) Write a function called root that is given a number x and an integer n and returns $x^{1/n}$. In the function definition, set the default value of n to 2.

23) Write a function called primes that is given a number n and returns a list of the first n primes. Let the default value of n be 100.

24)Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.

a) Do this using the sort method. (b) Do this without using the sort method.Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.

25)Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.

26)Write a program that reads a list of temperatures from a file called *temps.txt*, converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.

27)Write a class called Product. The class should have fields called name, amount, and price, holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price* that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase* that receives the number of items to be bought and decreases amount by that much.

28)Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes* that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called *convert_to_hours* that returns a string of hours, minutes, and seconds formatted analogously to the previous method.

29)Write a class called Converter. The user will pass a length and a unit when declaring an object from the class—for example, c = Converter(9,'inches'). The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call c.feet() and should get 0.75 as the result.

30)Write a Python class to implement pow(x, n)..

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III Year – I Semester	REGULATION : RM21 *Mandatory Course (AICTE Suggested):*	L	T	P	C
		2	0	0	0
PROFESSIONAL ETHICS AND HUMAN VALUES					

Course Objectives: To give basic insights and inputs to the student to inculcate Human values to grow as responsible human beings with proper personality. Professional Ethics instills the student to maintain ethicalconduct and discharge their professional duties.

Course Outcomes: It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.

It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.

UNIT I: Human Values:

Morals, Values and Ethics – Integrity –Trustworthiness - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation –Commitment – Empathy – Self-confidence – Spirituality- Character.

Principles for Harmony:

Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – FundamentalDuties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT II: Engineering Ethics and Social Experimentation*:*

History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism
—Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology-Types of Inquiry –Kohlberg's Theory - Gilligan's Argument –Heinz's Dilemma - Comparison with StandardExperiments — Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

UNIT III: Engineers' Responsibilities towards Safety and Risk:

Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk –Consequences - RiskAssessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/s Immediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT IV: Engineers' Duties and Rights:

Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality –Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining –Confidentiality - Gifts and Bribes -Problem solving-Occupational Crimes- Industrial Espionage Price Fixing-Whistle Blowing.

UNIT V: Global Issues:

Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics –Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics -Intellectual Property Rights. Related Cases Shall is dealt where ever necessary.

TEXT BOOKS:

1. Professional Ethics by R. Subramanian – Oxford Publications, New Delhi.

2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill –2003.

REFERENCE BOOKS:

3. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana - Maruthi Publications.

4. Engineering Ethics by Harris, Pritchard and Rabin's, Cengage Learning, New Delhi.

5. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd.,Noida.

6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumarPHI LearningPvt. Ltd – 2009.

7. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M.Jayakumaran – University Science Press.

III Year – II Semester	REGULATION : RM21 PROFESSIONAL CORE COURSE	L	T	P	C
		3	0	0	3
DESIGN AND DRAWING OF STEEL STRUCTURES					

Course Learning Objectives:

The objective of this course is to:

- Familiarize Students with different types of Connections and relevant IS codes
- Equip student with concepts of design of flexural members
- Understand Design of tension and compression members in trusses
- Familiarize students with types of Columns, column bases and their Design
- Familiarize students with Plate girder and Gantry Girder and their Design

Course Outcomes:

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

CO1: Work with relevant IS codes
CO2: Carryout analysis and design of flexural members and detailing
CO3: Design compression members of different types with connection detailing
CO4: Design Plate Girder and Gantry Girder with connection detailing
CO5: Produce the drawings pertaining to different components of steel structures

SYLLABUS

UNIT – I Types of structural steel – Mechanical properties of steel – Concepts of plasticity – yield strength -Loads and Stresses – Local buckling behaviour of steel. Concepts of limit State Design – Different Limit States Load combinations for different Limit states - Design Strengths-deflection limits – serviceability – stabilitycheck;
Connections: Design of Connections– Different types of connections – Bolted connections –Design strength efficiency of joint
Welded connections: Advantages and disadvantages - Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to in-plane moment acting in the plane and at right angles to the plane of the joints.

All units i.e. from unit II to unit-VI to be taught in Limit State Designand in Welded connections only.

UNIT – II

Plastic Analysis*;* Plastic moment – Plastic section modulus - Plastic analysis of continuous beams Beams: Allowable stresses, design requirements as per IS Code-Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, laterally unsupported beams**.**

UNIT III Compression and Tension Members: Effective length - Slenderness ratio – permissible stresses. Design of compression members, and struts. Built up compression members – Design of lacings and battens. Design Principles of Eccentrically loaded columns, Splicing of columns.
Roof Truss Element: Different types of trusses – Design loads – Load combinations as per IS Codes

–Design of simple roof trusses involving design of purlins, rafters and joints – tubular trusses.

UNIT – IV Design of Column Foundations: Design of slab base and gusseted base. Column bases subjected moment.

UNIT – V Design of Plate Girder: Design consideration – I S Code recommendations Design of plate girder - Welded – Curtailment of flange plates, stiffeners – splicing and connections. Design of **Gantry Girder**: impact factors - longitudinal forces, Design of Gantry girders.

NOTE: Welding connections should be used in Units II – VI. The students should prepare thefollowing plates.
Plate 1 Detailing of simple beams,
Plate 2 Detailing of Compound beams including curtailment of flange plates.
Plate 3 Detailing ofColumn including lacing and battens,
Plate 4 Detailing of Column bases – slab base and gusseted base,
Plate 5 Detailing of steel roof trusses including joint details and
Plate 6 Detailing of Plate girder including curtailment, splicing and stiffeners.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. Part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part-B is 60%.

TEXT BOOKS

1. Steel Structures Design and Practice, N. Subramanian, Oxford University Press.
2. Limit State Design of steel structures, S. K. Duggal, Tata Mc Graw Hill, New Delhi

REFERENCES

1. Structural Design in Steel, SarwarAlamRaz, New Age International Publishers, New Delhi
2. Structural Design and Drawing by N.Krishna Raju, Universities Press
3. Design of Steel Structures by K.S.Sai Ram, Person India Education Services

IS Codes:

1) IS-I800:2007, Indian Standard Code for General Construction in Steel, 3rd revision, Indian Standards Institution, New Delhi, 2008.
2) IS – 875, Code of practice for design loads (other than earth quake) for buildings and structures (Part-1-Part 5), Bureau of Indian standards.
3) Steel Tables.

Note: These codes and steel tables are permitted to use

in the examinations.

III Year – II Semester	REGULATION : RM21 PROFESSIONAL CORE COURSE	L	T	P	C
		3	0	0	3
WATER RESOURCES ENGINEERING-I					

Course Learning Objectives:

The course is designed to make the students,

1. Estimate irrigation water requirements.
2. Design irrigation canals
3. Understand hydrologic cycle and its relevance to Civil engineering.
4. Learn physical processes and their interactions in hydrology.
5. Learn measurement and estimation of the components of hydrologic cycle.
6. Have an overview and understanding of Hydrographs.

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Course Outcomes:

At the end of the course the students are expected to

CO1:Have a thorough understanding of the theories and principles governing the hydrologic processes.

CO2:Be able to quantify hydrologic components and apply concepts in hydrologic design of water resourcesprojects.

CO3:Develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.

CO4:Develop design storms and carry out frequency analysis.

CO5:Develop flow mass curve and flow duration curve, apply hydrograph analysis in the design of waterresources projects.

SYLLABUS:

UNIT – I

Irrigation: Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation.

UNIT--II

Canals: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals -Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting.

Diversion Head Works: Types of diversion head works, weirs and barrages, layout of diversion

headworks, components. Causes and failures of weirs on permeable foundations, Bligh's creep theory,

Khosla's theory, design of impervious floors for subsurface flow, exit gradient.

UNIT-III

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

Precipitation: Types and forms, measurement, introduction to radar measurement of rain fall, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm.

UNIT-IV

Abstractions: Initial abstractions, Evaporation: factors affecting, measurement, estimation, reduction, **Evapotranspiration**: factors affecting, measurement, estimation, control, Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices.

Runoff: Factors affecting runoff, components, empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

UNIT-V

Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, dimensionless unit hydrograph, synthetic unit hydrograph, introduction to IUH.

TEXTBOOKS:

1. 'Irrigation and Waterpower Engineering' by Punmia B C, P.B.B Lal, A.K. Jain and A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi
2. 'Irrigation Water Resources and Waterpower Engineering' by Modi P N (2011), Standard Book House, New Delhi
3. 'Engineering Hydrology' by Subramanya, K, Tata McGraw-Hill Education Pvt Ltd, (2013), New Delhi.
4. 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi
5. 'Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013).
6. 'Hydrology and Water Resources Engineering' by Patra K.C., Narosa Publications, (2011).

REFERENCES:

1. 'Water Resources Engineering' by Mays L.W (2013), Wiley India Pvt. Ltd, New Delhi.
2. 'Irrigation Engineering' by Sharma R.K. and Sharma, T. K (2012), S. Chand & Co Publishers.
3. 'Water Resources Engineering' by Satyanarayana Murthy Challa (2008), New Age International Publishers

IV Year – I Semester	REGULATION : RM21 PROFESSIONAL CORE COURSE	L	T	P	C
		3	0	0	3

I. GEOTECHNICAL ENGINEERING-II

Course Objectives:

The objectives of the course are to

- impart the concept of difference methods of soil exploration
- familiarize the students about the fundamental concepts of earth retaining structures
- introduce the concepts of bearing capacity of soils
- make students understand pile foundations
- impart the concepts of well foundation

Course Outcomes:

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

CO1. Explain the methods of soil exploration.

CO 2. Calculate the lateral earth pressure on retaining walls.

CO 3. Compute the bearing capacity and settlement of shallow foundations.

CO 4. Calculate the pile load capacity based on soil properties and load tests.

CO 5. Select the suitable type of well foundation and carryout the design calculations.

SYLLABUS:

UNIT – I (8H)

Soil Exploration: Need and Methods of soil exploration – Boring and Sampling methods – Field tests – Penetration Tests – Pressure meter –SPT, Dilatometer test, Planning of Soil exploration and preparation of soil investigation report.

UNIT – II (8H)

Earthen and Earth-Retaining Structures: Infinite and finite soilslopes in sand and clay – types of failures – factor of safety of infinite slopes – stability analysis by SAM– Taylor's Stability Number-Stability of slopes of dams and embankments - different conditions. Rankine's& Coulomb's theory of earth pressure – Culmann's graphical method – Earth pressures in layered soils, Earth structure, Earth pressure, Earth retaining structures, Types of retaining walls and designing

UNIT-III (10H)

Shallow Foundations Types of foundations and factors to be considered in their location - Bearing capacity – criteria for determination of bearing capacity – effect of water table, factors influencing bearing capacity – analytical methods to determine bearing capacity – Terzaghi's theory - IS Method. safe bearing capacity and settlement from plate load test – Types of foundation settlements and their determination - allowable settlements of structures.

UNIT -IV (8H)

Pile Foundation: Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae– Pile load tests - Load carrying capacity of pile groups, settlement in sands and clays.

UNIT –V (9H)

Well Foundations: Types – Different types of well foundation and theircomponents– Components of well – functions – forces acting on well foundations - Design Criteria – Determination of steining thickness and plug - construction and sinking of wells – Tilt and shift- remedial measures.

Text Books:

1. 'Principles of Foundation Engineering 'by Das, B.M., -–8th edition, (2017) (Indian edition), Cengage learning'
2. Basic and Applied Soil Mechanics' by GopalRanjan & ASR Rao, 3rd edition, (2016), New Age International Pvt. Ltd,

Reference Books:

1. 'Theory and Practice of Foundation Design' by N.N.SOM & S.C.DAS (2003), 8th printing, 2015, PHI Learning Private limited,.
2. Foundation Analysis and Design 'by Bowles, J.E., (2001) – 5th Edition, McGraw-Hill Publishing Company, Newyork.

III Year – II Semester	REGULATION : RM21 OPEN-ELECTIVE -II	L	T	P	C
		3	0	0	3

I. OOPS THROUGH JAVA

Course Objectives:

1. Understanding the OOP's concepts, classes and objects, threads, files, applets, swings and act.
2. This course introduces computer programming using the JAVA programming language with object-oriented programming principles.

Course Outcomes:

CO1: Understand Java programming concepts and
CO2: utilize Java Graphical User Interface in Program writing.
CO3: Write, compile, execute a Java programming for networking concepts.
CO4: troubleshoot Java programming for networking concepts
CO5: Build Java Application for distributed environment.

SYLLABUS:

UNIT I
Introduction to OOP, procedural programming language and object oriented language, principles of OOP, applications of OOP, history of java, java features, JDK, JVM, program structure. Variables, primitive data types, identifiers, literals, operators, expressions, precedence rules and associatively, primitive type conversion and casting, flow of control.

UNIT II
Arrays, command line arguments, Classes and objects, class declaration, creating objects, methods, constructors and constructor overloading, garbage collector, importance of static keyword and examples, this keyword, nested classes.

UNIT III
Inheritance, types of inheritance, super keyword, final keyword, overriding and abstract class. Interfaces, creating the packages, using packages, importance of CLASSPATH and java.lang package. Exception handling, importance of try, catch, throw, throws and finally block, user defined exceptions, Assertions.

UNIT IV
Multithreading: introduction, thread life cycle, creation of threads, thread priorities, thread synchronization, communication between threads. Reading data from files and writing data to files, random access file

UNIT V
Introduction to Java FX, AWT: introduction, components and containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Container class, Layouts, Menu and Scrollbar.

Text Books:
1. The complete Reference Java, 8th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford.
3. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.

Reference Books:

1. Swing: Introduction, JFrame, JApplet, JPanel, Componets in Swings, Layout Managers in
2. Swings, JList and JScrollPane, Split Pane, JTabbedPane, JTree, JTable, Dialog Box.

III Year – II Semester	REGULATION : RM21 OPEN-ELECTIVE -II	L	T	P	C
		3	0	0	3

II. OPERATIONS RESEARCH

Course Objectives:
To learn the importance of Operations Research in the design, planning, scheduling, manufacturing and business applications and to use the various techniques of Operations Research in solving such problems.

Course outcomes:
After successful completion of the course, the students will be able to
CO1. Solve Liner Programming Problems.
CO2. Estimate Optimal Solution for Transportation, Assignment Problems and
CO3. Apply sequencing principles to allocate jobs on different machines and Identify best replacement period for machines.
CO4. Solve Game theory Problems and estimate service times in queuing models
CO5. Model the Project Management Problems through CPM and PERT

SYLLABUS
UNIT – I
INTRODUCTION TO O.R.: Development – definition– characteristics and phases – types of operation research models – applications.
LINEAR PROGRAMMING: Problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method, duality principle.

UNIT – II
TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem.
ASSIGNMENT PROBLEM – Formulation – optimal solution - variants of assignment problem-traveling salesman problem.

UNIT – III
SEQUENCING – Introduction – flow –shop sequencing – n jobs through two machines – n jobs through three machines – job shop sequencing – two jobs through 'm' machines.
REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT – IV
THEORY OF GAMES: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.
WAITING LINES: Introduction – single channel – poison arrivals – exponential service times – with infinite population and finite population models– multichannel – poison arrivals – exponential service times with infinite population single channel poison arrivals.

UNIT – V
NETWORK ANALYSIS: Project planning, scheduling and controlling – tools for project management – critical path method – programme evaluation and review technique (PERT) – cost analysis and crashing – resource leveling – updating.

Text Books:

1. Operations Research-An Introduction/Hamdy A Taha/Pearson publishers
2. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd
3. Operations Research – Quantitative Techniques for Management, S Chand & Sons, 2018.

References:

1. Introduction to O.R/Hiller & Libermann/TMH
2. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.
3. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman/Wiley
4. Operations Research / R.Pannerselvam/ PHI Publications.
5. Operations Research / Wagner/ PHI Publications.
6. Operation Research /J.K.Sharma/MacMilan Publ.
7. Operations Research/ Pai/ Oxford Publications
8. Operations Research/S Kalavathy / Vikas Publishers
9. Operations Research / DS Cheema/University Science Press
10. Operations Research / Ravindran, Philips, Solberg / Wiley publishers

III Year – II Semester	REGULATION : RM21 OPEN-ELECTIVE -II	L	T	P	C
		3	0	0	3

III. MICRO CONTROLLERS AND APPLICATIONS

Objectives:

The main objectives of this course are

1. Give an understanding about the concepts and basic architecture of 8051.
2. Provide background knowledge and core expertise in microcontroller.
3. Study the architecture and addressing modes of 8051.
4. Impart knowledge about assembly language programs of 8051.
5. Help understand the importance of different peripheral devices & their interfacing to 8051.
6. Impart knowledge of different types of external interfaces including LEDS, LCD, Keypad,Switches.

Course Outcomes:

After going through this course, the student

CO1. Understand the architecture of micro controller

CO2. Understand the programming model of micro controllers

CO3. Acquire the knowledge of Real time control using Interrupts

CO4. Analyze the knowledge of Real time control using Timers

CO5. Gain the knowledge on Interfacing of different devices

SYLLABUS

UNIT I [12Hrs]

OVERVIEW OF ARCHITECTURE AND MICROCONTROLLER RESOURCES

Architecture of a microcontroller –Microcontroller resources- Resources in advanced and next generation microcontrollers –8051microcontroller–Internaland External memories–Counters and Timers - Interrupts.

UNIT II [12Hrs]

8051 FAMILYMICROCONTROLLERS INSTRUCTION SET

Basic assembly language programming, Data transfer instructions–Data and Bit-manipulation instructions–Arithmetic instructions –Instructions for Logical operations on the Registers, Internal RAM, and SFRs–Program flow control instructions–Interrupt control flow.

UNIT III [12Hrs]

REAL TIME CONTROL INTERRUPTS

Interrupt handling structure of an MCU – Interrupt Latency and Interrupt deadline – Multiple sources of the interrupts–Non-maskable interrupt sources–Enabling or disabling of the sources–Polling to determine the interrupt source and assignment of the priorities among them– Interrupt structure in Intel 8051.

UNIT IV [12Hrs]

REALTIMECONTROL TIMERS

Programmable Timers in the MCU's–Free running counter and real time control

UNIT V [12Hrs]

SYSTEMS DESIGN_DIGITAL AND ANALOG INTERFACING METHODS

Switch Keypad and Keyboard interfacings-LED and Array of LEDs –Keyboard-cum-Display controller (8279)–Alphanumeric Devices–Display Systems and its interfaces.

Text Books :

1. Microcontrollers Architecture, Programming, Interfacing and System Design–Raj Kamal Pearson Education, 2005.
2. The 8051 Microcontroller and Embedded Systems–Mazidi and Mazidi, PHI, 2000.
3. Microcontrollers [theory and Applications] –Ajay V Deshmukh, TMH,2005

References:

1. Microcontrollers (Theory & Applications) –A.V. Deshmuk, WTMH, 2005.
2. Design with PIC Microcontrollers–John B. Peatman, Pearson Education, 2005.
URL: https://www.youtube.com/watch?v=2-geyR_aM28

III Year – II Semester	REGULATION : RM21 PROFESSIONAL ELECTIVE-II	L	T	P	C
		3	0	0	3
I.ENVIRONMENTAL ENGINEERING					

Course Objectives:

1. Outline planning and the design of water supply systems for a community/town/city
2. Provide knowledge of water quality requirement for domestic usage
3. Impart understanding of importance of protection of water quality and enlightens the efforts involved in converting raw water into clean potable water.
4. Selection of appropriate water distribution systems.
5. Impart knowledge on design of water distribution network

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

CO1. Plan and design the water and distribution networks and sewerage systems.

CO2. Identify suitable treatment flow for water treatment for drinking purpose.

CO3. Design a water distribution system appropriate to the requirements of a area.

CO4. Identify the characteristics of waste water.

CO5. Select suitable treatment flow for sludge treatments.

SYLLABUS

UNIT – I (10 Hours)

Introduction: Importance and Necessity of Protected Water Supply systems, water demand, Population forecasts, design period –factors affecting – fluctuations – fire demand – storage capacity –water quality and testing – drinking water standards. **Quality and Analysis of Water**: Physical, Chemical and Biological-Analysis of Water – Physical, Chemical and Biological characteristics.

UNIT – II (10 Hours)

Treatment of Water: Layout and general outline of water treatment units –Sedimentation – principles – design factors – coagulation - flocculation clarifier design –coagulants – feeding arrangements. Filtration – theory – working of slow and rapid gravity filters – disinfection – theory of disinfection, chlorination and other disinfection practices- Softening of Water, Removal of color and odours - Iron and manganese removal – Adsorption-fluoridation and deflouridation–aeration–Reverse Osmosis-Ion exchange–Ultra Filtration

UNIT – III (12 Hours)

Distribution Systems: Requirements- Methods of Distribution system, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods service reservoirs. **Introduction to Sanitation** – Systems of sanitation –sewerage – classification of sewerage systems- Estimation of sewage flow and storm water drainage – fluctuations – types of sewers - Hydraulics of sewers and storm drains– design of sewers

UNIT – IV (10 Hours)

Sewage characteristics – Sampling and analysis of wastewater - Physical, Chemical and Biological Examination-Measurement of BOD and COD - BOD equations

Treatment of sewage: Primary treatment- design of preliminary and primary treatment units. Secondary treatment: Aerobic and anaerobic treatment process comparison. Suspended growth process: Activated Sludge Process, principles, designs, and operational problems, modifications of Activated Sludge Processes, Oxidation ponds, Aerated Lagoons.

UNIT – V (10 Hours)

Attached Growth Process: Trickling Filters–mechanism of impurities removal- classification–design-operation and maintenance problems. Rotating Biological Contactors, Fluidized bed reactors

Miscellaneous Treatment Methods: Nitrification and Denitrification – Removal of Phosphates – Upflow Anaerobic Sludge Blanket - Membrane bioreactor (MBR) - Integrated Fixed-film Activated Sludge (IFAS) Technology - Anaerobic Processes: Septic Tanks and Imhoff tanks. FAB Reactors.

Bio-solids (Sludge) management: Characteristics-SVI, handling and treatment of sludge-thickening – anaerobic digestion of sludge, Sludge Drying Beds. Centrifuge. **Disposal of sewage**: Methods of disposal –-Oxygen Sag Curve

Note: one tutorial hour must be allocated for every 6 hours of lecture

Text Books:

1. Water Supply And Sanitary Engineering By G.S. Birdie, Dhanpat Rai Publishers, 8th Edition, 2014

2. Sewage Disposal And Air Pollution Engineering [Environmental Engineering] By S.K. Garg, Khanna Publishers, 33rd Edition, 2015

References Books:

1. Waste Water Treatment By M.N. Rao, Cbs Publishers,3rd Edition, 2018

2. Waste Water Engineering By Metcalfe & Eddy, McGraw-Hill Publishers, 27th Edition, 2015

3. Waste Water Treatment By Soli.J.Arceival, McGraw-Hill Publishers, 3rd Edition, 2015.

4. Environmental Engineering by Gerard Kiely, McGraw-Hill Publishers, 12th Edition, 2013

III Year – II Semester	REGULATION : RM21 PROFESSIONAL -ELECTIVE -II	L	T	P	C
		3	0	0	3

II. ROAD SAFETY ENGINEERING

Course Objectives:

1. This module on the fundamental of traffic engineering & some of the statistics methods to analysis the traffic safety.
2. The accident interrogations & risk involved with measures to identity the causes aredealt.
3. The role of road safety in planning the urban infrastructures design is discussed.
4. The various traffic management systems for safety & safety improvement strategies aredealt.

Course Outcomes:

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

CO1:To understand fundamental of Traffic Engineering
CO2: To investigate & determine the collective factors & remedies of accident involved.
CO3: To design & planning various road geometrics.

CO4: To manage the traffic system from road safety point of view.
CO5: To lear mitigation measures.

SYLLABUS:

UNIT I

Introduction to Road Safety:

Road accidents, Trends, causes, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India. Multi-causal dynamic systems approach to safety; Crash Vs Accident; Road safety improvement strategies; Elements of a road safety plan, Safety data Needs; Safe vehicle design.

UNIT II

Statistical Interpretation and Analysis of Crash Data:

Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Case Studies.

UNIT III

Road Safety Audits:

Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies.

UNIT IV

Crash Reconstruction:

Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables

involved in pedestrian crashes, Case Studies.

UNIT V

Mitigation Measures:

Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law**.**

TEXT BOOKS:

1. Institute of Transportation Engineers (ITE), The Traffic Safety Toolbox: APrimer on Traffic Safety, ITE, 1999.
2. Towards Safe Roads in Developing country, TRL – ODA, 2004.

REFERENCES:

1. Athelstan Popkess, Traffic Control and Road Accident Prevention, Chapman andHall, 1997 (Digitized 2008)
2. Ezra Hauer, Observational Before-After Studies in Road Safety, PergamonPress, 1997 (reprinted 2002).
3. Geetam Tiwari and Dinesh Mohan, Transport Planning and Traffic Safety:MakingCities, Roads, and Vehicles Safer, CRC Press, 2016.

III Year – II Semester	REGULATION : RM21 PROFESSIONAL -ELECTIVE -II	L	T	P	C
		3	0	0	3

III. ENVIRONMENTAL IMPACT ASSESSMENT

Course Learning Objectives:

The objective of this course is:

1. To impart knowledge on different concepts of Environmental Impact Assessment
2. To know procedures of risk assessment
3. To learn the EIA methodologies and the criterion for selection of EIA methods
4. To know pre-requisites for ISO 14001certification
5. To know the procedures for environmental clearances and audit
6. To appreciate the importance of stakeholder participation in EIA

Course Learning Outcomes

Upon successful completion of this course, the students will be able to:

CO1: Prepare EMP, EIS and EIA report, estimate cost benefit ratio of a project
CO2: Selection of an appropriate EIA methodology
CO3: Evaluation of impacts on environment
CO4: Evaluation of risk assessment
CO5: Know the latest acts and guidelines of MoEF & CC

SYLLABUS:

UNIT-I:

Basic concepts of EIA: Elements of EIA-factors affecting EIA-Initial environmental Examination- lifecycle analysis preparation of Environmental Base map- Classification of environmental parameters – role of stakeholders in the EIA preparation – stages in EIA, Environmental economics, Cost/benefit Analysis -EIS and EMP. Identification of activities-application of remote sensing and GIS for EIA.

UNIT-II:

EIA Methodologies: Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad- hocmethods, matrix methods, Network method Environmental Media Quality Index method, overlay methods.

Impact of Developmental Activities and Land use: Introduction and Methodology for the assessmentof soil and ground water, Delineation of study area.

UNIT-III

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - E I A with reference to surface water, Air andBiological environment: Methodology for the assessment of Impacts on surface water environment, generalized approach for assessment of Air pollution Impact.

UNIT-IV: Assessment of Impact of development Activities on Vegetation and wildlife, Environmental Impact of Deforestation. Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment- Advantages of Environmental Risk Assessment

UNIT-V EIA: MoEF&CC Acts, Notifications and Guidelines: Provisions in the EIA notification, procedure for environmental clearance, and procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO14000. Environmental compliance reports. Case studies and preparation of EIA statement for various Industries.

Text Books:

1. Environmental Impact Assessment, Canter Larry W., McGraw-HilleducationEdi (1996)
2. Environmental Impact Assessment Methodologies, Y. Anjaneyulu, B. S.Publication,Sultan Bazar, Hyderabad.

References:

1. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke PrenticeHallPublishers
2. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. Katania&SonsPublication, New Delhi.
3. Environmental Pollution and Control, H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

III Year – ISemester	REGULATION: RM21 *Skill advanced course-I/ soft skill course*	L	T	P	C
		1	0	2	2
ADVANCED STAAD-PRO LAB					

List of Exercises:

1. Analysis of frame
2. Modeling of structure
3. Calculation and application on of dead and live loads on model
4. Calculation of wind load on model
5. Application of wind load on model
6. Calculation and application of seismic load on model
7. Design of the model
8. Creating beam and column detailing
9. Design of isolated footing
10. Design of pile cap

All **Ten** exercises shall be conducted.

Reference:

1. Analysis of Structural Elements by STAAD PRO by Raghunandan, STAAD PRO Beginners Publication, second edition, 2018

III Year -IISemester	REGULATION : RM21 PROFESSIONAL CORE COURSELAB	L	T	P	C
		0	0	3	1.5

BUILDING PLANNING ANDCOMPUTER ADIED LAB

Course Objective: Engineering drawing being the principal method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

EXPT– I

Objective: To introduce the students to use drawing instruments and to draw polygons, Engg.Curves.

Polygons: Constructing regular polygons by general methods, inscribing and describing polygons oncircles.

Curves: Parabola, Ellipse and Hyperbola by general and special methods, cycloids, involutes,tangents &normals for the curves.

Scales: Plain scales, diagonal scales and vernier scales

EXPT– II

Objective: To introduce the students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.

Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

EXPT– III

Objective: The objective is to make the students draw the projections of the plane inclined toboth theplanes.

Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to theother reference plane; inclined to both the reference planes.

EXPT– IV

Objective: The objective is to make the students draw the projections of the various types of solids indifferentpositions inclined to one of the planes.

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to both theplanes.

EXPT– V

Objective: The objective is to represent the object in 3D view through isometric views. The studentwillbe able to represent and convert the isometric view to orthographic view and vice versa.

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometricviews.
Computer Aided Design, Drawing practice using Auto CAD, Creating 2D&3D drawings of objectsusing Auto CAD.

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

III Year – II Semester	REGULATION : RM21	L	T	P	C
	PROFESSIONAL CORE COURSE LAB	0	0	3	1.5

EVIRONMENTAL ENGINEERING LAB

Course Learning Objectives:

The course will address the following:

- Estimation of important characteristics of water and wastewater in the laboratory
- Inference with reference to the significance of the characteristics of the water and wastewater

List of Experiments

1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.
2. Determination and estimation of Total Hardness–Calcium &Magnesium.
3. Determination ofAlkalinity/Acidity
4. Determination of Chloride in water and soil
5. Determination and Estimation of total solids, organic solids and inorganic solids and SettleableSolids by Imhoff Cone.
6. Determination of Iron.
7. Determination of Dissolved Oxygen with D.O. Meter &Wrinklers Method and BOD.
8. Determination of N, P, K values in solid waste
9. Physical parameters – Temperature, Color, Odor, Turbidity, Taste.
10. Determination of C.O.D.
11. Determination of Optimum coagulant dose- with and without coagulant aids
12. Determination of Chlorine residue and demand
13. Presumptive Coliformtest.

NOTE: Atleast 10 of the experiments enlisted are to be conducted.

List of Equipments

1) pH meter
2) Turbiditymeter
3) Conductivitymeter
4) Hot airoven
5) Mufflefurnace
6) Dissolved Oxygenmeter
7) U–V visiblespectrophotometer
8) COD RefluxApparatus
9) Jar TestApparatus
10) BOD Incubator
11) Autoclave
12) Laminar flowchamber
13) Hazen's Apparatus
14) Chlorocsope

Text Books

1. Standard Methods for Analysis of Water and Waste Water –APHA
2. Chemical Analysis of Water and Soil by KVSG Murali Krishna, ReemPublications, NewDelhi, 2010.

Reference

1. Relevant IS Codes.
2. Chemistry for Environmental Engineering by Sawyer and Mc.Carty.

III Year – II Semester	REGULATION : RM21 *Skill advanced course-II/ soft skill course/Computational Tools:*	L	T	P	C
		0	0	3	1.5
PROJECT MANAGEMENT SOFTWARE					

SOFTWARES: Primavera

List of Exercises:

1. Structuring Projects - Process Overview: Structuring Data in P6 EPPM - Setting Up the Organizational Breakdown Structure
2. Defining Resources and Roles
3. Setting Up The Work Breakdown Structure
4. Establishing Project Codes
5. User-Defined fields
6. Calendars
7. Setting Up the Enterprise Project Structure

Projects - Configuring Project Preferences - Project Templates

8. Implementing the Schedule

Activity Networks - the Activity Table and Grid View - Establishing Activity Codes – Gantt Charts Progress Spotlight Grouping and Sorting - Resources – Roles – Expenses – Activity Progress

9. Duration Types Constraints -Issues -Notebooks - Notebook Topics - Relationships Risks - Steps - Step Templates - Locations - Trace Logic - Budgets- Funding Sources - Earned Value- Milestones - Cost Accounts - Expenses
10. Managing the Schedule

Dates – Baselines - Critical Path Activities - Resource Leveling - Updating Progress - P6 Team Member Status Updates - The Apply Actuals Feature
All the above e-tools should be completed

References:

1. Oracle Primavera P6 User Guide Version 21 December 2021.
2. Primavera Project Manager for the Enterprise, Revision 4, September 2008, Custom for The University of North Carolina

III Year – II Semester	MANDATORY COURSE	L	T	P	C
		2	0	0	0
EMPLOYABILITY SKILLS					

Preamble: This course is introduced to enhance the soft and hard skills of students based on industry needsand helping the student to get the employment in the competitive industrial environment.

Course Objective: In this course the student should understand:

(i) Aptitude skill, (ii) Soft skills, (iii) Skills required for campus placement interview

Course Outcomes: After studying this course the student should able

(i)To solve aptitude and reasoning problems,

(ii) Apply the soft skills in dealing the issues related to Employability

(iii) Successful in getting employment in campus placement interview

SYLLABUS:

Unit 1: Aptitude

Numbers, HCF and LCM, Problems on ages, Averages, Ratio and Proportion, Percentages, Profit and Loss,Partnership, Interest calculations, Time and Work, Time and Distance, Pipes and Cisterns,Mensuration.

Reasoning:

Number and Letter Analogy, Coding and decoding, Odd Man out, Symbols and Notations, Permutations and Combinations, Probability, Data Interpretation, Data Sufficiency, Clocks and Calendars, Deductions, Logical Connectives, Venn Diagrams, Cubes, Binary Logic, Ordering and Sequencing, Blood relations – Syllogisms - Seating arrangement, Analytical Reasoning

Unit 2: Skills - I

Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. Goal Setting-Vision Vs Mission Vs Goals, SMART Technique to Goal Setting, SWOT Analysis. Self Esteem: Types of Self Esteem, Causes of Low Self Esteem, Merits of Positive Self Esteem and Steps to build a positive Self Esteem; Art of Compromise, Learn to Say: 'I Don't Know', Being organized, Showing Self-awareness, Self-Assessment for Attainable Career Objectives.

Attitude & Confidence: Attitude Vs Skills Vs Knowledge, Attitude Vs Behavior, Developing Positive Attitude and Confidence; Fear- Public Speaking, Steps to Overcome Fear, developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels, Adjusting Your Attitude-Arrogance has no Place in the Workplace,Cultural Sensitivity in the Workplace, Corporate Culture: Learning How to Fit In .Motivational Talk: Team Work, Team Vs Group, Stages in Team Building, Mistakes to avoid and Lessons to Learn**.**

Unit 3: Skills – II:

Interpersonal Communication: Interpersonal relations; communication models, process and Barriers; team communication; developing interpersonal relationships through effective Communication; essential formal writing skills; corporate communication styles – assertion, Persuasion, negotiation. Listening: Listening Vs Hearing, Possible reasons for why people do not Listen at times, Active Listening Vs Passive Listening, Listening effect on relationships. Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking. Group Discussion: Importance, Planning, Elements, Skills assessed; effectively disagreeing, Initiating, Summarizing and Attaining the Objective. On-Verbal Communication: Importance and Elements;

Body Language-Postures, gestures, eye contact.

Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills. Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. Etiquette and Manners: Socialand Business. Time Management –Concept, Essentials, Tips.

Unit 4: Personality Development: Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills. Decision-Making and Problem-Solving Skills: Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills. Conflict Management: Conflict - Definition, Nature, Types and Causes; Methods of Conflict Resolution

Stress Management: Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress. Leadership and Assertiveness Skills: A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behavior; Assertiveness Skills. Emotional Intelligence: Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance EmotionalIntelligence.

Unit 5: Group Discussions (GD):

Stages of a GD, GD Vs Debate, Skills assessed in a GD, Blunders to be avoided, Dos & Don’ts, GDPractice:

Conducting practice sessions and Brain Storming Sessions, Evaluation, feedback on their performanceResume Preparation: Resume Templates, Steps followed for resume preparation, Common mistakes in a resume; Covering letter Campus Placements Skills: Stages of Campus Placement, Skills assessed in Campus Placements, Changing scenario and its Challenges & How to get ready,

Motivational Talk on Positive Thinking: Beliefs, Thoughts, Actions, Habits & Results (Success);

Interview Skills: Types of Interview, Interviewer and Interviewee – in-depth perspectives; Before, during and after the Interview; Tips for Success, Dress code and Grooming, Dos & Don'ts, Skills assessed in an Interview,Mistakes to be avoided, How to equip oneself to excel; How to handle the

typical Interview Questions; Mock Interviews: Unconventional HR questions, Practice sessions with Feedback, Simulated Testing: Previous model papers of companies, Business Terminology: Financial Terms such as Debt, Equity, Share, Working Capital, Turnover, Net worth etc.; Vision, Mission, Objectives, Goals, Targets.

References:

1) B. K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2) S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
3) R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& CompanyLtd., 2018.
4) Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principlesand Practice,Oxford University Press, 2011.

IV Year – I Semester		L	T	P	C
		3	0	0	3
Estimation Specifications and Contract					

Course Learning Objectives:

The objective of this course is to enable the students to:

- Understand the quantity calculations of different components of thebuildings.
- Understand the rate analysis of different quantities of the buildingscomponents.
- Learn various specifications and components of thebuildings.

Course Outcomes:

Upon the successful completion of this course:

- The student should be able to determine the quantities of different components of buildings.
- The student should be in a position to find the cost of various buildingcomponents.
- The student should be capable of finalizing the value ofstructures.

SYLLABUS:

UNIT – I General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates –Approximate method of Estimating.

UNIT – II Rate Analysis – Working out data for various items of work over head and contingent charges.

UNIT-III Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

UNIT – IV Contracts – Types of contracts – Contract Documents – Conditions of contract, Valuation of buildings Standard specifications for different items of building construction.

UNIT-V Detailed Estimation of Buildings using individual wall and center line method

FINAL EXAMINATION PATTERN:

The end examination paper should consist of SIX questions from Unit 1 to Unit 4, out of which THREE are to be answered (60% weight-age) & ONE mandatory question (40% weight-age) from Units 5 & 6 is to be answered.

Text Books:

1. Estimating and Costing, B.N. Dutta, UBS publishers,2000.
2. Civil Engineering Contracts and Estimates, B. S. Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. Construction Planning and Technology, Rajiv Gupta, CBS Publishers & **Distributors Pvt. Ltd. NewDelhi.**
4. Estimating and Costing, G.S.Birdie.

References:

1. Standard Schedule of rates and standard data book, Public worksdepartment.
2. IS 1200 (Parts I to XXV-1974/ Method of Measurement of Building & Civil Engg Works –B.I.S.
3. Estimation, Costing and Specifications, M. Chakraborthi; Laxmipublications.
4. National BuildingCode

IV Year – I Semester		L	T	P	C
		3	0	0	3
Management Science					

OBJECTIVES:

- To familiarize with the process of management and to provide basic insight into select contemporary management practices
- To provide conceptual knowledge on functional management and strategic management.

OUTCOMES:

- After completion of the Course the student will acquire the knowledge on management functions, global leadership and organizational behavior.
- Will familiarize with the concepts of functional management project management and strategic management.

- **UNIT-1**

- Introduction to Management: Concept –nature and importance of Management –Generic Functions of Management – Evaluation of Management thought- Theories of Motivation – Decision making process- Designing organization structure- Principles of organization – Organizational typology- International Management: Global Leadership and Organizational behavior Effectiveness(GLOBE) structure

- **UNIT-2**

- Operations Management: Principles and Types of Management – Work study- Statistical Quality Control- Control charts (P-chart, R-chart, and C-chart) Simple problems- Material Management: Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis).

- **UNIT-3**

- Functional Management: Concept of HRM, HRD and PMIR- Functions of HR ManagerWage payment plans(Simple Problems) – Job Evaluation and Merit Rating – Marketing Management- Functions of Marketing – Marketing strategies based on product Life Cycle, Channels of distributions. Operationlizing change through performance management.

- **UNIT-4**

- Project Management: (PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems)

- **UNIT-5**

- Strategic Management: Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process – Environmental Scanning – SWOT analysis- Steps in Strategy Formulation and Implementation, Generic Strategy Alternatives. Global strategies, theories of Multinational Companies.

TEXT BOOKS:

1. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Management Science' Cengage, Delhi, 2012.
2. Dr. A. R. Aryasri, Management Science' TMH 2011.

REFERENCE BOOKS:

1. Koontz & Weihrich: 'Essentials of management' TMH 2011
2. Seth & Rastogi: Global Management Systems, Cengage learning , Delhi, 2011
3. Robbins: Organizational Behaviour, Pearson publications, 2011
4. Kanishka Bedi: Production & Operations Management, Oxford Publications, 2011
5. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications
6. Biswajit Patnaik: Human Resource Management, PHI, 2011
7. Hitt and Vijaya Kumar: Starategic Management, Cengage learning
8. Prem Chadha: Performance Management, Trinity Press(An imprint of Laxmi Publications Pvt. Ltd.) Delhi 2015.
9. Anil Bhat& Arya Kumar : Principles of Management, Oxford University Press, New Delhi, 2015.

IV Year – I Semester	REGULATION : RM21 PROFESSIONAL-ELECTIVE-III	L	T	P	C
		3	0	0	3

I. WATER RESOURCE ENGINEERING-II

Course Learning Objectives:

The course is designed to

introduce the types of irrigation systems

introduce the concepts of planning and design of irrigation systems

discuss the relationships between soil, water and plant and their significance in planning an irrigation system

understand design methods of erodible and non-erodible canals

know the principles of design of hydraulic structures on permeable foundations

know the concepts for analysis and design principles of storage and diversion head works

learn design principles of canal structures

Course Outcomes

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

CO1: able to estimate irrigation water requirements

CO2: ability to design irrigation canals and canal network

CO3:plan an irrigation system design irrigation canal structures

CO4: plan and design diversion head works analyse stability of gravity and earth dams

CO5: design ogee spillways and energy dissipation works

UNIT-I

Irrigation: Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation.

UNIT-II

Canals: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals -Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting.

Canal Structures:

Falls: Types and location, design principles of Sarda type fall and straight glacis fall.

Regulators: Head and cross regulators, design principles

Cross Drainage Works: Types, selection, design principles of aqueduct, siphon aqueduct and superpassage.

Outlets: types, proportionality, sensitivity and flexibility

UNIT-III

Diversion Head Works: Types of diversion head works, weirs and barrages, layout of diversion head works, components. causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient.

UNIT-IV

Reservoir Planning: Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation.

Dams: Types of dams, selection of type of dam, selection of site for a dam.

Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis, drainage galleries grouting.

UNIT-V

Earth Dams: Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters, stability analysis-stability of downstream slope during steady seepage and upstream slope during sudden drawdown conditions.

Spillways: Types, design principles of Ogee spillways, types of spillways crest gates. Energy dissipation below spillways-stilling basin and its appurtenances.

Text Books:

1. Garg, S.K (2015), "Irrigation Engineering and Hydraulic Structures", Khanna Book house PvtLtd , New Delhi.

2. Sharma,S.K.(2016). "Irrigation Engineering and Hydraulic Sructures." S.Chand& company Pvt.Ltd, New Delhi. Pp1174.

References:

1. Asawa G L (2013) : "Irrigation and Water Resources Engineering, New Age InternationalPublishers", New Delhi.

2. Modi, P. N (2011), "Irrigation Water Resources and Water Power Engineering", Standard Book House, New Delhi

IV Year – I Semester	REGULATION : RM21 PROFESSIONAL-ELECTIVE-III	L	T	P	C
		3	0	0	3

II. EARTH AND ROCK FILL DAMS

Course Objectives:

1. Suitability of materials for earth and rock fill dams

2. causes of failures

3. to determine slope stability

Course Outcomes:

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

CO1: Able to design earth and rock fill dams

CO2: get familiarity with slope stability calculations,

CO3: learn prevention techniques for slope failures

CO4: learn stability of slopes

CO5: design rock-fill dams

SYLLABUS:

Unit-I :

Earth and Rock fill Dams: General features, Selection of site; Merits and demerits of the earth and rock fill dams, Classification of earth dams, Materials of construction and requirements, Causes of failure, Safe design criteria. Instrumentation in earth dams: Pore pressure measurements, Settlement gauges, Inclinometers, Stress measurements, Seismic measurements.

Unit-II:

Failures, Damages and Protection of Earth Dams: Nature and importance of failure, Piping through Embankment and foundations, Methods of seepage control through embankments and foundations, Design Criteria for filters, Treatment of upstream and downstream of slopes, Drainage control, Filter Design.

Unit-III:

Slope Stability Analysis: Types of Failure: Failure surfaces – Planar surfaces, Circular surfaces, Noncircular surfaces, Limit equilibrium methods, Total stress analysis versus effective Stress analysis, Use of Bishop's pore pressure parameters, Short term and Long term stability in slopes.

Unit-IV:

Methods of Slope Stability: Taylor Charts, Method of Slices, Effect of Tension Cracks, Vertical Cuts.Bishop's Analysis, Bishop and Morgenstern Analysis, Non-circular Failure Surfaces: Morgenstern and Price Analysis, Janbu Analysis, Spencer Analysis, Sliding Block Analysis, Seismic stability, Stabilization of slopes: Drainage measures, Soil reinforcement (geo synthetics/soil nailing/micro piles etc), soil treatment (cement/lime/thermal treatment), surface protection (vegetation/erosion control mats/ shotcrete).

Unit-V:

Rock fills Dams: Requirements of compacted rock fill, Shear strength of rock fill, Rock fill mixtures, Rock fill embankments, Earth-core Rock fill dams, Stability, Upstream & Downstream slopes.

TEXT BOOKS:

1. Christian, K. Earth & Rock fill Dams – Principles of Design and Construction, CRC Press, 1997.

2. Sowers, G.F. – Earth and Rock fill Dam Engineering, Asia Publishing House, 1962.

REFERENCES:

1. Bharat Singh and Sharma, H. D. – Earth and Rock fill Dams, 1999

2. Abramson, L. W., Lee, T. S. and Sharma, S. – Slope Stability and Stabilisation methods – John Wiley & sons. (2002)

3. Sherard, Woodward, Gizienski and Clevenger. Earth and Earth-Rock Dams. John Wiley &. Sons. 1963.

4. US Army Corp of Engineers, Earth and Rock-fill Dams, General Design and construction Considerations, University Press of the Pacific (2004)

5. Bromhead, E. N. (1992). The Stability of Slopes, Blackie academic and professional, London.

IV Year – I Semester	REGULATION : RM21 PROFESSIONAL-ELECTIVE-III	L	T	P	C
		3	0	0	3

III. GREEN TECHNOLOGIES

Course Learning Objectives:

The objective of this course is:

1. To present different concepts of green technologies.
2. To acquire principles of Energy efficient technologies.
3. To impart knowledge on the methods of reducing CO2 levels in atmosphere.
4. To gain knowledge of the importance of life cycle assessment
5. To learn the importance of green fuels and its impact on environment.

Course Learning Outcomes

Upon successful completion of this course, the students will be able to:

CO1: Enlist different concepts of green technologies in a project
CO2: Understand the principles of Energy efficient technologies
CO3:Estimate the carbon credits of various activities
CO4:Identify the importance of life cycle assessment
CO5:Recognize the benefits of green fuels with respect to sustainable development.

SYLLABUS:

UNIT- I

Introduction: Green Technology – definition- Importance – Historical evolution – advantages and disadvantages of green technologies-factors affecting green technologies- Role of Industry, Government and Institutions – Industrial Ecology – role of industrial ecology in green technology. Cleaner Production (CP): Definition – Importance – Historical evolution - Principles of Cleaner Production–Benefits–Promotion-Barriers – Role of Industry,

UNIT- II

Cleaner Production Project Development and Implementation:

Government and Institutions – clean development mechanism, reuse, recovery, recycle, raw material substitution-Wealth from waste, case studies. Overview of CP Assessment Steps and Skills, Process Flow Diagram, Material Balance, CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - Total Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress- ISO 14000.

UNIT- III

Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Life Cycle Costing – Eco Labelling

UNIT -IV

Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Solar Energy-solar energy conversion technologies and devices, their principles, working and application.

UNIT- V

Green Fuels – Definition-benefits and challenges – comparison of green fuels with conventional fossil fuels with reference to environmental, economic and social impacts- public policies and market-driven initiatives.

Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in Indian context; tidal and geothermal energy.

TEXT BOOKS:

1. 'Pollution Prevention: Fundamentals and Practice' by Paul L Bishop (2000), McGraw Hill International.

2. 'Cleaner Production Audit' by Prasad Modak, C.Visvanathan and Mandar Parasnis (1995), Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok
3. 'Non-conventional Energy Sources' by Rai G.D.

REFERENCES:

1. 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production' by World Bank Group (1998), World Bank and UNEP, Washington D.C.
2. 'Handbook of Organic Waste Conversion' by Bewik M.W.M.
3. 'Energy, the Solar Hydrogen Alternative' by Bokris J.O.
4. 'Solar Energy' by Sukhatme S.P.

IV Year – I Semester	REGULATION : RM21 PROFESSIONAL -ELECTIVE -IV	L	T	P	C
		3	0	0	3

I. AIR POLLUTION & CONTROL

Course Objectives:

The objectives of this course are to

- Familiarize Students with different types of design philosophies
- Equip student with concepts of design of flexural members
- Understand Concepts of shear, bond and torsion
- Familiarize students with different types of compressions members and Design
- Understand different types of footings and their design

Course Outcomes:

After going through this course the student will be able to

CO1. classify air pollutants

CO 2. Design principles of particulate and gaseous control measures for an industry

CO 3. Examine the plume behavior in a prevailing environmental condition

CO 4. describe the design process for handling gaseous pollutant

CO 5. Explain the Environmental criteria for setting industries.

UNIT –I (6H)

Air Pollution: Sampling and analysis of air pollutants. Definition of terms related to air pollution and control, Classification of air pollutants- secondary pollutants – Indoor air pollution -Climate Change and its impact - Carbon Trade.

UNIT-II (8H)

Thermodynamics and Kinetics of Air-pollution: Applications in the removal of gases like SOx, NOx, CO and HC - Air-fuel ratio- Computation and Control of products of combustion, Automobile pollution, Odour pollution control, Flares. Filters–Scrubbers, Electrostatic precipitators.

UNIT– III (8H)

Meteorology and Air Pollution: Properties of atmosphere: Heat, Pressure, Wind forces, Moisture and relative Humidity, Lapse Rates - Influence of Terrain and Meteorological phenomena on plume behaviour and Air Quality - Wind rose diagrams and Plume Rise Models.

UNIT-IV (08H)

Ambient Air Quality Management: Monitoring of SPM, SO2; NOx and CO - Stack Monitoring for flue gases - Micro-meteorological monitoring –Weather Station, Emission Standards- Gaussian Model for Plume Dispersion.

UNIT-V (08H)

Air Pollution and Control Methods: Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control Equipment – Settling Chambers, Cyclone separators –Fabric filters- In-plant Control Measures- Methods of removal and recycling- Environmental criteria for setting industries and Green belts.

Text Books:

1. Air Pollution and Control by K.V.S.G. Murali Krishna, 1st edition, Laxmi Publications, New Delhi, 2016

2. Air Pollution by M.N. Rao and H. V. N. Rao, 1st edition, 2017, McGraw Hill Education.

Reference Books:

1. Air Pollution and Control-**Sharma**, N., **Agarwal**, A.K., **Eastwood,** P.,**Gupta,** T., **Singh**, A.P. 1st edition, springer, 2018
2. An Introduction to Air pollution, R. K. Trivedy and P.K. Goel, 2nd edition, B.S.Publications,2005.

IV Year – I Semester	REGULATION : RM21 PROFESSIONAL-ELECTIVE-IV	L	T	P	C
		3	0	0	3

II. PRESTRESSED CONCRETE STRUCTURES

Course Objectives:

The objectives of this course are to make students

- Understand the principles and necessity of prestressed concrete structures.
- Aware of different techniques of prestressing.
- Get the knowledge on various losses of prestress.
- Understand Analysis and design of prestressed concrete members

Course Outcomes:

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

CO1. Describe the concepts of prestressing.

CO 2. Determine the prestressing systems.

CO 3. Estimate the effective prestress including the short and long term losses.

CO 4. Analyze and design prestressed concrete beams under flexure and shear.

CO 5. Explain the relevant IS Codal provisions for prestressed concrete.

UNIT-I (10H)

Basic concepts of Prestressing- Advantages and Applications of Prestressed Concretes, High Strength Concrete- Permissible Stresses, Shrinkage, Creep, Deformation Characteristics, High strength Steel- Types, Strength-Permissible Stresses- Relaxation of Stress, Stress Corrosion- Durability, Fire Resistance, Cover Requirements.

UNIT-II (9H)

Prestressing Systems- Introduction, Tensioning devices, Pre-tensioning Systems, Post tensioning Systems, Basic Assumptions in Analysis of prestress and design, Analysis of prestress, Resultant Stresses at a section-pressure line- Concepts of load balancing- Stresses in Tendons, Cracking moment.

UNIT-III (10H)

Losses of Pre-stressing- Loss of Pre-stress in pre-tensioned and post tensioned members due to various causes -Elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage, differential shrinkage- bending of members and frictional losses-Total losses allowed for design.

UNIT-IV (8H)

Design for Flexural resistance- Types of flexural failure – Code procedures-Design of sections for flexure- Control of deflections- Factors influencing-Prediction of short term and long term deflections.

UNIT-V (8H)

Design for Shear and Torsion- Shear and Principal Stresses- Design of Shear reinforcements- Codal Provisions- Design for Torsion, Design for Combined bending, shearVand torsion.

Text Books:

1. Prestressed Concrete, N. Krishna Raju, 6th edition, 2018 Tata McGraw hill

References:

1. Prestressed Concrete, P. Dayaratnam, 7th edition, 2017, Medtech publications
2. Prestressed Concrete, T. Y. Lin & Burns, 3rd edition, 2010, Wiley Publications
3. prestressed concrete , M.K. Hurst, 2nd edition, 2019 ,CRC Press publication

IV Year – I Semester	REGULATION : RM21 PROFESSIONAL-ELECTIVE-IV	L	T	P	C
		3	0	0	3

III. REPAIR AND REHABILITATION OF STRUCTURES

Course Objectives:

The objectives of this course are to make students

- Understand the basic concepts of deterioration of structures
- Understand the corrosion aspect of steel structures
- Learning the principle of retrofit techniques

Course Outcomes:

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

CO 1. explain the deterioration of concrete instructures.

CO 2. Evaluate the structures by Non DestructiveTesting.

CO 3. Identify the failures and causes of failures instructures

CO 4. Determine the materials for repair and rehabilitation of structures.

CO 5. Discuss about the repair techniques.

UNIT–I (10H)

Deterioration of concrete in structures: Physical processes of deterioration like Freezing and Thawing, Wetting and Drying, Abrasion, Erosion, Pitting, Chemical processes like Carbonation, Chloride ingress, Corrosion, Alkali aggregate reaction, Sulphate attack Acid attack, temperature and their causes, Mechanism, Effect, preventive measures. - Cracks: Cracks in concrete, type, pattern, quantification, measurement & preventive measures.

UNIT- II (10H)

Non Destructive Testing- Non destructive test methods for concrete including Rebound hammer, Ultrasonic pulse velocity, Rebar locator, Corrosion meter, Penetration resistance and Pull out test, Core cutting- Corrosion: Methods for corrosion measurement and assessment including half-cell potential and resistivity, Mapping of data.

UNIT-III (8H)

Failure of buildings: Definition of building failure-types of failures- Causes of Failures- Faulty Design, Accidental over Loading, Poor quality of material and poor Construction practices- Fire damage - Methodology for investigation of failures-diagnostic testing methods and equipments-repair of cracks in concrete.

UNIT-IV (8H)

Materials for repair and rehabilitation -Admixtures- types of admixtures purposes of using admixtures- chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fiber wraps- Steel Plates- Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods- corrosion activity measurement- chloride content – Depth of carbonation-

UNIT - V (9H)

Repair Techniques: Grouting, Jacketing, Shotcreting, externally bonded plates, Nailing, Underpinning and under water repair; Materials, Equipments, Precautions and Processes - **Investigation of structures**:

Distress, observation and preliminary test methods. Case studies: related to rehabilitation of bridge piers, dams, canals, heritage structures, corrosion and erosion damaged structures.

Text Books:

1. 'Maintenance & Repair of Civil Structures' by B.L. Gupta &Amit Gupta, 2nd edition, 2009, Standard Publications.
2. 'Rehabilitation of Concrete Structures' by B. Vidivelli, 1st edition, 2009, Standard Publishers.
3. 'Concrete Bridge Practice Construction, Maintenance & Rehabilitation' by V. K. Raina, 2nd edition, 2019, Shroff Publishers.

Reference Books:

1. 'Concrete Structures- protection Repair and Rehabilitation' by R. Doodge Woodson, BH Publishers, 1st edition, 2009 Butterworth-Heinemann
2. Defects and Deterioration in Buildings,2nd edition E F & N Spon, New York : Spon Press, 2001
3. Repair and rehabilitation of concrete structure 1st edition, 2016, Poonam modi I, Chirag N. Patel, PHI learning Pvt Ltd.

IV Year – I Semester	REGULATION : RM21 OPEN-ELECTIVE-III	L	T	P	C
		3	0	0	3

I. DISASTER MANAGEMENT

Course Objectives:

The objectives of the course are to familiarize students with

- various types of disasters
- impact of disasters
- disaster risk reduction
- impact of environmental modifications

Course Outcomes:

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

CO 1. Identify the Disaster Concepts to Management

CO 2. explain the concepts of Development and Disasters.

CO 3. analyse the disaster impacts.

CO 4. plan the disaster risk reduction.

CO 5. Discuss about the disasters,environment and development.

UNIT – I (8H)

Introduction - Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation.

UNIT – II (10H)

Disasters- Disasters classification; natural disasters (floods, draught, cyclones, volcanoes,Earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT –III (8H)

Disaster Impacts- Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT – IV (10H)

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programs in India and the activities of National Disaster Management Authority.

UNIT – V (9H)

Disasters, Environment and Development- Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes,

urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Text Books:

1. Disaster Risk Reduction in South Asia, Pradeep Sahni, 2004, Prentice Hall.
2. Handbook of Disaster Management: Techniques & Guidelines, Singh B.K., 2008, Rajah Publication.

Reference Books:

1. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.
2. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.
3. Disaster management by AK Srivastava (1ST JAN 2021).
4. Disaster science & managements by tushar bhattacharya, Tata McGraw hill education Pvt Ltd, New delhi

IV Year – I Semester	REGULATION : RM21 OPEN-ELECTIVE-III	L	T	P	C
		3	0	0	3

II. EMBEDDED AND REAL TIME SYSTEMS

COURSE OBJECTIVES:

The main objectives of this course are given below

1. The basic concepts of an embedded system are introduced.
2. The various elements of embedded hardware and their design principles are explained.
3. Different steps involved in the design and development of firmware for embedded systems are elaborated.
4. Internals of Real Time operating system and the fundamentals of RTOS based embedded firm ware design is discussed. And Fundamental issues in hardware software co-design were presented and explained.
5. Familiarize with the different IDEs for firm ware development for different family of processors/controllers and embedded operating systems. And embedded system implementation and testing tools are introduced and discussed.

COURSE OUTCOMES:

At the end of this course the student can able to

CO1. Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specific function.

CO 2. Analyze the hardware components required for an embedded system and the design approach of an embedded hardware.

CO 3. Distinguish the various embedded firmware design approaches on embedded environment.

CO 4. Understand how to integrate hardware and firmware of an embedded system using real time operating system.

CO 5. Understand how to embedded system development and its testing

UNIT-I [12 Hrs]

INTRODUCTION: Embedded system-Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface ,Embedded firmware, Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

UNIT-II [12 Hrs]

EMBEDDED HARDWARE DESIGN: Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

UNIT-III [12 Hrs]

EMBEDDED FIRMWARE DESIGN: Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism,

UNIT-IV [12 Hrs]

REAL TIME OPERATING SYSTEM: Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronisation, Device Drivers.
HARDWARE SOFTWARE CO-DESIGN: Fundamental Issues in Hardware Software Co Design Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware, ICE.

UNIT-V [12 Hrs]

EMBEDDED SYSTEM DEVELOPMENT AND TESTING: The integrated development environment, Types of files generated on cross compilation, Deassembler / Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools, The main software utility tool, Debugging tools, Quality assurance and testing of the design, Testing on host machine.

Text Books:
1. Embedded Systems Architecture-By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.
3. Embedded System Design: A Unified Hardware/Software Approach, Frank Vahid and Tony Givargis, Draft version, Fall 1999

References:
1. Embedded System Design, FrankVahid, Tony Givargis, John Wiley Publications, 2013.
2. Embedded Systems-Lyla B.Das-Pearson Publications, 2013.
3. Embedded/Real-Time Systems: Concepts, Design & Programming- Dr. K. V. K. K. Prasad, Dreamtech , 2010
URLs.:
https://nptel.ac.in/courses/108102045

IV Year – I Semester	REGULATION : RM21 OPEN ELECTIVE-III	L	T	P	C
		3	0	0	3

III. REMOTE SENSING & GIS

Course Learning Objectives:

The course is designed to,

1. Introduce the basic principles of Remote Sensing and GIS techniques.
2. Learn various types of sensors and platforms.
3. Learn concepts of visual and digital image analysis.
4. Understand the principles of spatial analysis.
5. appreciate application of RS and GIS to Civil Engineering

Course outcomes

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

CO1: Be familiar with ground, air and satellite-based sensor platforms.

CO2: Learn image processing

CO3: Interpret the aerial photographs and satellite imageries.

CO4: Create and input spatial data for GIS application.

CO5: Apply RS and GIS concepts for application in Civil Engineering.

SYLLABUS:

UNIT – I

Introduction to Remote sensing: Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces, characteristics of remote sensing systems, types of resolutions - advantages & limitations, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line, band sequential, IRS, LANDSAT, SPOT & Recent satellite.

UNIT – II

Image analysis: Introduction, elements of visual interpretations, digital image processing- image pre-processing, image enhancement, image classification, supervised classification, unsupervised classification.

UNIT – III

Geographic Information System: Basic Principles, components, application areas of GIS, map projections. Data entry and preparation: spatial data structures, raster and vector data formats, data inputs,

data manipulation.

UNIT – IV

Spatial data analysis: Introduction, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, network analysis-optimal path finding.

UNIT – V

RS and GIS applications: Land cover and land use, agriculture, forestry, geology, urban & transportation, Hydrology and Water Resources: Flood zoning and mapping, groundwater prospects, groundwater quality monitoring and potential recharge zone.

TEXTBOOKS:

1. 'Remote Sensing and GIS', by Bhatta B, Oxford University Press, (2011) 2nd Edition'.

2. 'Remote Sensing and Image Interpretation, by Lille sand, T.M, R.W. Kiefer and J.W. Chipman, Wiley India Pvt. Ltd., (2015), 7th Edition.

3. 'Remote Sensing - Models and Methods for Image Processing' by Robert A Schowenger, Elsevier publishers, (2009).

4. 'Fundamentals of Remote Sensing' by George Joseph, Universities Press, (2013) 3rd Edition.

5. 'Fundamentals of Geographic Information Systems' by Michael N. Demers, Wiley India Pvt. Ltd, (2012) 4th Edition.

REFERENCES:

1. 'Remote Sensing and its Applications' by Narayan LRA, Universities Press, 2012.

2. 'Concepts and Techniques of Geographical Information System' by Chor Pang Lo and Albert K.W. Yeung, Prentice Hall (India), (2016) 2nd Edition.

3. 'Introduction to Geographic Information Systems' by Kang Tsung Chang, McGraw Hill Higher Education, (2020) 9th Edition.

4. 'Basics of Remote sensing & GIS' by S. Kumar, Laxmi Publications, New Delhi, 2005.

5. 'Principals of Geographical Information Systems' by Burrough P A and R.A. McDonnell, Oxford University Press, 2006.

IV Year – I Semester	REGULATION : RM21 OPEN-ELECTIVE-IV	L	T	P	C
		3	0	0	3

I. NON CONVENTIONAL ENERGY SOURCES

COURSE OUTCOMES:

After going through this course the student will be able to

CO1. Appreciate the Need for non-conventional energy sources

CO 2. Visualize the Energy from Bio mass

CO 3. Learn about Hydrogen Energy

CO 4. Know Applicability of electric cars

CO 5. Learn about Hybrid vehicle

SYLLABUS

UNIT-I:
Introduction: Need for non-conventional energy sources. Energy alternative: solar, photo- voltaic, Hydrogen, Bio mass. Electrical - their merits and demerits.
Solar photo-voltaic conversion, Collection and storage of solar energy, Collection devices, flat plate collectors, concentrating type collectors, Principles and working of photo-voltaic Conversion.

UNIT-II:
Energy from Bio mass: Photosynthesis, Photosynthetic oxygen production, Energy plantation. Bio gas production from organic waste, Description and types of Bio gas plants, Application and limitations - Merits and demerits performance characteristics and their comparison.

UNIT-III:
Hydrogen Energy: Properties of hydrogen, Sources of Hydrogen, Thermodynamics of water splitting production of hydrogen, Electrolysis of water, Thermal decomposition of water. Thermo-chemical production, Biochemical production.

UNIT-IV:
Electric Automobiles: Design considerations, limitations. Opportunities for improvement Batteries, problems. Future possibilities, capacities, types, material requirement.

UNIT-V
Applicability of electric cars, major parts, battery charging, HVAC, requirements, comparative use of fuel and energy;, Availability of energy for recharging; Impacts on use of fuel and energy; Impact on urban air quality, impact on price. Hybrid vehicle, benefits, types of HEVs, hybrid maintenance and service. Use of turbines in cars, arrangement, control merits and de-merits, Design of turbochargers for automobiles, their usefulness on the performance, Use of fuel cells in automobiles.

Text Books:
1. Non-conventional Sources of Energy, G.D. Rai, Khanna Publications.

IVYear – I Semester	REGULATION : RM21 OPEN ELECTIVE-IV	L	T	P	C

2. Electric Automobiles , William Hamilton, PHI

3. Alternative Fuel Technology, Erjavec and Arias, Cengage Learning

Reference Books:

1. Solar Energy, S.P. Sukhatme, Tata McGraw Hill.
2. Energy Technology, S. Rao & B.B. Larulekar, Khamma Lab
3. Principles of Solar Engineering, Frank Kreith& Jan F. Krieder, McGraw Hill.
4. Solar Energy -thermal Process, J.A. Duffie&W.A. Beckman, McGrawHill.

		3	0	0	3

I. CONSTRUCTION TECHNOLOGY &MANAGEMENT

Course

Learning Objectives:

The objective of this course is:

1. to introduce to the student, the concept of project management including network drawing and monitoring

2. to introduce various equipment's like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery, related to constriction.

3. to introduce the importance of safety in construction projects

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

CO1: appreciate the importance of construction planning

CO2: understand the functioning of various earth moving equipment

CO3: know the methods of production of aggregate products and concreting

CO4: know the methods and usage of machinery required for the works.

CO5: apply the gained knowledge to project management and construction techniques

SYLLABUS:

UNIT- I Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling **-** monitoring – bar charts – milestone charts – critical Path Method – Applications

UNIT -II Project Evaluation and Review Technique – cost analysis **-** updating – crashing for optimum cost – crashing for optimum resources – allocation of resources

UNIT- III Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

UNIT -IV Concreting equipment – crushers – jaw crushers – gyratory crushers – impact crushers – selection of crushing equipment **-** screening of aggregate – concrete mixers – mixing and placing of concrete – consolidating and finishing

UNIT –V Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering

Text Books:

1. Construction Planning Equipment and Methods, Peurifoy and Schexnayder , Shapira, Tata Mcgraw hill

2. Construction Project Management Theory and Practice, Kumar NeerajJha (2011), Pearson.

3. Construction Technology, Subir K. Sarkar and Subhajit Saraswati, Oxford University press.

4. Project Planning and Control with PERT and CPM, B. C. Punamia and K K Khandelwal, Laxmi Publications Pvt Ltd. Hyderabad.

References:

1. Construction Project Management - An Integrated Approach, Peter Fewings , Taylor and Francis
2. Construction Management Emerging Trends and Technologies, Trefor Williams, Cengagelearning.
3. Hand Book of Construction Management, P. K. Joy, Trinity Press Chennai, New Delhi.

IV Year – I Semester	REGULATION : RM21 OPEN-ELECTIVE-IV	L	T	P	C
		3	0	0	3

III. 3D PRINTING TECHNOLOGIES

Course Objectives:

- To understand the fundamental concepts of Rapid Prototyping and 3-D printing, its advantages and limitations.
- To classify various types of Additive Manufacturing Processes and know their working principle, advantages, limitations etc.
- To have a holistic view of various applications of these technologies in relevant fields such as mechanical, Bio-medical, Aerospace, electronics etc.

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

CO1: Describe various CAD issues for 3D printing and rapid prototyping and related operations for STLmodel manipulation.

CO2:. Formulate and solve typical problems on reverse engineering for surface reconstruction from physical prototype models through digitizing and spline-based surface fitting.

CO3: Formulate and solve typical problems on reverse engineering for surface reconstruction from digitized mesh models through topological modelling and subdivision surface fitting.

CO4: Explain and summarize the principles and key characteristics of additive manufacturing technologies and commonly used 3D printing and additive manufacturing systems.

CO5: Explain and summarize typical rapid tooling processes for quick batch production of plastic and metal parts

SYLLABUS:

UNIT – I Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages, and Limitations of Rapid Prototyping, Commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain: Fundamental Automated Processes, Process Chain.

UNIT - II Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies Solid-based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT - III Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle,

Applications, Advantages and Disadvantages, Case studies. Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification; Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling : Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP

UNIT - IV Rapid Prototyping Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid Prototyping Software's: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT - V RP Applications : Application - Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules.

TEXT BOOKS:

1. Rapid prototyping; Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific Publications

2. Rapid Manufacturing /D.T. Pham and S.S. Dimov/Springer

REFERENCE BOOKS:

1. Terry Wohlers, Wholers Report 2000, Wohlers Associates

2. Rapid Prototyping and Manufacturing /PaulF.Jacobs/ASME

IV Year – I Semester	REGULATION : RM21 *Professional Core courses Lab*	L	T	P	C
		3	0	0	3

RS&GIS LAB

Learning Objectives:

- The course is designed to
- Understand the process Geo-referencing, Preparation of Base map from of Toposheet.
- Digitization, creation of thematic maps from toposheets.
- Developing Digital Elevation model
- Interpretation and Estimation of features of Land Use/land cover details from satellite imagery.
- Learn to apply GIS software to simple problems in water resources, transportation engineering
- and Agriculture

SYLLABUS:

SOFTWARES:

1. Arc GIS 10.1

2. ERDAS Imagine 13

3. MapInfo 6.5

4. ILWIS or Any one or Equivalent.

EXCERCISES IN GIS:

1.Geo-referencing of Toposheet.

2. Preparation of Base map from topo sheet including legend, scale and annotation

3 Digitization of Map/Toposheet

4. Developing Digital Elevation model

5. Interpretation of Land Use/land cover detail from satellite imagery

6. Creation of thematic maps.

7. Estimation of features and interpretation

8. Simple applications of Remote Sensing & GIS in water Resources

9. Simple applications of Remote Sensing & GIS in Transportation

10. Simple applications of Remote Sensing & GIS in Agriculture

TEXT BOOK:

1. Concept and Techniques of GIS' by C.P.L.O. Albert, K.W. Yong, Printice Hall Publishers

2. Software Manuals.

IV-Year – I Semester	HUMANITIES AND SOCIAL SCIENCE	L	T	P	C
		3	0	0	3
INTELLECTUAL PROPERTY RIGHTS AND PATENTS					

Course Outcomes (CO):

After studying these units, the student is expected to be able to:

i) understood the significance of innovations, distinguish different kinds of IPRs and know the legislative framework, practice and procedure relating to Patents, Copyrights, Trademarks, Designs, Trade Secrets, Geographical Indications, Traditional Knowledge and certain emerging areas.

ii) understood the various components of copyright law, its protection and enforcement to know the application of copyright law, its duration, advantages and the issues of 'fair use' and 'plagiarism' in the digital era.

iii) Understood the Patent law in India and its global instruments and spell out the procedural requirements of novelty, non-obviousness and inventive step involved in obtaining a Patent, its exclusive rights besides assignment and licensing patterns and how the patent does benefit the society.

iv) understood the conceptual and legal framework, procedural requirements relating to Trade Marks and its infringement and gives an insight how the Trademark is commercially advantageous to its owner and to prevent unfair competition and further safeguarding the trade secrets of the business enterprises.

v) Understood the importance of E-commerce, data security, online transactions and how the confidentiality and privacy can be safeguarded through the digital signatures and the prevention and punishment of cybercrimes under the law.

SYLLABUS:

Unit I: Introduction to Intellectual Property Rights (IPR)

Concept of Property - Introduction to IPR – IPR Tool Kit – International Instruments and IPR – WIPO - TRIPS – WTO – IPR Laws - IPR Protection and Regulation - Copyrights and Neighboring Rights – Industrial Property – Patents – Designs - Traditional Knowledge – Geographical Indications - Emerging Areas of IPR.Law of Unfair Competition – Competition Commission**.**

Unit II: Copyrights and Neighboring Rights

Introduction to Copyrights – Principles of Copyright Protection – Law Relating to Copyrights - Subject Matters of Copyright – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works – Rights of Distribution – Rights of Performers – Copyright Registration – Limitations – Infringement of Copyright – Case Law.

Unit III: Patents

Introduction to Patents - Patent Laws in India – Patent Requirements – Product Patent and Process Patent - Patent Search - Registration and Grant of Patent – Exclusive and Monopoly Rights – Limitations - Ownership - Transfer — Revocation of Patent – Patent Appellate Board - Infringement of Patent – Double Patenting — Compulsory Licensing - Patent Cooperation Treaty – New developments - Software Protection and Computer related Innovations.

Unit IV: Trademarks & Trade Secrets

Introduction to Trademarks – Trademark Laws – Functions of Trademark – Marks Covered under Trademark Law - Trade Mark Registration – Maintenance – Transfer - Deceptive Similarities - Infringement – Remedies.

Introduction to Trade Secrets – Laws Relating to Trade Secrets – Safeguarding Trade Secrets – Physical Security – Employee Access Limitation – Confidentiality Agreements – Breach of Contract
– Remedies.

Unit V: Cyber Laws and Cyber Crime

Introduction to Cyber Laws – Information Technology Act 2000 - Protection of Online and Computer Transactions - E-commerce - Data Security – Privacy - Authentication - Confidentiality - Digital Signatures – Certifying Authorities - Cyber Crimes - Prevention - Punishment – Liability of Network Providers.

Texts Books:

1. Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press,New Delhi.
2. Deborah E.Bouchoux: Intellectual Property, Cengage Learning, New Delhi.
3. PrabhuddhaGanguli: Intellectual Property Rights, Tata Mc-Graw –Hill, New Delhi
4. Richard Stim: Intellectual Property, Cengage Learning, New Delhi.
5. Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications(Press).
6. Cyber Law - Texts & Cases, South-Western's Special Topics Collections.
7. R.Radha Krishnan, S.Bala Subramanian: Intellectual Property Rights, Excel Books. NewDelhi.

M.Ashok Kumar and MohdIqbal Ali: Intellectual Property Rights, Serials Pub