SCHOOL OF ENGINEERING
COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
COCHIN -682022

SCHEME
AND
SYLLABUS

B.TECH CIVIL ENGINEERING
(2019 Admissions onwards)

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
B.TECH DEGREE PROGRAMME IN CIVIL ENGINEERING

Scheme of Examinations (2019 admissions)

SEMESTER I [Stream A]

***Stream A*:** Civil Engineering, Electrical and Electronics Engineering, Mechanical Engineering and Safety and Fire Engineering.

Code No.	Subject	L Hrs/ Wk	T Hrs/ Wk	P/D Hrs/ Wk	C	Marks		Total
						CA	SEE	
19-200-0101A	Computer Programming	3	1	0	3	40	60	100
19-200-0102A	Engineering Chemistry	3	1	0	3	40	60	100
19-200-0103A	Engineering Graphics	2	1	3	3	40	60	100
19-200-0104A	Basic Electrical Engineering	3	0	0	3	40	60	100
19-200-0105A	Basic Electronics Engineering	3	0	0	3	40	60	100
19-200-0106A	Environmental Studies	3	1	0	3	40	60	100
19-200-0107A	Electrical Engineering Workshop	0	0	3	1	25	25	50
19-200-0108A	Computer Programming Laboratory	0	0	3	1	25	25	50
	TOTAL	**17**	**4**	**9**	**20**			

CA – Continuous Assessment, SEE – Semester End Examination

SEMESTER II [Stream A]

Code No.	Subject	L Hrs/ Wk	T Hrs/ Wk	P/D Hrs/ Wk	C	Marks		Total
						CA	SEE	
19-200-0201A	Calculus	3	1	0	3	40	60	100
19-200-0202A	Engineering Physics	3	1	0	3	40	60	100
19-200-0203A	Engineering Mechanics	4	1	0	3	40	60	100
19-200-0204A	Basic Civil Engineering	3	0	0	3	40	60	100
19-200-0205A	Basic Mechanical Engineering	3	0	0	3	40	60	100
19-200-0206A	Soft Skills Development	2	1	0	2	50	-	50
19-200-0207A	Civil Engineering Workshop	0	0	3	1	25	25	50
19-200-0208A	Mechanical Engineering Workshop	0	0	3	1	25	25	50
19-200-0209A	Language Lab	0	0	1	1	25	25	50
19-200-0210A	NSS/Nature conservation Activities	0	0	1	0	-	-	-
	TOTAL	**18**	**4**	**8**	**20**			

SEMESTER III

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	SEE	
19-200-0301*	Linear Algebra and Transform Techniques	3	1	3	40	60	100
19-201-0302	Surveying –I	3	1	3	40	60	100
19-201-0303	Strength of Materials	3	1	3	40	60	100
19-201-0304	Concrete Technology	3	1	3	40	60	100
19-201-0305	Fluid Mechanics –I	3	1	3	40	60	100
19-201-0306	Engineering Geology and Seismology	4	-	3	40	60	100
19-201-0307	Strength of Materials Lab	-	3	1	25	25	50
19-201-0308	Concrete Lab	-	3	1	25	25	50
	TOTAL	**19**	**11**	**20**			

*Common to all branches

SEMESTER IV

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	SEE	
19-200-0401*	Complex Variables and Partial Differential Equations	3	1	3	40	60	100
19-201-0402	Surveying –II	3	1	3	40	60	100
19-201-0403	Analysis of Determinate Structures	3	1	3	40	60	100
19-201-0404	Transportation Engineering	4		3	40	60	100
19-201-0405	Fluid Mechanics II	3	1	3	40	60	100
19-201-0406	Building Technology and Planning	3	1	3	40	60	100
19-200-0407*	Universal Human Values	3		3	50	-	50
19-201-0408	Survey Practical	-	3	1	25	25	50
19-201-0409	Fluid Mechanics Lab	-	3	1	25	25	50
	TOTAL	**22**	**11**	**23**			

*Common to all branches

SEMESTER V

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	SEE	
19-200-0501*	Numerical and Statistical Methods	3	1	3	40	60	100
19-201-0502	Design of Concrete Structures-I	3	1	3	40	60	100
19-201-0503	Analysis of Indeterminate Structures	3	1	3	40	60	100
19-201-0504	Geotechnical Engineering –I	3	1	3	40	60	100
19-201-0505	Water Resources and irrigation Engineering	4		3	40	60	100
19-201-05**	Professional Elective -I	3	1	3	40	60	100
19-201-0510	Geotechnical Engineering Lab	-	3	1	25	25	50
19-201-0511	Transportation Engineering Lab	-	3	1	25	25	50
	TOTAL	**19**	**11**	**20**			

*Common to all branches

19-201-0506 to 0509 Professional Elective – I	
Code	Name of Subject
19-201-0506 (IE)	Precast Construction of Structures
19-201-0507	Rail and Water Transport Engineering
19-201-0508	Functional Planning of Buildings
19-201-0509	Disaster Management

SEMESTER VI

Code No	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	SEE	
19-201-0601	Environmental Engineering -I	3	1	3	40	60	100
19-201-0602	Design of Steel Structures	3	1	3	40	60	100
19-201-0603	Advanced Method of Structural Analysis	3	1	3	40	60	100
19-201-0604	Geotechnical Engineering –II	3	1	3	40	60	100
19-201-0605	Construction Management	4		3	40	60	100
19-201-06**	Professional Elective- II	3	1	3	40	60	100
19-201-0610	Environmental Engineering Lab	-	3	1	25	25	50
19-201-0611	Computer Applications in Civil Engineering - I	-	3	1	25	25	50
	TOTAL	19	11	20			

19-201-0606 to 0609 Professional Elective – II	
Code	Name of Subject

19-201-0606 (IE)	Sustainable Construction Techniques
19-201-0607	Traffic Engineering and Management
19-201-0608	Air Pollution Control and Management
19-201-0609	Ground Water Engineering

SEMESTER VII

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	SEE	
19-201-0701	Environmental Engineering - II	3	1	3	40	60	100
19-201-0702	Quantity Surveying and Valuation	3	1	3	40	60	100
19-201-0703	Design of Concrete Structures - II	3	1	3	40	60	100
19-201-07**	Professional Elective- III	3	1	3	40	60	100
19-201-07**	Open Elective - I	3	0	3	40	60	100
19-201-0712	Computer Applications in Civil Engineering - II	-	3	1	25	25	50
19-201-0713	Structural Engineering and Building Technology Lab	-	3	1	25	25	50
19-201-0714	Entrepreneurship Development	-	2	1	50		50
19-201-0715	Project –Phase I	-	3	1	50		50
19-201-0716	Industrial Internship	-	-	1	50		50
	TOTAL	**15**	**15**	**20**			

19-201-0704 to 0707Professional Elective – III	
Code	Name of Subject
19-201-0704 (IE)	Ground Improvement Techniques
19-201-0705	Bridge Engineering
19-201-0706	Pavement Analysis and Design
19-201-0707	Architecture and Town Planning

19-201-0708 to 0711 Open Elective - I	
Code	Name of Subject
19-201-0708	Finite Element method
19-201-0709	Principles of Management
19-201-0710	Industrial Waste Engineering and Management
19-201-0711	Introduction to Aquaculture Engineering

SEMESTER VIII

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	SEE	
19-201-0801	Earthquake Engineering	4		3	40	60	100
19-201-08**	Professional Elective –IV	3	1	3	40	60	100
19-201-08**	Professional Elective –V	3	1	3	40	60	100
19-201-08**	Open Elective –II	3		3	40	60	100
19-201-0815	Seminar	-	3	1	50		50
19-201-0816	Project – Phase II	-	12	6	200		200
19-201-0817	Comprehensive Viva Voce	-	-	1		50	50
	TOTAL	**13**	**17**	**20**			

19-201-0802 to 0805 Professional Elective – IV	
Code	Name of Subject
19-201-0802	Design of special Structures
19-201-0803	Solid Waste Management
19-201-0804	Construction Safety and Fire Engineering
19-201-0805	Remote Sensing and GIS

19-201-0806 to 0809 Professional Elective – V	
Code	Name of Subject
19-201-0806	Retrofitting and Rehabilitation of Structures
19-201-0807	Construction Engineering and Materials Management
19-201-0808	Geoenvironmental Engineering
19-201-0809	Design of Hydraulic Structures

19-201-0810 to 0814 Open Elective – II	
Code	Name of Subject
19-201-0810	Building Services Engineering
19-201-0811	Environmental Impact Assessment
19-201-0812	Sustainable Built Environment
19-201-0813	Aquaculture Engineering in Practice
19-200-0814*	Constitutional Law

*common to all branches

Industry based Electives:

Industry based electives are offered in 5th, 6th and 7th Semesters and are listed among the Professional Electives with notation (IE) along with the subject code. A student should opt for at least one Industry based elective during the B.Tech. programme.

Open Electives:

Open Electives are offered in 7th and 8th Semesters. A student should opt for at least one Open Elective offered by any Division other than their branch of study.

Industrial Internship:

Industrial Internship of minimum duration of 2 weeks must be completed by the student after 4th Semester and before the commencement of 7th Semester. The evaluation of internship will be conducted along with Project Phase I.

Evaluation Pattern for Theory and Practical courses

1. Theory courses

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.

Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.

Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.

Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

2. Practical courses

50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor.

3. Pass Requirements

A candidate has to obtain a minimum of 50% marks for continuous assessment and semester end examination put together with a minimum of 40% marks in the semester end examination for a pass in theory and laboratory courses.

In the case of theory/laboratory/other courses having only continuous assessment, a candidate has to obtain a minimum of 50% marks in continuous assessment for a pass.

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SEMESTER I

19-200-0101A / 19-200-0201B COMPUTER PROGRAMMING

Course Outcomes:

On completion of this course the student will be able to:

1. Identify main components of a computer system and explain its working.
2. Develop flowchart and algorithms for computational problems.
3. Write the syntax of various constructs of C language.
4. Build efficient programs by choosing appropriate decision making statements, loops and data structures.
5. Illustrate simple search and sort algorithms.
6. Demonstrate how to perform I/O operations in files for solving real world problems.
7. Design modular programs using functions for larger problems.

Module I

Basics of Computer and Information Technology:

Digital Computer System (CPU, Memory, I/O devices)- Working of a digital computer-Hardware and Software : Definition - Categories of Software, Application of Computers.

Problem Solving Methodology:

Problem statement, Analysis, Design a solution, Implement/Coding the solution, Test the solution, Design tools (Algorithm, Flow-chart, Pseudo-code)- Develop algorithms for simple problems.

Programming Languages:

Types of programming languages-Compiler–Interpreter-Linker–Loader–Execution of program.

Module II

Basics of C:

Character set-Identifier- Keywords- Constants –Data Types- Variables and declaration –Operators and Expressions – Operator precedence and associativity – Expression Evaluation (Simple Examples) - Input and output functions – Simple computational problems involving the above constructs.

Control Statements:

Selection, Conditional operator, Iteration (for, while, do-while), Branching (switch, break, continue, goto), Nesting of control statements- Problems using control statements.

Module III

Arrays and Strings:

1D and 2D arrays –Searching (Linear and Binary) - Sorting (Bubble, Selection) – Matrix manipulation programs – Strings and basic operations on strings – Strings functions -Programs on string manipulation. Functions:

Definition – Calling – Declaration – Parameter Passing (by value and by reference) – Recursion – Programs based on functions.

User defined data types:

Structure – Union - Enumerated data type - Programs involving structure and union.

Module IV

Pointers:

Declaration, Initialization – Operations on pointers- Pointers and arrays – Pointers and Structures- Command line arguments-Dynamic memory allocation — Programs involving the above concepts.

Files:

File concept – File pointer – File handling operations (open, close, read, write etc) on sequential and random access files. Programs on file manipulations using fgetc(), fgets(),fseek().

References:

1. Pradip Dey and Manas Ghosh, Computer Fundamentals and Programming, Second Edition, Oxford University Press, (2013).

2. Byron Gottfried, Programming with C, Second edition, Tata McGraw-Hill, (2006).
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Second Edition, Pearson Education, (2001).
4. R.G. Dromey, How to solve it by Computer, Pearson Education, (2008).
5. Kanetkar Y, Let Us C, BPB Publications, (2007).

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-200-0102A / 19-200-0202B ENGINEERING CHEMISTRY

Course Outcomes:
On completion of this course the student will be able to:
1. Interpret the basic principles and concepts of quantum mechanics
2. Account for how spectroscopic methods can be used to determine molecular structures, with focus on the identification of characteristic groups in polyatomic molecules
3. Apply the laws of thermodynamics to engineering systems.
4. Explain the chemistry of a few important engineering materials and their industrial applications.

Module I
Quantum Chemistry: Schrodinger equation. Derivation from classical wave equation. Operator form of the equation. Application of Schrodinger equation to 1-D box solutions. Significance of wave functions, probability and energy. Application of 1-D box solutions to conjugated molecules. Forms of hydrogen atom wave functions and the plots of these functions to explore their spatial variations.
Energy level diagrams of diatomic molecules, Pi-molecular orbitals of butadiene, and benzene and aromaticity.

Module II
Spectroscopy: Principles of spectroscopy and selection rules. Electronic spectroscopy.
Fluorescence and its applications in medicine.
Vibrational and rotational spectroscopy of diatomic molecules. Applications.
Nuclear magnetic resonance and magnetic resonance imaging.
Surface characterisation techniques. Diffraction and scattering.

Module III
Chemical Thermodynamics: Fundamentals. First law of thermodynamics. Molecular interpretation of internal energy, enthalpy and entropy. Heat of reaction. Kirchoff's equations. Dependence on pressure and temperature. Gibbs-Helmholtz equation. Free energy changes and equilibrium constant. Chemical potential and fugacity. Thermodynamics of biochemical reactions.
Phase Rule: Terms involved in phase rule and examples, Application of phase rule to one component water system, Application of phase rule to two-component systems. (Simple eutectic systems).

Module IV

Engineering materials:
Polymers- Classifications- Mechanism of polymerisation (Addition, free radical, cationic, anionic and coordination polymerisation)- Thermoplastics and thermosetting plastics-Compounding of plastics-Moulding techniques of plastics (Compression, Injection, Transfer and Extrusion moulding)-Preparation, properties and uses of PVC, PVA, PET, Nylon- Silicon polymers-Biodegradable plastics. Elastomers- structure of natural rubber- vulcanisation- synthetic rubbers (Buna-S, Butyl rubber and Neoprene).
Lubricants- Introduction-Mechanism of lubrication- solid and liquid lubricants- Properties of lubricants-Viscosity index- flash and fire point- cloud and pour point- aniline value.
Refractories: Classification – Properties of refractories.
Cement- Manufacture of Portland cement- Theory of setting and hardening of cement.

References:

1. B. H. Mahan and R. J. Meyers University Chemistry, 4th Edition, Pearson publishers. (2009).
2. Peter W. Atkins, Julio de Paula, and James Keele. Physical Chemistry, 11th Edition, Oxford publishers. (2018).
3. M. J. Sienko and R. A. Plane. Chemistry: Principles and Applications, 3rd Edition, McGraw-Hill publishers.(1980).
4. C. N. Banwell. Fundamentals of Molecular Spectroscopy, 5th Edition, McGraw-Hill publishers.(2013).
5. B.L. Tembe, M.S. Krishnan and Kamaluddin. Engineering Chemistry (NPTEL Web Course)
6. Shashi Chawla. A Text book of Engineering Chemistry. Dhanpat Rai & Co, New Delhi. (2013).

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-200-0103A/ 19-200-0203B ENGINEERING GRAPHICS

Course Outcomes:
On completion of this course, the students will be able to:
1. Prepare drawings as per Indian standards
2. Produce orthographic projection of straight lines and planes.
3. Draw orthographic projection of solids.
4. Understand development of surface of different geometric shapes
5. Construct isometric scale, isometric projections and views.

Module I
Introduction to engineering graphics. Drawing instruments and their use. Familiarisation with current Indian Standard Code of Practice for general engineering drawing.
Scales- plain scale, Vernier scale, diagonal scale.
Conic sections- Construction of ellipse, parabola, hyperbola - construction of cycloid, involute, Archimedian spiral and logarithmic spiral- drawing tangents and normal to these curves.

Module II

Introduction to orthographic projections- plane of projection- principles of first angle and third angle projections, projection of points in different quadrants.
Orthographic projection of straight lines parallel to one plane and inclined to the other plane- straight lines inclined to both the planes- true length and inclination of lines with reference planes- traces of lines.
Projection of plane laminae of geometrical shapes in oblique positions.

Module III

Projection of polyhedra and solids of revolution- frustum, projection of solids with axis parallel to one plane and parallel or perpendicular to other plane- projection of solids with axis inclined to both the planes- projection of solids on auxiliary planes.
Section of solids by planes inclined to horizontal or vertical planes- true shape of sections.

Module IV

Development of surface of cubes, prisms, cylinders, pyramids and cones
Intersection of surfaces- methods of determining lines of intersection - intersection of prism in prism and cylinder in cylinder.

Module V

Introduction to isometric projection- isometric scales, isometric views- isometric projections of prisms, pyramids, cylinders, cones and spheres.
Introduction to perspective projections: visual ray method and vanishing point method- perspective of circles- perspective views of prisms and pyramids.

References:

1. John, K.C. Engineering graphics. PHI Learning, New Delhi.(2013)
2. Bhat, N.D. Elementary engineering drawing. (Forty ninth edition). Charotar Publishing House, Anand.(2010)
3. Gill P.S. Geometric drawing. B.D Kataria &Sons, Ludhiana.(2012)

Type of questions for Semester End Examination

Two questions of 12 marks each from Module I with option to answer any one. (1 x 12 = 12)
Two questions of 15 marks each from Module II, Module III, Module IV and Module V with option to answer any one question from each module. (4 x 15 = 60).

19-200-0104A / 19-200-0204B BASIC ELECTRICAL ENGINEERING

Course Outcomes:

On completion of this course the student will be able to:

1. Analyse and solve electric circuits
2. Understand the principles of electromagnetic induction and identify meters for measuring electrical quantities
3. Recognise the basic elements and phases in AC circuits
4. Identify the type of electrical machine for a given application

Module I

Basic principles of Electric circuits: Review of Ohm's law - Definition of Resistance, Current, Voltage and Power - Series and Parallel circuits- Constant voltage source and Constant current source.
Network Theorems: Kirchhoff's laws- Network analysis by Maxwell's circulation currents - Superposition theorem -Thevenin's theorem - Norton's theorem - simple illustrative problems on network theorems.
Review of electrostatics - Coulomb's Law- Electric field strength and electric flux density, Capacitance.

Review of electromagnetic induction -Faraday's Law- Lenz's Law - Mutually induced emf. Magnetic circuits - Magnetic field of a coil - Ampere turns calculation - Magnetic flux - Flux density
- Field strength.
Measuring instruments: Working principle of galvanometer, Ammeter, Voltmeter, Watt meter & Energy Meter (elementary concepts).

Module III
AC Fundamentals: Sinusoidal Alternating Waveforms - Sinusoidal AC Voltage characteristics and definitions — General representation of voltage or current – Phase Relations – Average value – Effective (Root mean square) value.
The Basic Elements and Phasors: Response of basic R, L and C elements to a sinusoidal voltage or current –Phasor diagrams, Frequency response of the basic elements – Average power and power factor – Complex representation of vectors (Rectangular & polar forms)
Series and Parallel ac Circuits: Series & parallel impedances and admittances, Analysis of RL, RC & RLC circuits, Resonance in series and parallel circuits- Variation of impedance and admittance in series and parallel resonant circuits. Power in ac circuits: active, reactive & apparent power.
Introduction to 3 phase Systems: Star& Delta connection, Power in three phase circuits

Module IV
Electrical Machines: Principle of operation, Types and applications of DC machines, Transformers and Induction Machines. (Only an elementary qualitative treatment is envisaged.)
Elementary Concepts of Generation, Transmission, and Distribution: Conventional sources of electrical energy: Hydro, Thermal, Nuclear and Diesel power station, Non-conventional Sources: Solar energy, wind energy & energy from oceans, Various levels of power transmission, introduction to primary and secondary distribution

References:

1. Robert L. Boylestad. Introductory circuit analysis. (Twelfth edition). Pearson Education, New Delhi. (2012)
2. Cotton, H. Electrical technology. (Seventh edition). CBS Publishers and Distributors, New Delhi. (2005)
3. Leonard S. Bobrow. Fundamentals of electrical engineering. Oxford University Press, New Delhi.(1996).
4. Rajendra Prasad. Fundamentals of electrical engineering. (Second edition). PHI Learning, New Delhi.(2009)
5. Edward Hughes. Electrical technology. Addison Wesley Longman, Boston. (1995).

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

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19-200-0105A / 19-200-0205B BASIC ELECTRONICS ENGINEERING

Course Outcomes:

On successful completion of this course the student will be able to:

1. Develop an understanding of the behaviour of semiconductor junctions, diodes and BJTs
2. Familiarize with the applications of Diodes in rectification and regulation
3. Relate the role of BJTs in amplification and switching
4. Identify various measuring instruments and their functions
5. Gain knowledge on the fabrication of semiconductor devices and ICs

Module I:

Basic Semiconductor and PN Junction Theory: Atomic Theory, Conduction in Solids, Conductors, Semiconductors and Insulators, n-Type and p-Type semiconductors, Semiconductor conductivity
The p-n Junction, Biased Junctions. Junction Currents and Voltages

Module II:

Semiconductor Diodes and Applications: PN Junction Diode, Characteristics and parameters, Diode Approximations, DC Load Line Analysis, Temperature Effects, Diode AC Models, Diode Specifications, Diode Testing, Zener Diodes
Half wave rectification, Full wave rectification, RC and LC Filters, Shunt Voltage Regulators, Power supply - performance and Testing
Optoelectronic Devices-LED, LCD, Seven segment displays

Module III:

Bipolar Junction Transistors and Electronic measuring instruments: BJT Operation, BJT voltages and currents, BJT Amplification and Switching, Common Base, Common Emitter and Common Collector Characteristics, Transistor Testing
Electronic measuring instruments – Power Supply, Function Generator, CRO, Multimeter.

Module IV:

Fabrication of Semiconductor Devices and ICs: Processing of Semiconductor materials, Diode Fabrication and Packaging, Transistor construction and Performance, Transistor Fabrication, Integrated Circuits, IC components and circuits, Transistor and IC packaging, Transistor Data sheets, Power measurement in dB

References:

1. David A Bell, Electronic Devices and Circuits Oxford Higher Education, 5th Edition, (2017).

2. NN Bhargava, DC Kulshreshtha, SC Gupta, Basic Electronics and Linear circuits, Tata McGrawHill Publishing Company, 2nd Edition, (2013).

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-200-0106 A/19-200-0206B ENVIRONMENTAL STUDIES

Course Outcomes:

On completion of this course the student will be able to:

1. Identify the natural resources and suitable methods for conservation and sustainable development
2. Realise the importance of eco system and biodiversity for maintaining ecological balance
3. Identify environmental pollutants and abatement mechanisms
4. Understand environmental problems arising due to developmental activities and population growth

Module I

Multidisciplinary nature of environmental studies. Definition, scope and importance, need for public awareness.

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Module II

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 the following ecosystems: - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. Inida as a mega-diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Module III

Environmental Pollution: Definition. Cause, effects and control measures of: - a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies.

Diaster management: floods, earthquake, cyclone and landslides.

Environmental legislation: Environment 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.

Module IV

Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation. Consumerism and waste products.
Social Issues and the Environment: From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case Studies. Public awareness.
Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.
Field work: Visit to a local area to document environmental assets river/ forest/grassland/hill/mountains. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

References:

1. Rajagopalan, R. Environmental studies: From crisis to cure. Oxford University Press, New Delhi. (2005).
2. Erach Bharucha. Textbook of environmental studies and ethics. Universities Press (India), Hyderabad. (2005).
3. Jayashree A. Parikh. Balsaraf, V.M. and Dwivedi, P.B. Environmental studies. Ane Books Pvt. Ltd, New Delhi. (2010)
4. Anindita Basak. Environmental studies, Pearson, New Delhi. (2009).
5. Misra, S.P. (2011). Essential environmental studies. (Third edition). Ane Books Pvt. Ltd., New Delhi. (2011).
6. Benny Joseph. Environmental science & engineering, Tata McGraw Hill Education Pvt. Ltd., New Delhi. (2010).

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-200-0107A/19-200-0207B ELECTRICAL ENGINEERING WORKSHOP

Course Outcomes:

On completion of this course the student will be able to:

1. Apply basic electrical engineering knowledge for house wiring practice

Experiments:

1. One lamp controlled by one switch
2. Series and parallel connections of lamps.
3. Stair case wiring.

4. Hospital Wiring.
5. Godown wiring.
6. Fluorescent lamp.
7. Connection of plug socket.
8. Different kinds of joints.
9. Winding of transformers.
10. Soldering practice.
11. Familiarisation of CRO.
12. Single Phase Distribution Board Wiring.

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

19-200-0108A/19-200-0208B COMPUTER PROGRAMMING LABORATORY

Course Outcomes:
On completion of this course the student will be able to:

1. Solve problems efficiently by choosing loops and decision making statements in C programming.
2. Implement different operations on arrays.
3. Solve problems using functions and recursion.
4. Design and implement C programs using the concepts of structure, pointers and files.

Cycle I
Application Packages:
Text Editor
1. To create a word document like an
advertisement. Spread Sheet
2. To create a spread sheet to analyse the marks of the students of a class and also to create appropriate charts.
Presentation Software
3. To create a presentation for the department using Power Point.
C Programming Basics:
4. To write a program to calculate and display areas of rectangle and triangle.
Decision Making:
5. To write a program for electricity bill preparation.
6. To write a program to find the roots of a quadratic equation.
7. To write a simple menu driven calculator program using switch statement.
8. To write a program to find the sum of digits of a given number.

Cycle II
Looping:
9. To write a program to print all the prime numbers of a given range.
10. To write a program to print the sine and cosine series.
11. To write a program to print Pascal's triangle.
Arrays:
12. To write a program to print the sum and average of elements in an array.
13. To write a program to sort the given numbers using bubble sort.
14. To write a program to perform Matrix addition and matrix multiplication.
String:
15. To write a program to perform string manipulation functions like string concatenations, comparison, find the length and string copy without using library functions.

16. To write a program to arrange names in alphabetical order.

Cycle III

Functions:

17. To write a C program to calculate the mean, variance and standard deviation using functions.
18. To write a C program to perform sequential and binary search using functions.

Recursion:

19. To write a program to print the Fibonacci series using recursive function.
20. To write a program to print the factorial of the given number using recursive function.

Structure:

21. To print the mark sheet of n students using structures.

Pointers:

22. To write a program using pointers to access the elements of an array and count the number of occurrences of the given number in the array.

Files:

23. To write a program to count the number of characters,lines in a file.

References:

1. Pradip Dey and Manas Ghosh, Computer Fundamentals and Programming in C, Second Edition, Oxford University Press, (2013).
2. Smarajit Ghosh, All of C, PHI Learning Pvt. Ltd, (2009).
3. Byron Gottfried, Programming with C, 2 nd edition, Tata McGraw-Hill, (2006).
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Second Edition, Pearson Education, (2001).
5. Sukhendu Dey, Debobrata Dutta, Complete Knowledge in C, Narosa PublishingHouse, New Delhi, (2009).

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

SEMESTER II

19-200-0201A/19-200-0101B CALCULUS

Course Outcomes:
On completion of this course the student will be able to:

1. Recall the methods of differentiation and integration.
2. Solve ordinary differential equations and linear differential equations of higher orders with constant coefficient and apply them in engineering problems
3. Estimate the maxima and minima of multi variable functions.
4. Evaluate area as double integrals and volume as triple integrals in engineering applications.
5. Illustrate the application and physical meaning of gradient, divergence and curl.

Module I
Ordinary differential equations:
First order differential equations - exact differential equations, Bernoulli's equations--Methods of solution and Simple applications.
Linear differential equations of higher orders with constant co-efficient-Methods of solution of these equations. Cauchy's linear differential equations. Simultaneous linear differential equations-Simple applications of linear differential equations in engineering problems –Electrical Circuits, Mechanical Systems.

Module II
Partial differentiation: Partial differentiation-Concept of partial derivative - Chain rule- Total derivative- Euler's theorem for homogeneous functions, Differentials and their applications in errors and approximations, Jacobians - Maxima minima of functions of two variables(Proof of the result not required)-Simple applications.
Co-ordinate systems: Rectangular co-ordinates-Polar co-ordinates-In plane and in Space-Cylindrical polar co-ordinates-Spherical polar co-ordinates.

Module III
Integral calculus:
Application of definite integrals: Area, Volume, Arc length, Surface area.
Multiple integral: Evaluation of double integrals-Change of order of integration. Evaluation of triple integrals-Change of Variables in integrals.
Applications of multiple integrals. Plane Area, Surface area &Volumes of solids

Module IV
Vector calculus: scalar and vector point functions, gradient and directional derivative of a scalr point function, divergence and curl of vector point functions, their physical meaning. Evaluation of line integral, surface integral, and volume integrals, Gauss's divergence theorem, Stoke's theorem (No proofs), conservative force fields, scalar potential.
References:

1. Sastry, S.S. Engineering mathematics: Vol1. (Fourth edition).PHI Learning, New Delhi. (2008).
2. Erwin Kreyzig. Advanced engineering mathematics (Tenth edition). John Wiley& Sons, Hoboken, NJ.(2011)
3. Veerarajan, T. Engineering mathematics.(third edition). Tata McGraw Hill Publishers, New delhi. (2011)
4. Grewal, B.S. Higher engineering mathematics. (Forty third Edition). Khanna Publishers, New Delhi. (2013).

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-200-0202A/19-200-0102B ENGINEERING PHYSICS

Course Outcomes:

On completion of this course the student will be able to:

1. Interpret modern devices and technologies based on lasers and optical fibres.
2. Explain the basic principles of crystal physics and applications of liquid crystals.
3. Summarise the characteristics and applications of nano materials and superconducting materials
4. Explain the factors affecting the acoustics of buildings and application of ultrasonics in non- destructive testing.

Module I

Laser-introduction—properties-interaction of radiation with matter-absorption-spontaneous and stimulated emission-principle of laser--Einstein coefficients- conditions for getting laser- population inversion- metastable state -Basic components of a laser-Different types of lasers- construction, working and applications of Ruby laser-Neodymium YAG laser- He-Ne laser -Applications of laser in medicine, industry, science and communication.

Holography-basic principle-Comparison with ordinary photography-Recording and reconstruction of holograms -applications.

Fibre optics - Basic structure of an optical fibre - propagation of light in an optical fibre-classifications-step-index fibre and graded index fibre- single mode and multimode-Numerical aperture of a step-index fibre, graded index fibre---acceptance angle and acceptance cone-modes of propagation - Applications.

Module II

Crystallography – Space lattice- Basis- Unit cell- Unit cell parameters- Crystal systems-Bravais lattices-Three cubic lattices-sc, bcc, and fcc- Number of atoms per unit cell- Co-ordination number- Atomic radius-Packing factor- Relation between density and crystal lattice constants- Lattice planes and Miller indices-Separation between lattice planes in sc- Bragg's law- Bragg's x-ray spectrometer.

Liquid crystals- Liquid crystals, display systems-merits and demerits- Metallic glasses-Types of metallic glasses (Metal-metalloid glasses, Metal-metal glasses) – Properties of metallic glasses (Structural, electrical, magnetic and chemical properties). Shape memory alloys- Shape memory effect.

Module III

Introduction to nanoscale science and technology- nanostructures-classifications-nanoring, nanorod,nanoparticle,nanoshells,fullerence- surface occupancy-quantum confinement effect- Properties of nanoparticles- optical, electrical, magnetic and mechanical properties-Applications of nanotechnology.

Superconductivity-Introduction--transition temperature-Meissner effect-effect of current- entropy-specific heat-isotope effect-penetration depth-.Types of superconductors-type 1 and type 2- cooper pair-BCS theory (briefly)-AC Josephsons effect- DC Jospehsons effect- Applications of super conductivity.

Module IV

Quantum mechanics-Introduction- quantum theory-black body radiation and Photoelectric effect (brief ideas only)-matter waves- de broglie wavelength-wave packet-uncertainty principle-wave function -Physical intrepretation -Time dependent Schrodinger equation for a free particle- Time independent schrodinger equation.

Ultrasonics-production of ultrasonics -piezo electric effect-Magnetostriction effect-properties of ultrasonics- Application of ultrasonics in non-destructive testing - Acoustics of building-reverberation- Absorption Coefficient- Sabines formula for reverberation time (no derivation)-Accoustic intensity- loudness-decibel-phon-conditions for good acoustics(Qualitative study).

References:

1. S. Mani Naidu, A Text book of Engineering Physics, Pearson. (2010)
2. A.S. Vasudeva, Modern Engineering Physics, S. Chand & Co. (2013)
3. Prabir K. Vasu and Hrishikesh Dhasmana, Engineering Physics, Ane books Pvt. Ltd. (2010)
4. S.O. Pillai and Sivakami, Applied Physics, New Age International (P) Ltd., Second Edition. (2008)
5. G.S. Raghuvanshi, Engineering Physics, Prentice Hall of India.(2008)

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-200-0203A/ 19-200-0103B ENGINEERING MECHANICS

Course Outcomes: On completion of this course, a student will be able to

1. Understand the principles of mechanics (statics and dynamics), the concept of free body diagrams and resolution of forces.
2. Apply the principles of mechanics, concept of free body diagrams and resolution of forces and equations of equilibrium or motion to given engineering or physical applications.
3. Analyse given engineering or physical applications and calculate the required parameters like forces, moments, various motion parameters like, displacement, velocity, acceleration, etc.
4. Ascertain the physical and mathematical meaning of quantities, like centroid, moment of inertia and their applications in engineering and locate centroid and calculate the moment of inertia or second moment of area of typical sections used in engineering.

Module I

Introduction to Mechanics: Definition and classification of mechanics – rigid body (statics and dynamics) and deformable body mechanics.

Forces and Force systems: Force and its characteristics, Principles of statics – concept of resultant and equilibrant, Composition and resolution of forces, force systems.

Coplanar Concurrent force system: Equilibrium of two, three and more than three forces, Moment of a force, Varignon's theorem of moments, Equations of equilibrium, Friction and its effects on bodies, Engineering applications.

Coplanar Parallel force System: Two parallel forces, General case of parallel forces in a plane, Centre of parallel forces, Centre of gravity, Centre of mass, Centroids of curves, areas and volumes
– regular and composite, Pappus's theorems, Equilibrium of distributed forces in a plane, Applications of the concept of centroid in engineering practice.

Module II
Moment of Inertia: Concept of moment of inertia and second moment of area, Moment of inertia of regular and composite solids, Second moment of area of regular and irregular surfaces, Polar moment of inertia / second moment of area, Product of inertia, Principal moments of inertia and principal axes, Applications of the concepts in engineering practice.

Coplanar non-concurrent force system and Analysis of Plane trusses and frames: Resultant of a general case of force system in a plane, Equilibrium equations, Concept of load carrying mechanism in trusses and frames – internal (axial) forces, two force and multi force members, Analysis of plane trusses by Method of joints and Method of sections, Analysis of Plane frames by Method of members.

Module III
Principle of virtual work: Concept of virtual work and the principle of virtual work, Applications in engineering, Equilibrium of ideal systems, Stable and unstable equilibrium.
Introduction to Dynamics: Definitions, Units, Divisions – Kinematics, Kinetics.
Rectilinear translation: Kinematics of rectilinear motion – displacement, velocity, acceleration, Kinetics – Differential equations of motion, D'Alembert's principle in rectilinear translation and its applications, Motion of a particle due to a constant force, Motion of a particle due to a force proportional to displacement – Simple harmonic motion, Momentum and impulse, Work and energy, Conservation of energy, Collision of two bodies – direct central impact.

Module IV
Curvilinear translation: Kinematics of curvilinear translation – components of displacement, velocity and acceleration, normal and tangential acceleration, Kinetics – Differential equations of motion, Motion of a projectile – projection on horizontal and inclined surfaces, D'Alembert's principle in curvilinear motion and its applications, Moment of momentum, Work and energy in curvilinear motion.
Rotation of a rigid body: Kinematics of rotation – angular displacement, velocity and acceleration, RPM, Relations of kinematic parameters of linear and angular motions, Kinetics – Differential equations of motion of a rigid body rotating about a fixed axis, Rotation under the action of a constant moment, Rotation proportional to angular displacement – Compound pendulum, D'Alemberts principle in rotation, Resultant inertia force in rotation, Principle of angular momentum in rotation, Energy equation for rotating bodies.

References

1. Timoshenko and Young. Engineering mechanics. McGraw Hill Book Company, Singapore. (1956)
2. Beer, F. P. and Johnston, E. R. Mechanics for engineers (Vol. 1: Statics and Vol.2: Dynamics). Tata McGraw Hill, New Delhi.(2004).
3. Merriam, H. L. and Kraige, L. G. (2003). Engineering mechanics (Vol. 1: Statics and Vol.2: Dynamics*)*. John Wiley and Sons, Somerset, N.J.(2003)
4. Hibbeller, R.C. Engineering mechanics. Vol. 1: Statics, Vol. 2: Dynamics. (Twelfth edition). Pearson Education Asia Pvt. Ltd., New Delhi.
5. Rajasekaran,S. and Sankarasubramanian,.G. Fundamentals of engineering mechanics. (Third edition). Vikas Publishing House Pvt. Ltd., New Delhi.(2010)

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-200-0204A /19-200-0104B BASIC CIVIL ENGINEERING

Course outcomes

At the end of the course students will be able to
1. Summarize the types, uses and properties of various building materials
2. Explain the different components of building and types of foundations
3. Illustrate the fundamental aspects of civil engineering
4. Discuss about the surveying techniques and to solve problems related with levelling
5. Recognize the various modern services emerging in the field of civil engineering
6. Prepare site plan based up on the Kerala Municipality Building Rule

Module I

Engineering Materials: Cement - varieties and grade of cement and their uses. Cement mortar- Steel- types of steel for reinforcement bars, steel structural sections. Brick- varieties and strength, tests on bricks.
Aggregates- types & requirements. Concrete- grades of concrete as per IS code, water cement ratio, workability, mixing, batching, placing, compaction and curing.

Module II

Construction : Components of a building-Foundation- types of foundations- isolated footing, combined footing, raft, pile & well foundations- Foundation for Machinery
Super structure: Brick masonry, English bond and Flemish bond, Stone masonry-Ashlar masonry-Rubble masonry. Roofing- Steel trusses, roofing for industrial buildings

Module III

Surveying: Basic Principles of surveying, instruments, methods and measurements- linear measurements- reconnaissance, selection of survey stations.
Leveling: Leveling instruments, different types, temporary adjustments, reduced level of point, booking of field notes, and reduction of levels by height of collimation method.
Introduction to Total Station.

Module IV

Site planning and Building Rules-Selection of site-Site plan preparation for buildings-Kerala Municipal Building Rules prevailing, general provisions regarding site and building requirements-Coverage and Floor Area Ratio-Basic concepts of Intelligent Buildings and Green Buildings
Roads- Classification of Rural and urban Roads.
Sources of Water - Water Supply-Quality of Water.

References:

1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England (2011).
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England (1998)
3. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers (2011)
4.McKay, W. B. and McKay, J. K., Building Construction, Vol. 1 to 4, Pearson India Education Services.(2013)

5. Rangwala,S.C and Dalal,K.B.,Building Construction, Charotar Publishing House (2017).
6. Kerala Municipal Building Rules (latest revision)

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-200-0205A /19-200-0105B BASIC MECHANICAL ENGINEERING

Course Outcomes:

On completion of this course the student will be able to:

1. Understand basics of thermodynamics and working of steam turbines
2. Understand basics of internal combustion engines, refrigeration and air conditioning
3. Gain knowledge on the working of hydraulic turbines and centrifugal pumps
4. Identify manufacturing methods encountered in engineering practice and understand mechanism of power transmission

Module I

Thermodynamics: Thermodynamics systems – open, closed and isolated systems, equilibrium state of a system, property and state, process, cycle, Zeroth law of thermodynamics- concept of temperature, temperature scales. First law – internal energy, enthalpy, work and heat, Different processes (isobaric, isochoric, isothermal, adiabatic and polytropic processes). Second law – Kelvin-plank and Claussius statements and their equivalence, Carnot Cycle (Elementary problems only).
Thermodynamic properties of Steam, Steam Generator. Different types of boilers, boiler mountings and accessories. Formation of steam at constant pressure, working of steam turbines, compounding of turbines.

Module II

Internal Combustion Engines: Air standard cycles – Otto and Diesel cycles, working of two stroke and four stroke Petrol and Diesel engines, Carburetted and MPFI engines, fuel pump, fuel injector, ignition system, cooling system, lubricating system.
Refrigeration & Air-conditioning: Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapour compression cycle (Elementary problems only), Summer and winter air conditioning.

Module III

Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton Wheel, Francis and Kaplan turbines, Specific speed (Definition and significance only), Classification of water pumps, working of centrifugal pumps and reciprocating pumps (Theory of working principles only)
Power plants: Hydro-electric power plants, Thermal power plants, Nuclear power plants, Diesel power plants, Wind mills, solar energy (Working principles using schematic representations only)

Module IV

Introduction to Manufacturing Systems: Welding- different types of welding, resistance welding, arc welding, gas welding, Brazing and soldering, Different welding defects. Casting- different casting processes, sand casting, casting defects, Rolling- hot rolling and cold rolling, two high, three high , cluster rolling mills, wire drawing, forging, extrusion, Heat treatment of steel, elementary ideas of annealing, hardening, normalizing, surface hardening.
Power Transmission Methods and Devices: Introduction to Power transmission, Belt, Rope, Chain and Gear drive. Length of belt open and crossed. Ratio of belt tensions (Elementary problems only). Different types of gears (Elementary ideas only). Types and functioning of clutches.

References

1. Nag, P.K. Engineering thermodynamics. (Fifth Edition). McGraw Hill Education (India) Pvt. Ltd, New Delhi.(2013).
2. Gill, J.H. Smith Jr. and Ziurys, E.J. Fundamentals of internal combustion engines, Oxford & IBH, New Delhi.(1959)
3. Stoecker, W. F. Refrigeration and air conditioning. Tata McGraw Hill, New Delhi.(1980).
4. JagadishLal. Hydraulic machines. Metropolitan Book co, New Delhi.(1994)
5. Raghavan, V. Material science and engineering, Prentice Hall of India, New Delhi.(2004)
6. Rajendar Singh.Introduction to basic manufacturing processes and workshop technology, New Age International, New Delhi. (2006).

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-200-0206A / 19-200-0106B SOFT SKILLS DEVELOPMENT

Course Outcomes:
On completion of this course the student will be able to:
1. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
2. Read, comprehend and answer questions based on literary, scientific and technological texts
3. Develop self-motivation, raised aspiration, belief in one's own abilities and commitment to achieving one's goal
4. Demonstrate emotional maturity and emotional health.

Module I
Role and importance of verbal communication, Everyday active vocabulary, Common words used in transitions, enhancing vocabulary, affixes and changes in pronunciation and grammatical functions, words often confused in pronunciation and usage. Passage comprehension- skimming, scanning techniques, note making, note taking and summarizing. Deciphering meaning from contexts. Two types of meaning- literal and contextual. Constructive criticism of speeches and explanations.

Module II

Fundamental grammar, Simple structures, passivizing the active sentences, reported speech, the judicious use of tenses and moods of verbs, forming questions and conversion from questions to statements and vice versa, forming open –ended and close- ended questions. Words and style used for formal and informal communication. Practice converting informal language to formal, the diction and the style of writing. Dealing with the nuances of ambiguous constructions in language. Learning authoritative writing skills, polite writing and good netiquette. Writing for internships and scholarships.

Module III

Kinesics, Proxemics, Haptics, and other areas of non-verbal communication, fighting communication barriers, positive grooming and activities on the same.

Different types of interviews, and presentation - oral, poster, ppt. Organizing ideas for group discussions, the difference between GD and debates.

Effective listening and seeking to understand others' perspectives.Non-violent negotiation and persuasion, communicating across age groups, cultures or identity groups.

Higher order thinking and evaluation, information-seeking, research, and independent learning, synthesis, creativity, problem analysis and problem solving. Decision making, Self-reflection and learning from experience.

Module IV

Developing positive self: Understanding oneself, A realistic awareness of oneself and one's abilities, strengths and potential, Self-esteem, Self-efficacy, steps for improvement.

Intra-personal skills – Self-control, emotional regulation and self-discipline, conscientiousness, dutifulness, reliability, truthfulness, honesty and trustworthiness. Goal orientation and initiative. Time management – prioritising work.

Interpersonal skills – cross cultural competence and valuing diversity of perspectives, respecting and expressing concern for others. Empathy and ability to notice the effect of one's actions on others, tolerance for disagreement, conflict management and resolution.

Civic engagement and social responsibility – Global and local awareness (issues, challenges, priorities). Vision, ability to imagine something new or improved. Social responsibility and willingness to take constructive action.

References:

1. Duck, Steve and David T. Macmahan. Communication in Everyday Life. 3rd Ed. Sage, (2017).
2. Gamble, Kawl Teri and Michael W. Gamble. The Public Speaking Playbook. Sage, (2015).
3. Raman, Meenakshi and Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, (2015).
4. Coleman, D. Emotional intelligence: Why it can matter more than IQ, Bantam Books, New York (2006).
5. Devadas Menon. Stop sleep walking through life, Yogi Impressions Books Pvt. Ltd, Mumbai (2012).
6. Barun K Mitra. Personality Development and Softskills, Oxford University Press (2012).

ASSESSMENT

1. 'Soft Skills Development' is a practical and activity oriented course which has continuous assessment for 50 marks based on class room interaction, activities, and assignments. The activities may include 'Just a Minute' (JAM) sessions, group discussion, role play, debate, and extempore speech.

The weightages for the different components shall be as follows:

Class room interaction – 10 marks
Activities – 30 marks

Assignments (mainly from Modules I and II) – 10 marks
2. Semester End Examination is not envisaged.
3. A student should secure a minimum of 50% marks in continuous assessment for a pass in the course.

19-200-0207A /19-200-0107B CIVIL ENGINEERING WORKSHOP

Course Outcomes:
On completion of this course the student will be able to:

1. Identify simple plumbing and sanitary fittings and state its use
2. Identify the various methods used in building construction.
3. Construct brick walls using English Bond and Flemish Bond
4. Set out a building as per a given building plan using surveying instruments
5. Compute the various quantities of materials required for a building

Plumbing:
Introduction to simple plumbing and sanitary fittings.

Building Materials:
Familiarization of building materials and their testing.

Masonry:
Construction of English bond and Flemish bond – wall junction – one brick – one and a half brick –and two brick thick

Surveying:
Surveying and levelling instruments
Setting out of building (single room only) as per the given building plan using surveying instruments
Compute the area and/or volume of various features of a building/structure such as door and window size, number of bricks required to construct a wall of a building, diameter of bars used in windows etc. (to create an awareness of measurements and units)
Demonstration of Total Station

Assignment:
Students shall collect the list of various building materials used for the construction of a building including their market rate.

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

19-200-0208A /19-200-0108B MECHANICAL ENGINEERING WORKSHOP

Course Outcomes:

On completion of this course the student will be able to:

1. Identify and use tools, and make different types of joints used in carpentry, fitting, and sheet metal shop.
2. Compare basic fabrication techniques of different types of welding.

Preliminary exercises for beginners in all the following shops. Specific models may be designed by the teachers.

1) Fitting Shop.

2) Sheet Metal Shop
3) Foundry Shop
4) Welding Shop
5) Carpentry Shop

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

19-200-0209A/19-200-0109B LANGUAGE LAB

Course Outcomes:

On completion of this course the student will be able to:

1. Test pronunciation skills through stress on word accent, intonation, and rhythm.
2. Use English language effectively for writing business letters, resume, minutes of meeting and reports.
3. Use English language effectively to face interviews, group discussions, and public speaking.

Following course content is prescribed for the **Language Laboratory** sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Preparing business letters
4. Preparing a resume
5. Conducting a meeting and writing the minutes
6. Writing a report
7. Situational Dialogues / Role Play.
8. Oral Presentations- Prepared and Extempore.
9. 'Just A Minute' Sessions (JAM).
10. Describing Objects / Situations / People.
11. Debate
12. Group discussion

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

19-200-0210A / 19-200-0110B NSS/NATURE CONSERVATION ACTIVITIES

NATIONAL SERVICE SCHEME (NSS)

Course Outcomes:

On completion of this course the student will be able to:

1. Recognise the community in which they work
2. Utilise their knowledge in finding practical solution to individual and community problems

A student enrolling as member of NSS will have to complete 10 hours of training / social service.

NATURE CONSERVATION ACTIVITIES

Course Outcomes:

On completion of this course the student will be able to:

1. Practice and spread the message of sustainable life styles
2. Understand the importance of green plants in mitigating global environmental problems
3. Identify suitable waste management practices for the local community

A student enrolling as member of the Nature Conservation Club will have to complete 10 hours of campus cleaning and greening activities.

SEMESTER III

19-200-0301 LINEAR ALGEBRA & TRANSFORM TECHNIQUES
(Common for all branches)

Course Outcomes:
On completion of this course the student will be able to

1. Solve linear system of equations and to determine Eigen values and vectors of a matrix.
2. Exemplify the concept of vector space and sub space.
3. Determine Fourier series expansion of functions and transform.
4. Solve linear differential equation and integral equation using Laplace transform.

Module I.
Linear Algebra 1:Rank of a matrix, solution of linear system of equations- existence, uniqueness, general form-Eigen values and Eigen vectors- properties of Eigen values - Diagonalization of a matrix - Cayley Hamilton theorem (without proof) Verification-Finding inverse and power of a matrix using it-Quadratic form-orthogonal reduction of quadratic form to Canonical form.

Module II
Linear Algebra 2: Vector space-subspace-Linear dependence and independence-Spanning of a subspace- Basis and Dimension. Inner product- Inner product spaces - Orthogonal and Orthonormal basis –Gram- Schmidt Orthogonalization process. Linear Transformation.

Module III
Fourier Analysis: Periodic function, Fourier series, Functions of arbitrary period, Even and odd functions, Half Range Expansion, Harmonic analysis, Complex Fourier Series, Fourier Integrals, Fourier Cosine and Sine Transform, Fourier Transform.

Module IV
Laplace Transforms: Gamma functions and Beta function-Definition and properties, Laplace transforms. Inverse Laplace Transform, Shifting theorem, Transform of Derivative and Integrals, Solution of differential equation and integral equation using Laplace transform, Convolution, Unit step function, Second Shifting theorem, Laplace transform of periodic function.

References:

1. Erwin Kreyzig. (2010). *Advanced engineering mathematics*. (tenth edition). John Wiley & Sons, Hoboken, N.J
2. Grewal, B.S. (2013). *Higher engineering mathematics*. (forty third edition). Khanna Publishers, New Delhi.
3. Hsiung,C.Y and Mao, G. Y. (1999). *Linear algebra*. World Scientific, New Jersey.
4. Hoffman, K. and Kunze, R. (1971). *Linear algebra*. Prentice Hall of India, New Delhi.
5. Venkataraman,M.K. (1999). *Linear algebra*. The National Publishing Co, Chennai.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19–201-0302 SURVEYING-I

Course Outcomes: On completion of the course, a student will be able to:

1. Carry out preliminary surveying in the field of civil engineering applications and use various surveying instruments involved in with respect to utility and precision.
2. Plan a survey, taking accurate measurements, field booking, plotting and adjustment of traverse.
3. Understand the principles of levelling and the preparation of contour map.
4. Acquire knowledge of EDM and total station survey
5. Plan a survey for applications such as road alignment and height of the building

MODULE I

Introduction : Classification of surveys, primary division of Surveying- conventional signs. **Surveying for linear measurements**: Instruments - principles - Tie and check line- obstacles- measurement on sloping ground –Errors.

Methods of orientation, Principle of resection,True and magnetic bearing-Dip and Declination-Local attraction-Traversing-Plotting a Traverse Survey -Graphical adjustment of closing error in a closed Traverse.

Electromagnetic distance measurement (EDM): Electromagnetic waves, types of waves,Principle of EDM, measurement of distance from transit time and from phase difference,methods of modulation, Types of EDM instruments, effect of atmospheric conditions, atmospheric calibration of instruments, slope and height correction.

MODULE II

Levelling: Definitions of Terms used in Leveling- levelling instruments-Temporary and permanent adjustments-principles of levelling-Simple levelling, Differential levelling-Reduction of levels- Classification of levelling-Profile levelling and cross sectioning -correction for curvature and refraction-Reciprocal levelling- Errors in levelling. **Contour Survey**: Definition-characteristics of Contour- uses of contours- Methods of contouring-Interpolation Contours-uses of Contour map.

MODULE III

Area and volumes: Areas along Boundaries- Mid ordinate rule-Average ordinate rule-Trapezoidal rule-Simpson's rule- Area by Meridian distance method- Area by Double meridian method. Departure and total latitude method-Coordinate method- Computation of volume by Trapezoidal and Prismoidal formula -Mass haul curve.

Total Station: Total station, accessories, advantages and applications. Field procedure for total station survey, errors in total station survey.

MODULE IV

Theodolite Surveying: Study of Theodolite - Temporary and permanent adjustments-measurement of horizontal angle- method of repetition and reiteration- measurement of vertical angle – Theodolite traversing by direct observation of Angles and by direct observation of Bearings- Adjustment of a closed Traverse (angular error, bearings and closing error) - Bowditch rule-Transit rule-Gale's traverse Table- Omitted measurements.

TacheometricSurveying : Instruments used-Stadia System-fixed and movable hair methods-Tacheometric constants- Anallatic lens-Tangential System

References:

1. Plane and geodetic surveying, 2nd edition Johnson aylmer, CRC Press
2. Surveying. Vol.I& II, Punmia, B.C, Ashok Kumar Jain &Arun Kumar Jain, Laxmi Publications.
3. Advanced Surveying - Total Station, GPS, GIS and Remote Sensing Second Edition SatheeshGopi, R. Sathikumar, N. Madhu, Pearson publications

4. Surveying and Levelling, N.N Basak, , MC Graw Hill Education
5. Surveying Theory and Practice, James M Anderson, Edward M Mikhail, ,MC Graw Hill Education
6. Elementary Surveying Ghilani, C. D, and Wolf, P. R. , Prentice Hall. 2012
7. Surveying. Vol.I and II Arora, K.R. Standard Book House. 2012
8. Surveying. Vol. I Duggal, S.K.,Tata McGraw Hill Publishing Co Ltd.2010

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0303 STRENGTH OF MATERIALS

Course outcome: On completion of the course, a student will be able to

1. Assimilate the fundamentals of stress and strain and their relationships and understand the basic elastic and inelastic properties of materials.
2. Analyze a structure for its elastic response under axial forces.
3. Thoroughly understand the importance of principal stresses and strains and physical measurement of strains.
4. Learn and reinforce the idea of internal forces, such as shear force and bending moment due to transverse external forces in structures.
5. Understand the theory of simple bending, shear stresses due to shear force and simplified theory of torsion of bars with circular cross-sections (importance of geometry in torsion).
6. Conceive the idea of calculating elastic deflections in beams.
7. Understand elementary analysis of stability of slender columns and principal stresses and strains in thin pressure vessels distinguishing the role of "thickness" in structural action.

MODULE I
Material properties and Basic assumptions in strength of materials – elasticity, plasticity, ductility, brittleness, malleability, isotropy / anisotropy, linear / non-linear elasticity, Stress-strain curve of a mild steel bar in a tension test.
The concept of Stress and Strain: Definition of stress and strain at a point, normal stress and shear stress, Complementary shear stress, shear strain, Hooke's law and Poisson' s ratio, Constitutive equations, Elastic moduli, Relationship between elastic moduli of an elastic and isotropic material, Factor of safety, Allowable stress.
Axially loaded Members: Change in lengths of axially loaded members, Changes in lengths of non-uniform bars, Statically indeterminate problems, Thermal effects, misfits and pre strains.

MODULE II
Principal stresses and strains - Stresses on inclined planes for axial and biaxial stress fields, principal stresses, Mohr's circle of stress, principal strains, strain rosette.
Shear force and bending moment: Types of beams (determinate and indeterminate), loads and reactions in determinate beams, shear force and bending moment, relationships between intensity of loading, shear force and bending moment, Shear force and bending moment diagrams of statically determinate beams.

MODULE III

Stresses in beams : Pure bending and non uniform bending, Assumptions (for pure bending), Curvature of a beam, Longitudinal strains in a beam, Normal stresses in beams (linearly elastic and isotropic materials) due to bending, Design of beams for bending stresses, Non-prismatic beams, **Shear stresses** in beams of rectangular, circular, I and T cross sections.

Torsion: Circular bars of linearly elastic and isotropic materials, uniform torsion, assumptions, angle of twist, transmission of power by circular shafts, statically indeterminate problems, non-uniform torsion, Close and open coiled helical springs.

MODULE IV

Elastic Deflection of Determinate Beams: Basic concept of slope and deflection, Differential equation of elastic line of a beam, Relation between intensity of loading, shear force, bending moment, slope and deflection, Macaulay's method, Moment-area method.

Columns : Structural behavior of short and slender (long) columns, Buckling and stability, Euler's formula, Columns with pinned ends, and other support conditions, Slenderness ratio, Limitations of Euler's formula, Columns with eccentric axial loads, The secant formula for columns.

Thin Cylinders: Stresses and strains in thin cylinders and spherical shells.

References:

1. Gere, J. M. , *Mechanics of Materials*. Brooks/Cole Thomson Learning. 2004
2. Popov, E. P. , *Engineering Mechanics of Solids*. Prentice-Hall of India Limited, New Delhi, India. 1990
3. Timoshenko, S. P. and Young, D. H., *Elements of strength of materials*. East-West Press Private Limited, New Delhi, India. 2004
4. Case, J.,Chilver, L. and Ross, C. T. F. , *Strength of Materials and Structures.* Elsevier, New Delhi. 1999
5. Nash. , *Strength of Materials*. Shaum's outline series, McGraw Hill publishers.1998
6. Subramanian, R. , *Strength of Materials*. Oxford University Press. 2016
7. Vazirani, V. N. and Ratwani, N. M., *Strength of Materials*. Vol I. Khanna Publishers.1996

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0304 CONCRETE TECHNOLOGY

Course Outcomes: On completion of the course, a student will be able to

1. Understand the constituent materials of concrete, their properties and functions in concrete.
2. Design concrete mixes of specified grades via IS and ACI methods and generate an awareness regarding manufacturing process of concrete.
3. Clearly understand properties of concrete in its fresh and hardened state and tests for determination of them.
4. Generate awareness regarding special forms of concrete and some non-destructive testing methods of concrete.

MODULE I

Materials: Cement – Ingredients, Chemical composition, basic properties of cement compounds, Hydration of cement- heat of hydration, physical properties of Portland cements, Indian standard tests and specification, various types and grades of cement, storage of cement
Aggregates:- Classification of aggregates. Characteristics of aggregates – Strength of aggregate, particle shape and texture, specific gravity, bulk density, porosity, water absorption and moisture content of aggregate, bulking of fine aggregate, deleterious substance in aggregate, soundness of aggregate , alkali- aggregate reaction , sieve analysis:- grading curves, fineness modulus, grading requirements, grading of fine and coarse aggregates, zoning, IS tests and specification for aggregates for concrete.
Water: - Quality of mixing water, effect of impurities in water on properties of concrete. permissible impurities as per I.S
Admixtures:- Functions and classification of admixtures, factors influencing the dosage of different admixtures- IS specification for admixtures for concrete. accelerators - retarders - plastizers - water reducing agents - use of silica fumes.

MODULE II
Properties of fresh concrete: Water/ Cement ratio and its significance in fresh concrete- workability- different methods for assessing workability according to IS Specification, factors affecting workability, requirements of workability for various work, segregation, bleeding, setting, hardening, strength development.
Properties of Hardened concrete: Strength of concrete- strength of concrete in compression, tension and flexure - stress- strain characteristics and elastic properties - shrinkage and creep. durability of concrete - permeability - chemical attack - sulphate attack - resistance to abrasion and cavitaion - resistance to freezing and thawing - resistance to fire - marine atmosphere - quality control - frequency of sampling - test specimens - statistical analysis of test results - standard deviation - acceptance criteria.

MODULE III
Mix Design: Quality Control - Factors causing variations in the quality of concrete - mix design - nominal mixes - design mixes - factors influencing mix design - A.C.I method - I.S method - design for high strength mixes.
Process of manufacture of Concrete:- Mix proportion and grade of concrete - Various types of batching, mixing, transporting, placing, compacting, curing and finishing of concrete (in detail). Joints in concreting – construction and expansion.

MODULE 1V
Special concrete: Lightweight concrete, High strength concrete, Polymer concrete, fiber reinforced concrete, Ferro-cement, Ready mixed concrete. vacuum concrete - shotcrete - steel fibre reinforced concrete- high performance concrete, reactive powder concrete, self-compacting concrete.
Non-destructive testing of concrete: Rebound hammer test, ultrasonic pulse velocity test, core cutter test.

References :

1. Neville, A. M. , *Concrete Technology*. Pearson Education.2010
2. Neville, A. M. , *Properties of Concrete* (4th edition). Pearson Education.2011
3. Orchard, D. F. , *Concrete Technology*. Vol. I & II.,1976
4. Shetty, M. S. , *Concrete Technology*. S I Chand & Company.2006
5. Gambhin, M.L. , *Concrete Technology*. Tata McGraw Hill. 2017
6. IS 10262:2019 Concrete Mix Proportioning - Guide lines and other relevant IS codes

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0305 FLUID MECHANICS – I

Course Outcomes: On completion of the course, a student will be able to

1. Compute hydrostatic forces acting on submerged surfaces
2. Apply conservation laws to solve steady state fluid flow problems
3. Apply the basic laws of mechanics in the fields of hydrology, irrigation engineering and hydraulic structures
4. Apply the principles of dimensional analysis for design of experiments
5. Design experimental procedure for physical model studies
6. Analyse the characteristics of flow through pipes
7. Design simple pipe systems

MODULEI

Introduction: Fundamental difference between a solid and a fluid, constituent relationships for solids and fluids, conservation principles applied in fluid mechanics.
Properties of fluids, concept of continuum, viscosity, compressibility, ideal and real fluids, surface tension, capillarity.
Stress at a point, pressure, Pascal's law, Variation of pressure with elevation in compressible and incompressible fluids, hydrostatic law, Pressure measurement, piezometers and manometers.

MODULEII

Hydrostatic forces exerted on submerged surfaces.
Description of fluid flow: with reference to translation, rotation and deformation, concept of continuum, control mass and control volume approach. Steady flow and uniform flow.
Velocity field, one and two-dimensional flow analysis, circulation and vorticity, stream function and velocity potential function, potential flow, standard flow patterns, combination of flow patterns, flownet.

MODULEIII

Forces exerted in a fluid flow, derivation of Continuity equation and Euler's equation. Bernoulli's equation and its applications. Momentum equation and its applications.
Dimensional Analysis as a tool in design of experiments, identification of non-dimensional numbers and their significance, dimensional analysis methods. Hydraulic Similitude: Similarity laws, and Model studies.
Measurement of flow in pipes and open channels.

MODULEIV

Head loss in flow through pipes, Darcy Weisbach equation, major and minor losses. Flow through pipes and pipe networks, equivalent pipe.
Laminar flow and its characteristics, Reynolds experiment. Laminar flow between parallel plates. Laminar flow through pipes, Hagen-Poiseuille equation.
Introduction to turbulent flow, Velocity distribution in turbulent flow. Introduction to boundary layer theory

References:

1. White, F. M. .*Fluid Mechanics*. Tata McGraw Hill Publication.2011

2. Fox, R. W., Pritchard, P. J. and McDonald, A. T. .*Introduction to Fluid Mechanics*(7th Student edition). Wiley India Edition. 2011
3. Shames .*Mechanics of Fluids*.McGraw Hill Book Co., New Delhi. 1988
4. Streeter, V. L. and Wylie, B. .*Fluid Mechanics*. McGraw Hill Book Co., New Delhi. 1999
5. Modi, P. N. and Seth, S. M. (200).*Hydraulics and Fluid Mechanics (including hydraulic machines)*. Standard Book House, Delhi, India.
6. Ojha, C.S.P, Chandramouli, P.N and Berndtsson, R . Fluid Mechanics and Machinery. Oxford University Press.2010

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b) 12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b) 12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b) 12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b) 12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0306 ENGINEERING GEOLOGY AND SEISMOLOGY

Course Outcomes:On completion of the course, a student will be able to

1. Understand weathering process and mass movement.
2. Distinguish geological formations.
3. Identify subsurface information and groundwater potential sites through geophysical investigations.
4. Apply geological principles for mitigation of natural hazards.

MODULE I

Introduction: Definition - branches of geology -scope of geology – geology in civil engineering- Geological time scale.

Physical Geology: Rock weathering and soils - physical weathering - chemical weathering - climate and soil formation - classification of soil - soil erosion and its control. *Wind* - Wind erosion - Wind transportation - Wind deposition

Rivers - erosion - transportation - deposition - river meandering - types of rivers - drainage patterns.- *Oceans* – sea erosion - transportation - deposition – coastal protection.

MODULE II

Mineralogy: Definition of minerals - physical properties–Quartz, Feldspar, Muscovite, Biotite, Kyanite, Serpentine.

Petrology : Classification, texture and structures of Igneous , Sedimentary and Metamorphic rocks- factors & kinds of metamorphism – Engineering properties of rocks- Description, engineering properties and uses of the following rocks – Granite , Gabbro, Basalt, Limestone, Shale, Laterite, Quartzite, Marble.

Structural Geology: Attitude of beds, study of structures –folds, faults, fractures and joints – classification, recognition in the field, relevance to civil engineering.

MODULE III

Geological Investigation : Objectives – Methods of investigation – Surface investigation – Sub - surface explorations –Geophysical Methods

Engineering Geology : Geological conditions necessary for design and construction of dam & reservoirs, tunnels, buildings & road cuttings – Landslides –definition, classification, causes and their corrections.

MODULE IV

Seismology : Internal structures of the earth – M-discontinuity – sources of seismic activity - Continental Draift - Plate tectonics –fault movement – Reservoir associated earthquakes – Elastic Rebound Theory - seismic waves – Terminology – Intensity and Magnitude of Earthquake – Energy Released during on earthquake – Locating Epicentre and Focus – Recording of an earthquake – Seismograph – working Principle and Sensitivity of a Seismographs – classification of earth quakes
- based on depth of focus , magnitude, cause of origin –effects of earthquakes – Primary effects – Secondary effects - Distribution of earth quakes –Seismic History of India Seismic Zones of India – Tsunami – Introduction – Tsunami velocity – Velocity in deep ocean –Velocity in shallow water – wavelength of tsunami wave – Drawdown and Run up of a tsunami – inundates of Tsunami waves.

References:

1. Singh, P.*A text book of Engineering and General Geology*.Katson Publishers, Ludhiana.
2. Waltham,.T.*Foundations of Engineering Geology*.Spon Press, London.
3. Blyth, F. G. H.and de Frieitis, M. H. *Geology for Engineering*
4. Judo, W. R. *Principles of Engineering Geology and Geotechnics*.McGraw Hill.
5. Mukerjee, P. K.*A text book of geology*.World Press Ltd., Calcutta.
6. Frost, J. An Introduction to Seismology, Larsen and Keller Education, 2017.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0307 STRENGTH OF MATERIALS LAB

Course Outcomes: On completion of the course, a student will be able to

1. Conceive and reinforce the ideas of axial tension, compression, bending, torsion (circular bar), thoroughly through the respective experiments.
2. Understand the determination of certain material properties, like, hardness, toughness, Young's modulus, Rigidity modulus, ductility, flexural strength, etc.
3. Familiarize with testing equipment and machine in the laboratory.

LIST OF EXPERIMENTS

1. Tension test on mild steel bar.
2. Double shear test on mild steel bar
3. Torsion test on mild steel bar
4. Izode Impact test
5. Charpy Impact test.
6. Rockwell and Brinnell Hardness tests
7. Determination of modulus of rigidity of springs– close coiled and open coiled.
8. Fatigue strength test
9. Bending test of wooden / steel beam – determination of flexural strength and modulus of elasticity.
10. Compression test on wood and brick.

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

19-201-0308 CONCRETE LAB

Course Outcomes: On completion of the course, a student will be able to

1. Feel the constituent materials of concrete and test their properties of engineering interest and assess the quality and suitability of such materials.
2. Clearly understand batching and mixing of concrete and the concept of workability and water-cement ratio.
3. Determine strength of concrete in compression and tension and hence appreciate grade of concrete and mix design.
4. Determine desirable properties of concrete of engineering interest.

LIST OF EXPERIMENTS

1. Determination of Standard consistency and Initial Setting time of Cement.
2. Determination of Soundness of cement (Le Chatelier's apparatus).
3. Particle size distribution of fine aggregate – sieve analysis
4. Bulking of sand.
5. Determination of compressive strength of cement
6. Mix Design, Workability of concrete and Casting of cubes, cylinders and beams
7. Compression test on concrete cubes and split-tensile test on concrete cylinders.
8. Determination of Modulus of elasticity of concrete.
9. Flexure test on concrete.
10. Workability tests of SCC

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

SEMESTER IV

19-200-0401 COMPLEX VARIABLES AND PARTIAL DIFFERENTIAL EQUATIONS
(Common to all branches)

Course Outcomes:

On completion of this course the student will be able to:
1. Transform a region to another region using conformal mapping
2. Evaluate real integrals using residue theorem
3. Form and solve partial differential equation
4. Determine solution of partial differential equation for vibrating string and heat conduction

Module I

Analytic function- Cauchy-Riemann equation (Cartesian and polar)-Harmonic function-construction of analytic function given real or imaginary parts- Conformal mapping of standard elementary function and bilinear transformation.

Module II

Cauchy's integral theorem, Cauchy's integral formula and for derivatives-Taylor's and Laurent's expansion (without proof) - Singularities-Residues-Cauchy's Residues theorem- Contour integration involving unit circle.

Module III

Formation of partial differential equation eliminating arbitrary constants and function—Solution of first order equation-four standard types- Lagrange's equation—Linear homogeneous partial differential equation with constant coefficient.

Module IV

One dimensional wave equation, Alembert's solution and one dimensional heat flow equation—solution by the method of separation of variables- application of Fourier series solution. Solution of Laplace's equation over a rectangular region by the method of separation of variables.

References:

1. Erwin Kreyzig. (2010). Advanced engineering mathematics. (Tenth edition). John Wiley & Sons, Hoboken, N.J
2. Grewal, B.S. (2013). Higher engineering mathematics. (Forty third edition). Khanna Publishers, New Delhi.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201 -0402 SURVEYING - II

Course Outcomes: On completion of the course, a student will be able to:

1. Set out horizontal curves.
2. Carry out a geodetic survey, taking accurate measurements using instruments and apply mathematical adjustment of errors involved in surveying measurements.
3. Plan a survey for applications such as road alignment and height of the building.
4. Invoke advanced surveying techniques over conventional methods in the field of civil engineering.
5. Provide a basic understanding on geospatial acquisition and its process.

MODULE I

Curves: Types of curves - Basic definitions-Elements of a simple curve - Methods of setting out (Linear methods and Angular methods)-Compound Curves-Elements of a compound curve-Reverse Curve-Transition curves-advantages-super elevation- length of a transition curve - vertical curves-Types of vertical curves- length of the vertical curve.

MODULE II

Triangulation : Principles of Triangulation-classification triangulation-reconnaissance-Selection of Triangulation Stations-Intervisibility of Triangulation stations-Determination of elevations of stations (No obstruction due to intervening ground and obstruction due to intervening ground) - Signals-Elevated towers-selection of site for base line-Base line measurement-corrections-Satellite station.

Adjustments of observations: Laws of weight-Corrections to vertical controlled measurements with a closing error-Theory of least squares-Normal equation method-Most probable values of directly observed quantities and indirectly observed quantities, Triangulation adjustments -Station adjustments for 3 different. Cases (when the horizon is closed with angles of equal weight - unequal

weight-when several angles are measured at a station individually and also in combinations)- Figure adjustment of a plane triangle adjustment of two connected triangles.

MODULE III

Field Astronomy: Definitions - solution of astronomical triangle

Global Positioning Systems- Components and principles, Satellite ranging- calculating positions, Satellite signal structure, code phase and carrier phase measurements, GPS errors and biases, Application of GPS.

GPS Surveying methods: Static, Rapid static, Kinematic methods, Phases of GPS survey, Planning and preparation, Field operation, horizontal and vertical control

MODULE IV

Hydrographic Survey: Introduction - Methods of sounding - Method of locating soundings – plotting soundings-Three Point problem.

Photogrammetry: Principle of Terrestrial and Arial photogrammetry, Scale and distortion of the vertical photograph, flying height, Application of Air photograph.

Remote Sensing: Basics, platform and sensors, visual image interpretation.

Geographical Information System: Basics, components of GIS and GIS operations.

References:

1. Burrugh P , Principles of Geographical Information Systems ,Oxford University Press
2. George Joseph , Fundamentals of Remote Sensing, University Press .
3. Duggal, S.K. *Surveying*. Vol. II. Tata McGraw Hill Publishing Co Ltd.
4. Punmia, B.C, Jain, A. K. andJain,A. K. *Surveying*. Vol.II. Laxmi Publications.
5. Arora, K.R.Surveying.Vol. II and III. Standard Book House.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0403 ANALYSIS OF DETERMINATE STRUCTURES

Course Outcomes: On completion of the course, a student will be able to:

1. Appreciate the effects of sudden loading and stress concentration on determinate structures.
2. Conceive the behavior of beams to asymmetric loading and geometry and initial curvature and the concept of shear centre which play a pivotal role in structural steel design.
3. Assimilate the concept of strain energy and its utility in determining deflections and slopes in determinate structures motivated by the importance of serviceability part of analysis and design.
4. Develop basic concepts of stresses in built-up and composite beams.
5. Thoroughly understand the governing equations of two-dimensional linear elasticity and employing principal stresses in design through theories of failure in elementary level.
6. Thoroughly assimilate the powerful concepts of moving loads and influence lines and their applications in determinate structural analysis.

MODULE I

Behavior of Structures to Impact and Stress concentration: Impact loading, Fatigue (progressive fracture), Stress concentration in axial loading, bending and torsion (elementary treatment only).
Asymmetry in Bending: Asymmetry in loading and geometry, Stresses in doubly symmetric beams with inclined loads, bending of determinate beams with initial curvature subjected to symmetrical loading.
Shear centre: The concept of shear centre introduced through singly symmetric and asymmetric cross-sections of beams.

MODULE II

Strain Energy: Definition of strain energy and complementary energy, strain energy due to axial load, bending moment, shear force and twisting moment.
Deflection and slope in Beams by Strain energy method: Castigliano's theorems, Unit load method – deflection and slope in determinate beams.
Deflection of Determinate Trusses: Deflection of joints of trusses through Castigliano's theorems, Unit load method, temperature effects.

MODULE III

Built-up and Composite Beams: Analysis of built-up and composite beams – shear flow, Combined stresses in Beams subjected to axial load, bending and torsion.
Plane stress and Plane strain problems: Introduction to plane stress and plane strain problems, equations of equilibrium, compatibility and constitutive equations in two-dimensions, examples of plane stress and plane strain problems.
Theories of failure: Maximum principal stress theory, maximum principal strain theory, maximum shear stress theory, maximum strain energy theory, maximum distortion energy theory, applications of each theory.

MODULE IV

Moving Loads and Influence Lines: Moving loads in structures introduced through examples of bridge girders, Definition and purpose (in analysis) of influence line, influence lines for reaction, shear force and bending moment at a given cross-section in statically determinate beams, criteria for maximum reaction, shear and bending moment at a section and absolute maximum of the same in determinate beams, Muller-Breslau influence theorem for statically determinate beams, influence lines for statically determinate trusses, criteria for maximum bending moment at a panel point on the loaded chord, and unloaded chord of a truss, Muller Breslau influence theorem for statically determinate trusses.

References:

1. Timoshenko, S. P. and Young D.H. , *Elements of strength of materials*. East-West Press Private Limited New Delhi, India. 2004
2. Gere, J. M. , *Mechanics of Materials*. Brooks/Cole Thomson Learning. 2004
3. Wang, C. K. , *Intermediate Structural Analysis*. McGraw Hill International Edition. 2010
4. Popov, E. P. , *Engineering Mechanics of Solids*. Prentice-Hall of India Limited, New Delhi, India.1999
5. Srinath, L. S. , *Advanced Mechanics of Solids*. Tata McGraw Hill Education Pvt Ltd, New Delhi.2010
6. Punmia B. C., Jain A. K. and Jain A. K. (, *Strength of Materials and Theory of Structures*: Vol. II., Laxmi Publications (P) Ltd, New Delhi. 2005
7. Menon, D. , *Structural Analysis*.Narosa publishers. 2010

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201 - 0404 TRANSPORTATION ENGINEERING

Course Outcomes:On completion of the course, a student will be able to:

1. Carry out surveys involved in planning and highway alignment.
2. Design cross section elements, sight distance, horizontal and vertical alignment.
3. Implement traffic studies, traffic regulations and control, and intersection design.
4. Determine the characteristics of pavement materials.
5. Carry out the surveys, perform geometric design for airports.

MODULE I

Classification, Alignment and surveys: Classification of highways – typical cross sectionof roads in embankment and in cutting, definition of various cross sectional elements – requirements and factors controlling alignment of roads, Engineering surveys.

Geometrical Design of Highways: Camber – sight distances – Stopping, passing and overtaking Sight distances, Overtaking zone requirements, worked out problems – design of horizontal alignments, design speed – horizontal curves – Super elevation – Super elevation design – radius of horizontal Curve – extra widening of pavement – transition curves and methods of provision of super elevation and design of horizontal alignment – design of vertical alignment – gradient and grade Compensation Vertical curves – summit curves – length of summit curve - valley curves – length of valley curve.

MODULE II

Traffic Engineering: Introduction - road user, vehicle and traffic characteristics - traffic engineering studies – speed – speed and delay - volume - origin and destination - parking and accident studies.
Road intersections- Design of intersections at gradeand grade separated intersections.
Traffic operation-Traffic control devices- classifications and uses of traffic signs and markings – traffic signals, design of isolated signals by Webster's method.

MODULE III
Highway Materials, Testing and Design:Road aggregates – Desirable props & tests – Bituminous materials – Types of bituminous materials used in highway construction – requirements – desirable properties and tests.
Highway construction and Maintenance: Construction ofbituminous concrete and cement concrete pavements . Joints in Concrete pavements – types and causes of failures in flexible and rigid pavements, Pavement Design –Basic difference between flexible and rigid pavements – factors to be considered in Design of pavements.

MODULE IV
Airport planning and design
Introduction - aircraft characteristics and their influence on planning of airports –classification of airports- airport obstructions and zoning - component parts of airports and site selection – runway design - orientation - basic runway length - corrections to basic runway length - worked out problems- geometric design of runways; design of taxiways and aprons – Controlling of air traffic- Operation of instrument landing system-terminal area planning concepts and its facilities - aircraft parking configurations.

References:

1. Khanna, S.K., Justo and Veeraraghavan.*HighwayEngineering*.NemChand and Bros, Roorkee, India.
2. Khadiyali, L.R.*TrafficEngineering and Transport Planning*. Khanna Publishers.
3. Ministry of Road Transport and Highways Specifications for Road and Bridge Works. Fourth Edition. Indian Roads Congress, New Delhi, India.
4. Khanna, S. K., Arora, M. G., and Jain, S. S. *Airport planning and Design*, Sixth Edition.Nem Chand and Bros, Roorkee, India.
5. Rangwala, S.C.*AirportEngineering*.Charoter Publishing House.
6. Horonjeff, R., McKelvey, F. X., Sproule, W. J., and Young, S. B. *Planning and Design of Airports*. Fifth Edition. McGraw-Hill, New York.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0405 FLUID MECHANICS – II

Course Outcomes: On completion of the course, a student will be able to
1. Design channels
2. Compute the flow profiles in channel transitions
3. Compute the discharge of rivers and streams

4. Formulate and solve the problem of propagation of flood wave and surges in channels
5. Design the working proportions of hydraulic machines

MODULEI

Introduction: Difference between open channel flow and pipe flow. Types of channels- types of flow .Velocity distribution in open channels. Geometrical parameters of a channel. Condition for uniform flow –Computation of uniform flow – Chezy‟s and Manning‟s equations . Determination of normal depth - Algebraic & Graphical method. Most efficient cross section- Rectangular – trapezoidal – triangular, circular cross section not flowing full. Conveyance – Hydraulic exponent N for uniform flow computation. Energy and Momentum Principles: Concept of specific energy, specific force, critical flow, critical depth critical velocity- hydraulic exponents M for critical flow. Application of specific energy principle - transitions in rectangular channel – problems.

Metering flumes- venturi - standing wave - parshall.

MODULEII

Non uniform flow: gradually varied flow - basic assumptions - dynamic equation for gradually varied flow - different forms of the dynamic equation - characteristics of flow profiles in prismatic channels. Back water curve: computation of length of back water curve - Standard step method- direct step method – computation of backwater profile using spreadsheet. Stream flow measurement - gauges and recorders - determination of velocity of flow - measurement of discharge in rivers - area-velocity method - stage - discharge relation.

MODULE III

Rapidly varied flow: characteristics of the flow - hydraulic jump - initial and sequent depths – nondimensional equation - practical application of hydraulic jump - types of jump in horizontal floor – basic characteristics of the jump - energy loss - efficiency - height of jump - jump as energy dissipater – stilling basins - jump position - tail water conditions - jump types - stilling basins of generalized design – rapidly varied unsteady flow – introduction to surges and types of shallow water waves.

MODULEIV

Hydraulic Machinery: Impact of jets, Classification of hydraulic machines, one dimensional flow analysis and velocity triangles, Design of Pelton turbine, Design of Francis turbine, Design of a Kaplan turbine Design of centrifugal pump, Design of axial flow pump, Selection of hydraulic machines.

References:

1. Chow, V.T. *Open Channel Hydraulics*. Blackburn Press.2009
2. White, F. M. . *Fluid Mechanics*. Tata McGraw Hill Publications. 2011
3. Fox, R. W., Orutcgardm, O. H. and McDonald, A. T. *Introduction to Fluid Mechanics* (7th student edition). Wiley India. 2011
4. Subramnaya, K. .*Flow In Open Channel*. Tata McGraw Hill Publications, New Delhi. 2008
5. Modi, P. N. and Seth, S. M. .*Hydraulics and Fluid Mechanics (including hydraulic machines)*. Standard Book House, Delhi, India.2002
6. Rajesh Srivastava . Flow Through Open Channels. Oxford University Press.2007

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0406 BUILDING TECHNOLOGY AND PLANNING

Course Outcomes: On completion of the course, a student will be able to:

1. understand non-structural building materials and their uses in construction.
2. understand components of building construction, like stairs, doors, windows, lintels, walls, etc. and their appropriate uses. Also acquaint with finishing works in building construction.
3. attain an overall outlook of all building codes and also able to prepare working drawings including plan, elevation, section, site plan, location plan, etc. of various types of buildings from requirements using building code

Module I

Building Materials: Stone - Tiles- Timber -. Paints - Glass
Building Technology: Structural Systems - Walls, frames, arches, truss
Stairs, Doors, Windows and Ventilations, precast systems.

Building Rules: Selection of site-site plan, preparation for buildings, Kerala Municipal Building Rules (1999) - National Building Code.
General requirements of sites and building- building codes and rules - Coverage and Floor Area Ratio - Occupancy classification of buildings – licensing of building works.

Module II

Buildings –Preparation of working drawings (from line sketches or from specifications) of different types of buildings
Single storeyed and double storeyed residential buildings
Public utility buildings – Educational, hospital, hotel, auditorium,
Industrial building
Building Planning & Drawing: Functional planning of residential buildings - Planning and designing of residential buildings from given requirements of areas and specifications - Preparation of working drawings, Preparation of site plans and service plans as per building rules - Plumbing (including rain water harvesting) and house drainage drawing for building.

References:

1. National Building Code of India (2016)
2. Kerala Municipal Building Rules (1999)
3. Balagopal T.S. Prabhu Building Drawing and Detailing, Spades, Calicut (2007).
4. Punmia, B. C. *Building Construction*, LaxmiPublications, New Delhi (1999).
5. Ravindra K. Dhir, Neil Jackson, Civil Engineering Materials (5th Edition), Red Globe Press (1997)

Type of Questions for Semester End Examination (Duration 4 hrs)

Part A

Question No. 1 (a) to (f) - Module I – 6 questions, 4 marks each (6 x 4 = 24 marks)
Part B
Questions No. 2 Module II –Building plan – section - elevation – site plan from Specifications – 48 Marks.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-200-0407 UNIVERSAL HUMAN VALUES
(Common to all branches)

Course Outcomes: On completion of the course, a student will be able to:

1. More aware of themselves and their surroundings (family, society, nature).
2. More responsible in life in handling problems with sustainable solutions
3. Keep human relationships and human nature in mind.
4. Having better critical ability and would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. Apply what they have learnt to their real life.

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Purpose and motivation for the course, recapitulation from Universal Human Values-I
Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and experiential Validation- as the process for self-exploration
Continuous Happiness and Prosperity- A look at basic Human Aspirations
Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
Understanding the characteristics and activities of 'I' and harmony in 'I'
Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
Understanding the meaning of Trust; Difference between intention and competence
Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
Understanding the harmony in the Nature
Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and selfregulation in nature
Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics
Natural acceptance of human values, Definitiveness of Ethical Human Conduct
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
Case studies of typical holistic technologies, management models and production systems
Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.
Sum up.

Include practice exercises and case studies to discuss the conduct as an engineer or scientist etc.

References

1. P.R Gaur, R Asthana, G.P Bagaria, Human Values and Professional Ethics (2nd revised edition) Excel Books, New Delhi, 2019
2. A Nagaraj, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. A. N Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.

19- 201- 0408 SURVEY PRACTICAL

Course Outcomes: On completion of the course, a student will be able to

1. Conduct survey, prepare field notes from survey data, interpret survey data and compute areas and volumes.

Leveling:

1. Differential leveling.

2. Longitudinal sectioning and Cross sectioning.
3. Contour surveying.

Theodolite

4. Determination of Horizontal Angle- Repetition method, Reiteration Method.
5. Determination of Vertical angle
6. Three Point Problem
7. Determination of Tacheometric Constants. .
8. Heights and distances - stadia tacheometry, tangential tacheometry.
9. Setting out simple curve-angular methods.

Total Station.

10. Heights and distance
11. Area computation
12. Downloading

Study of Instruments- Automatic level, Digital level, Electronic Theodolite and hand held GPS.

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

19-201-0409 FLUID MECHANICS LAB

Course Outcomes: On completion of the course, a student will be able to

1. Identify the behavior of various fluid flows and use this information in practical applications.
2. Apply the knowledge of metacentric height, losses due to friction, purpose of notches, etc. for practical use.

LIST OF EXPERIMENTS

1. Study of pipe fittings and plumbing tools
2. Experiment on notches
3. Pipe friction apparatus
4. Determination of minor losses
5. Metacentric height
6. Venturimeter and Orificemeter
7. Flow through orifice
8. Heleshaw experiment
9. Reynolds experiment
10. Free & forced vortex apparatus
11. Verification of Bernoullis equation
12. Hydraulic turbines and pumps

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

SEMESTER V

19-200-0501 NUMERICAL AND STATISTICAL METHODS
(Common to all branches)

Course Outcomes: On completion of this course the student will be able to:

1. Solve algebraic and transcendental equations by numerical methods
2. Solve numerical differentiation and integration problems
3. Compute the mean and variance of a probability distribution including the binomial distribution.
4. Test hypotheses on data

MODULE I

Numerical solution of algebraic and transcendental equation by - Regula-Falsi method, Newton Raphson's method. Gauss Seidal iteration method to solve a system of equations and convergence (without proof) Newton's forward and backward interpolation formula. Lagrange interpolation, Newton's divided difference and central differences.

MODULE II

Numerical differentiation at the tabulated points with forward, backward and central diffrences. Numerical integration with trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule. Taylor series method. Euler method, Modified Euler method, Runge–Kutta method of second and fourth order for solving 1st order ordinary differential equation.

MODULE III

Random variable (discrete and continuous) Expectation-mean and variance of probability distribution. Binomial, Poisson and Normal distribution and Fitting of this Distribution to the given data. Curve fitting-fitting of straight line, parabola, exponential.

MODULE IV

Population and Sample-Sampling Distribution (of mean and variance) Testing of Hypothesis-level of significance, Z-test statistic, Chi square test for variance, for goodness of fit and F-test .

References:

1. Erwin Kreyzig. (2010). *Advanced engineering mathematics*. (tenth edition). John Wiley & Sons, Hoboken, N.J
2. Grewal, B.S. (2013). *Higher engineering mathematics*. (forty third edition). Khanna Publishers, New Delhi.
3. Kandaswamy, P. Thilagavathy, K. and Gunavathy, K. (2007) *Numerical methods*. S Chand &Co, New delhi.
4. Richard A. Johnson. Irvin Miller and John E. Freund. (2010). *Probability and statistics for engineers*. (eighth edition). Pearson, New Delhi.

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0502 DESIGN OF CONCRETE STRUCTURES – I

Course Outcomes: On completion of the course, a student will be able to

1. Understand the basic principles of structural design using limit state method of design and familiarize with relevant IS codes
2. Identify and calculate different types of loads acting on structures.
3. Apply limit state method to design Reinforced Concrete beams and slabs.
4. Check serviceability of structures based on IS specifications.
5. Apply limit state method to design Reinforced Concrete Columns and staircase.
6. Prepare structural drawings of beam, slabs, staircases and columns.

MODULE I

Introduction to different design philosophies, Principles of Working Stress and Limit State methods (Limit State method in detail), Analysis of singly and doubly reinforced beams of rectangular and flanged sections, Design for bending, compression, shear and torsion – Design of singly and doubly reinforced beams of rectangular and flanged sections.

MODULE II

Design of slabs – design of one-way slabs – temperature and shrinkage reinforcement – behavior of two way edge supported slab – analysis by coefficient method.

Analysis and design for torsion: Torsion in plain concrete members – torsion in reinforced concrete members – combined torsion and shear – Limit state design of beams – Code provision for torsion design.

MODULE III

Bond, anchorage and development length: Fundamentals of flexural bond – ultimate bond strength and development length – Code provisions for development of tension reinforcement – anchorage of tension bars by hooks – anchorage requirements for web reinforcement – development of bars in compression – bundled bars – bar cutoff and bend points in beams.

Serviceability: Cracking in flexural members – Code provisions for crack control – control of deflection – immediate deflection – deflection due to long term loads – Code provisions for control of deflection – deflection due to shrinkage and temperature changes.

MODULE IV

Staircases- types of staircase-design of straight flight stair cases.

Columns: Design of short columns – axial compression – lateral ties and spirals – compression plus bending in rectangular columns – strain compatibility analysis and interaction diagrams – balanced failure – distributed reinforcement –unsymmetrical reinforcement – circular columns – Code provisions for design of short columns – biaxial bending – Design of slender columns – concentrically loaded columns – compression plus bending – Code provisions for design of slender columns.

References:

1. Nilson, A.H., Darwin D., and Dolan C.W., *Design of Concrete Structures*. McGraw Hill Companies, 2009.
2. Pillai, S.U.and Menon, D.*Reinforced Concrete Design*. Tata McGraw Hill Publishing Company Limited, New Delhi, India, 2009
3. Varghese, P.C. *Limit State Design of Reinforced Concrete*. Prentice Hall of India Pvt Ltd, New Delhi, India, 2008.

4. Syal and Goel.*Reinforced concrete structures*, S Chand, 2007.
5. Jain, A. K., *Reinforced Concrete -Limit State Design*, Nem Chand and Bros., 2012.
6. Mallick, S. K., and Gupta, A. K., *Reinforced Concrete*, Oxford and IBH, 1982.

Type of Questions for Semester End Examination
Question nos. I and II [with sub sections (a), (b), …] (18 marks each with option to answer either I or II) from Module I.
Question nos. III and IV [with sub sections (a), (b), …] (18 marks each with option to answer either III or IV) from Module II.
Question nos. V and VI [with sub sections (a), (b), …] (18 marks each with option to answer either V or VI) from Module III.
Question nos. VII and VIII [with sub sections (a), (b), …] (18 marks each with option to answer either VII or VIII) from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

Use of IS. Codes: 456-2000, 875-1987 and Interaction charts for column design (SP:16) are permitted in the Examination Hall.

19-201-0503 ANALYSIS OF INDETERMINATE STRUCTURES

Course Outcomes: On completion of the course, a student will be able to

1. Distinguish clearly static and kinematic indeterminacy of structures and force and displacement methods of analysis of indeterminate structures.
2. Understand a few force methods of analysis of pin-jointed and rigid-jointed indeterminate plane structures, i.e. the method of consistent deformation, unit load method and three moment equation method.
3. Analyze rigid-jointed structures by the well known displacement based method, the slope-deflection technique motivated by matrix formulation of equilibrium equations of the method and its computer implementation.
4. Apply the iterative procedure of analysis of rigid-jointed structures illustrated via the moment distribution method.
5. Identify the advantage of certain geometrical features in structures and supports through the analysis of arches and cable stayed suspension bridges.

MODULE I

Indeterminacy of structures: Degree of static and kinematic indeterminacy of pin-jointed and rigid-jointed structures (sufficient examples should be included to reinforce the concept), redundant and degree of freedom, brief introduction to force and displacement methods based on the degree of static and kinematic indeterminacy.
Force method of Analysis of indeterminate beams and frames: Method of consistent deformation, strain energy method (Castigliano's theorems), unit load method, induced reactions due to yielding of supports, Three moment equation method – application of three moment equation to continuous beams, analysis of continuous beams subjected to uneven support settlement.
Force method of Analysis of indeterminate trusses: Force method in which reactions as redundant, axial forces in members as redundant, both reactions and axial forces in members as redundant, induced reactions due to yielding of support, pre-strains.

MODULE II

Displacement Method of Analysis – The Slope Deflection method: Derivation of the slope-deflection equation for a one-span beam, analysis of continuous beams, beams subjected to uneven support settlement, analysis of rigid jointed frames with and without unknown joint translation, rigid frames subjected to support settlement, analysis of gable frames.

MODULE III

Displacement Method of Analysis – The Moment Distribution method: Stiffness and carry over factors, distribution factors, analysis of continuous beams, check on moment distribution, modified stiffness factors at the near end when far end is hinged, beams subjected to uneven support

settlement, analysis of rigid jointed frames with and without joint translation, rigid frames subjected to support settlement.

MODULE IV

Arches and frames: Theory of arches, Eddy's theorem, three hinged arches, two hinged arches, fixed arches, Influence lines for bending moment, shear force and axial thrust.
Cable Suspension bridges: Equilibrium of un-stiffened cable, tension in the cable, length of the cable, anchor cable, roller support, saddle support, effect on cable length due to change in temperature.

References:

1. Wang, C.K. (2010), *Intermediate Structural Analysis*. McGraw Hill International Edition.
2. Menon, D. (2010), *Structural Analysis*.Narosa publishers.
3. Pandit, G. S. and Gupta, S. P. (2017) *Theory of structures*, Vol.1 and 2, Tata McGraw Hill.
4. Roy and Chakrabarty. (2003), *Fundamentals of Structural Analysis*. S Chand.
5. Norris, C. H. and Wilbur J. B. (1948), *Elementary Structural Analysis*. McGraw Hill, New York.
6. Punmia, B.C. and Jain, A. K. (2005), *Theory of Structures*, Laxmi Publications (P) Ltd.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0504 GEOTECHNICAL ENGINEERING –I

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

1. Identify the properties of soils and to classify them through laboratory investigation.
2. Compute the effective stress in soils under variable conditions
3. Illustrate the principles of compaction and its control.
4. Comprehend the volume change behavior under static loading; compute consolidation settlement in soft soil and time rate of settlement.
5. Apply the knowledge of shear strength parameters determined under different drainage conditions to the field problems including that of slope stability.

MODULE I
Nature of soil and functional relationships: Soil types – residual soil and transported soil. Three phase system – void ratio –specific gravity-– porosity-water content-dry, saturated and submerged unit weight-– degree of saturation –relative density -Relationship between Basic Soil properties. Concepts of single grained, honey combed and flocculent structure - Basic Structural units of clay minerals- common clay minerals.

Laboratory and field identification of soils: Determination of water content by oven drying – specific gravity using Pycnometer and specific gravity bottle – grain size analysis by sieve analysis, hydrometer analysis and pipette analysis – Atterberg limit and indices
field density by core cutter, sand replacement and wax coating methods. Classification of Soils: Necessity – Principles of classification – I.S. classification – plasticity chart.

MODULE II

Soil water: Classification- effective stress - total stress - pore pressure - pressure diagrams for different conditions.
Permeability: definition - Darcy's law - factors affecting permeability - laboratory determination – permeability of stratified soils.
Seepage through soils: Uplift pressure-piping-seepage force and quick sand condition- flow nets
Stress distribution: Boussinesque's and Westergaard's equations for vertical pressure due to point loads and uniformly distributed loads - assumptions and limitations - pressure bulb – Newmarks` charts and their use.

MODULE III
Compaction: definition and objectives of compaction - proctor test and modified proctor test - concept of OMC and maximum dry density - zero air voids line - factors influencing compaction - field compaction methods - Proctor needle for field control.
Consolidation: definition - concepts of coefficient of compressibility - coefficient of volume change and compression index - e-log p curves - pre-consolidation pressure - Terzaghi's theory of one dimensional consolidation - determination of coefficient of consolidation – consolidation settlement of NC clays.

MODULE IV
Shear Strength: definition - Mohr's strength and stress circles - Mohr's envelope - Mohr-Coulomb strength theory
Measurement of shear strength- direct shear test- triaxial testing- UU,CU and CD test,UCC test,vane shear test, sensitivity of clays
Stress strain behavior of clays- Total and effective shear strength parameters - Stress path- .stress strain behavior of granular soils
Stability of slopes: Slope failure, base failure and toe failure - Swedish circle method - friction circle method - Taylor's stability number - stability charts.

References:

1. Ranjan, G. and Rao, A.S.R. *Basic and Applied Soil Mechanics*, New Age International Publishers, 2007.
2. Das, B.M. *Principles of Geotechnical Engineering*. Thomas Brooks Cole, Singapore, 2007.
3. Punmia, B.C. *Soil Mechanics and Foundations*. Laxmi Publications, 2018.
4. Terzaghi, K. and Peck, R.B. *Soil Mechanics in Engineering Practice*. John Wiley, 1996.
5. Venkataramaiah, C. *Geotechnical Engineering*. New Age International Publishers, 1995.
6. Arora, K.R. *Soil Mechanics and Foundation Engineering*. Standard Publishers and Distributors, 2008.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0505 WATER RESOURCES AND IRRIGATION ENGINEERING

Course Outcomes: On completion of the course, a student will be able to:

1. Analyze hydro meteorological data and components of hydrological cycle
2. Assess surface and groundwater resources

3. Identify basic requirements of irrigation and various irrigation techniques, water requirements of the crops
4. perform investigation and planning of reservoirs
5. design head works, irrigation canals, spillways and energy dissipation structures

MODULE I

Hydrologic cycle, scope, application of hydrology, Precipitation: Formation of precipitation – forms of precipitation – type of precipitation - measurement of precipitation –recording and non recording gauges – gauge network - adjustments of precipitation data - average depth of precipitation over an area - Arithmetic mean, Theissen polygon and isohyetal method – Hyetograph – Mass curve - Depth area duration curves. Water Loses: Evaporation, transpiration and infiltration – Factors affecting evaporation-measurement of evaporation - Evaporation formulas – Infiltration, factors affecting infiltration, Determination of infiltration rate - Effect of infiltration on run–off - Recharge of ground water.
Run off : Factors affecting run–off – Empirical formulae-runoff – hydrograph - Components of hydrograph - Separation of base flow - Hydrograph for isolated storm and complex storm - unit hydrograph - derivation of unit hydrograph for isolated and complex storm – Unit hydrograph for different duration – S hydrograph.

MODULE II

Ground water Hydrology : Occurrence, distribution of ground water – Darcy' s law – Permeability, safe yield - Location and development of ground water supplies - Hydrology of well – Steady flow in confined and unconfined aquifers - open well – yield of an open well – Effect of partial penetration - Interference of wells - Boundary effect - Specific capacity of well – Tube wells –Yield from a tube well - Strainers – Site for a tube well Flow and lift Irrigation –Perennial and Inundation irrigation - Important Crops and crop seasons –Duty and delta – Method of Cultivation - Water requirement – Irrigation efficiency – Multipurpose projects. Reservoirs : Investigation and planning
– Selection of site – Engineering, Geological, and hydrological Investigations - Fixation of storage capacity - Contours- Mass curve - operation of reservoirs - reservoirs sedimentation.

MODULE III

Head works : Storage and diversion works- Layout of head works - Selection of site – Weirs- Types of weirs – Weirs on permeable foundation – Uplift and piping – Bligh' s creep theory - Lane' s weighted creep theory – Khosla' s theory of independent variables - Design of aprons- Body wall
– vertical drop weir - design of sloping glacis weir. River regulators - Silt excluder -Silt vane,Surplussing Arrangements: Spillways – Type and Functions – design of Ogee Spillway and Siphon Spillway - energy dissipation below spillways – stilling basin – spillway crest gates. Distribution works : Classification of canals – design of canals – erodible canals - canals in alluvial soils – regime theory – Kennedy, Lacey traction theories – Manning' s formula - Design. Non– erodible canals - Friction formula—Chezy,Manning's formula, Silting in canal and prevention – Scour-protection against scour.

MODULE IV

Storage works: Type of dams-Gravity dams –Forces acting on a gravity dam-Elementary profile-Single step method of design –Method of stability analysis-Zonal method of designsafety criteria-Galleries in dams. Arch dams – Types-Thin cylinder theory. Earth and rockfill dams-Types of earthern dams.

References:

1. Subramanya, K. *Engineering Hydrology*, Tata McGraw-Hill. (2013)

2. Punmia, B. C. and Lal. *Irrigation and Water Power*. Laxmi Publications Pvt Ltd. (2016)
3. Modi, P. N. *Irrigation Water Resources and Water Power*, Standard Book House. (2008)
4. Sahasrabudhe, S. F. *Irrigation Engineering and Hydraulic Structures*. Kataria Publications.(2011)
5. Garg, S.K., *Irrigation Engineering and Hydraulic Structures*, Khanna Publishers(1976)

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0506 (IE) PRECAST CONSTRUCTION OF STRUCTURES

Course Outcomes: On completion of the course, a student will be able to

1. Identify the suitability and advantage of precast construction for various structures and components
2. Understand the general principles in precast construction for structural integrity and stability.
3. Apply design principles for modular coordination and connections of pre fabricated components
4. Assimilate sufficient ideas for promoting precast constructions for floor slabs, beams, columns, walls and other components of the structures.
5. Apply precast construction techniques for architectural facades, cladding, panels and other such elements.

Module 1
Suitability of precast construction: when to use precast concrete – advantages and limitations: speed of construction, optimum use of materials, appearance and finishes, tolerance, transport and site erection, building services, quality assurance and product certification, and testing, codal provisions
Preliminary design considerations: Approaches to design, Fame and skeletal system, bearing walls, facades, cell system, mixed construction

Module 2
General design principles: Overall stability, structural integrity, basic force transfer mechanism, types of connections, modular coordination and standardization, transportation and erection planning.
Frame and skeleton structures: Components of skeletal frame, Layout and modulation, Frame action: cantilever action of column, braced skeletal structures, comparison of system, floors and balconies. Typical connections: column to foundation connections, column to column connections, beam to column connection, beam to beam connection, beam to column to floor connection.

Module 3
Precast floors: totally precast floors, partially precast floors, stairs, modulation, design considerations: diaphragm action, transverse load distribution of concentrated loads, composite floor structures, ribbed soffit units, floor plates, beam-block floor, opening and cutouts
Bearing walls: Load bearing cross walls, spine wall system, mixed system, elevator and stair well shaft, special arrangement at ground level, modulation, elements of load bearing walls: interior walls, cavity walls, interior walls, retaining walls, wall to wall connection, wall to floor connections

Module 4
Architectural concrete facades: Capabilities, structural system: load bearing façade elements, non- load bearing façade elements, split structure façade, fibre reinforced cladding, guidelines to select a structural system

Shape of façade units and dimensions: shape in relation to the moulds, preferred dimension, modulation and flexibility, joints in the exterior façade, Superficial appearance: Texture, colour, faced panels, Panel fixing: type of connections and applications, durability, fire protection.
Case Study/Mini Project and Field visits to precast construction projects.

Reference

1. Federation internationale de la Precontrainte (FIP), 1994, Planning and design handbook on precast building structures, SETO Ltd, 11 Upper Belgrave Street, London, ISBN 1 874266 11 5.
2. Mark Anderson, Peter Anderson,2007, Prefab Prototypes- Site-specific Design for Offsite Construction, Princeton Architectural Press
3. Arnt Cobbers, Oliver Jahn, 2010, Prefab Houses, Taschen Publisher,
4. Sergi Costa Duran, 2008, New Prefab Architecture, Loft Publisher
5. Hand Book on Precast Concrete Buildings , ICI , 2016.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19 – 201 -0507 RAIL AND WATER TRANSPORT ENGINEERING

Course Outcomes: On completion of the course, a student will be able to:

1. Understand the basics and design of various components of railway track.
2. Study the railway operation control.
3. Demonstrate the tunnel driving procedures, its lighting, ventilation and drainage.
4. Outline the types of harbour and construction of break waters.
5. Explain the types of docks and dredgers.

MODULE I

Railway Engineering: Permanent way – main requirements – Component parts. Rails –functions of rails –requirements of a good rail, weight and length., defects in rails, rail joint and other fastenings, check and guard rails, coning of wheels, creep of rail. Sleeper- its functions and requirements, sleeper density, Ballast- functions and requirements, different types used.
Geometric Design: Design of horizontal curves-Super elevation, negative super elevation in branches, length of transition curves –grade compensation on curves, widening of gauge on curves.

MODULE II

Railway Operation control: Points and Crossings-Design features of a turn out-Types of railway track points –Details of station yards and Marshalling yards-Signaling and interlocking – Principles of track circuiting-Control of train movement by absolute block system-automatic block system-Centralized traffic control systems.
Tunnel Engineering: Tunnel sections-types size and shapes-tunnel surveying-Alignment, transferring center grade in to tunnel-tunnel driving procedure-tunneling through hard and soft soils(Only Shield method of tunneling and Compressed air method) –Tunnel lining ventilation lighting and drainage of tunnels.

MODULE III

Harbor Engineering: Classification of harbors Breakwaters-necessity and functions-different types-forces acting on breakwater-design principles-construction of breakwaters-general study of pier heads, quays, landing stages-wharves, jetties, transit sheds and warehouses-channel demarcation-signal characteristics Beacons, buoys, channel- lighting, light houses).

MODULE IV

Dock Engineering: Function and types of docks, dry docks, floating docks slipways, dock gates and caissons-s Dredging-Mechanical and hydraulic dredgers-general study of bucket ladder-Dredger, grab dredger and dipper dredgers.

References:

1. Chandra, S. and Agarwal, M.M. Railway Engineering. Oxford University Press, New Delhi, India.(2013)
2. Saxena, S.C, and Arora S. P. Railway Engineering. Dhanpat Rai and Sons, New Delhi, India. (2010)
3. Agarwal, M.M. Indian Railway Track. Prabha and Co., New Delhi, India.(2018)
4. Rangwala, S.C. Principles of Railway Engineering. Charotar Publishing House, Anand, India. (2012)
5. Bindra, S.P.A Course in Docks and Harbour Engineering. Dhanpat Rai and Sons, New Delhi, India.(2012)
6. Seetharaman, S. Dock and Harbour Engineering.Umesh Publications, New Delhi, India.
7. Srinivasan, R. Harbour, Dock and Tunnel Engineering.Charotar Publishing House, Anand, India.(2016)

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0508 FUNCTIONAL PLANNING OF BUILDINGS

Course outcomes: After completing the course students will be able to –

1. Gain knowledge about the climatic factors influencing the planning of buildings
2. Understand the factors influencing human comfort
3. Assimilate knowledge about the factors influencing the ventilation and air movement
4. Gain knowledge about the requirements of natural & artificial lighting.
5. Undertake the functional planning of buildings under different occupancy classifications
6. Gain knowledge about the standard requirements of various building services.

Module 1.

Elements of climate – Temperature, humidity, vapour pressure, precipitation, sky condition, solar radiation, wind, special characteristics, vegetation.
Introduction to human comfort- comfort factors- Thermal comfort indices – Effective temperature
Sun's movement and building: Sun control devices; External shading devices; Internal blinds and curtains and Special glasses.

Module 2.

Ventilation and air movement – stack effect- wind effect, Air flow through buildings- external features- Cross ventilation - position, size and control of openings -Orientation- factors affecting orientation –

criteria for Indian conditions. Mechanical Ventilation systems Thermal insulation – Materials and properties; Thermal insulation of roofs, exposed walls and openings.
Lighting : Photometric quantities , illumination requirements for various buildings, Day lighting ,Day light factor and components ; Artificial lighting , Lamps and luminaries ; Polar distribution curves , Design of artificial lighting - Lumen method , Point by point method ; Glare , Measurement of illumination.

Module 3.

Principles of planning of buildings- Planning of buildings under different occupancy classifications- Educational buildings – Hospitals – Hotels- Buildings of recreation- Banks - Government offices

Module 4.

Building services: water supply requirements for buildings & Fittings-General requirements for pipe works -Principles of house drainage & maintenance. Systems of plumbing- sewage disposal arrangements for buildings – Domestic septic tank- standard requirements. Vertical transportation -elevators , Fire fighting services

References:

1. SP 7:2016, National Building Code of India
2.Koenigsberger, O. H., et al. *"Manual of tropical housing and building: Climatic Design Part 1."* Orient Longman, London, UK *(1974)*. ISBN: 9788173716973 |
3. Singh, Gurcharan, and Jagdish Singh. *Building planning designing and scheduling*. Standard Publishers Distributors, 2006.Lomus offset press – Delhi.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0509 DISASTER MANAGEMENT

Course Outcomes: On completion of the course, a student will be able to:

1. Understand the basic principles of disaster management
2. Understand different types of disasters and their associated damages caused to environment and structures.
3. Prepare vulnerability mapping, ~~and~~ risk assessment and developing Emergency management System.
4. Learn about the engineering and non-engineering controls of mitigating various natural disasters incorporating latest tools.
5. Learn about the national initiatives and framework related to disaster management.

MODULE I

Disaster, Hazard, Vulnerability, Resilience. Types of hazards- Natural disasters - hydro-meteorological disasters such as flood, drought, cyclone etc ; geological disasters- earthquake, tsunami, landslides, volcanic eruption. Man made disasters - chemical industrial hazards, major power break downs, traffic accidents, fire hazards, biological hazards, nuclear accidents. Environmental hazards - forest hazards (deforestation, degradation and forest fire), land and soil degradation, desertification and pollution (water, air and soil). Global trends in disasters

MODULE 2

Hydrological Hazards: Flooding – classification, causes and impacts - PMP – PMF – Inundation mapping -flood prone area analysis and management. Dam breach analysis - Drought- types of drought - Factors influencing drought - delimiting drought prone areas - drought index, SPI and Palmer. Geological Hazards: Earthquakes; location, faults, causes, types, associated hazards and impacts, Richter scale and Modified Mercalli scale. Mass movements: Definition of landslide - types – causes - slope stability analysis. Coastal Hazards – storm surge - Tsunami and floods – cyclone – coastal vulnerability – shore line erosion – shore defense structures.

MODULE 3

Natural disasters- hazards in arid and semi-arid areas - nature of the hazard – hazard management activities – disaster mitigation – natural hazard prediction – emergency preparedness – community based DRR- disaster, rescue and relief – post disaster rehabilitation and reconstruction. Roles and responsibilities of the community, Panchayati Raj institutions/ Urban Local Bodies, States, Centre, and other stakeholders including NGOs. Education and training activities – vulnerable elements to be considered in the development planning for natural hazard management – applications of remote sensing and GIS in disaster management. Prediction and early warning systems.

MODULE 4

Components of disaster relief - water, food, sanitation, shelter, health, waste management, Institutional arrangements for mitigation, response and preparedness, Legislation in India on Disaster Management. National disaster management policy. Other related policies, plans, programmes and legislation relevant to / pertaining to disaster management. Disaster damage assessment. Disaster mitigation. Existing organizational structure for managing disasters in India. Case studies.

References:

1. S. R. Sharma, Disaster Management, A P H Publishers, 2011.
2. Sreeja. S. Nair, Training Manual on Geoinformatics Applications in Disaster Management, NIDM, 2012.
3. Harsh. K. Gupta, Disaster Management, Universities Press, 2003.
4. J. P. Singhal, Disaster Management, Laxmi Publications, 2010.
5. K. Venugopala Rao, Geoinformatics for Disaster Management, Manglam Publishers and
6. Distributors, 2010.
7. Matthews, J.A., Natural Hazards and Environmental Change, Bill McGuire, Ian Mason, 2002.
8. Sulphey, M. M.,Disaster Management, PHI Learning, 2016.
9. Damon P. Coppola, Introduction to International Disaster Management, Butterworth-
10. Heinemann, 2016.
11. Parag Diwan,A Manual on Disaster Management, Pentagon Press, 2010 10. Websites – National Disaster Management Authority, National Institute for Disaster Management, and State Disaster Management Authorities
12. ILO, Geneva. *Major Hazard Control – a Practical Manual.*

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0510 GEOTECHNICAL ENGINEERING LAB

Course Outcomes: On completion of the course, a student will be able to:

1. Determine the index properties of soils.
2. Classify soils as per Indian Standards
3. Determine the engineering properties of soils.

LIST OF EXPERIMENTS

1. Determination of Specific gravity, water content and particle size distribution by hydrometer method.
2. Determination of field density by core cutter and sand replacement method.
3. Determination of Atterberg Limits.
4. Compaction tests – I.S. light and heavy compaction.
5. Permeability tests – constant head and variable head methods.
6. Consolidation test.
7. Shear strength tests – Direct shear, Triaxial, UCC & Vane Shear Test

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

19- 201- 0511 TRANSPORTATION ENGINEERING LAB

Course Outcomes: On completion of the course, a student will be able to:

1. Characterize the aggregates and bitumen used for road construction.
2. Design a bituminous mixture.

Tests on Aggregates

1. Crushing Value
2. Los-Angeles Abrasion Value
3. Impact Value
4. Specific Gravity
5. Water Absorption
6. Shape Test – Flakiness Index, Elongation Index & Angularity Number

Tests on Bitumen

7. Viscosity Test
8. Ductility Test
9. Softening Point Test
10. Specific Gravity
11. Penetration Test
12. Flash and Fire Point Test

Tests on Soil

13. CBR Test

Test on Bituminous mixes

14. Marshall Test
15. Bitumen extraction test

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

SEMESTER VI

19-201-0601 ENVIRONMENTAL ENGINEERING –I

Course Outcomes:

1. Recognize the important professional and ethical responsibilities as an environmental engineer so as to estimate or analyze the quantity and quality of water required for a community water supply scheme
2. Apply perfect knowledge on water supply sources for the design of collection, transport, transmission systems
3. Demonstrate knowledge on sanitary plumbing systems, design of sewerage systems and distribution systems in water supply engineering
4. Recognize various natural methods of wastewater disposal and self purification of streams
5. Demonstrate an ability to provide engineering solutions for the environmental problems related with air pollution, solid wastes disposal and noise pollution

MODULE I

Scope of Environmental Engineering.Global environmental problems. Water supply Engineering: Rural and Urban water supply systems - Water demand – percapita demand, factors affecting per capita demand, variations in the rate of consumption, fire demand, design period, forecasting population. Quality of water – impurities in water and their importance - water borne diseases - analysis of water - physical, chemical and bacteriological tests. WHO and Indianstandards for drinking water.

MODULEII

Sources of water: Surface water sources-groundwater sources.Collection of water: intakes - location, types, pipe materials- design of gravity and pumping main. Pumps: classification - selection of pumps - location of pumping stations. Distribution systems-different layout of pipe networks - appurtenances in the distribution system - meters, valves, fire hydrants etc. pipe laying, testing & disinfections of mains- detection and prevention of leaks in distribution system-maintenance of distribution system. Storage of water - effect of storage on quality of water

MODULE III

Sanitary plumbing: Sanitary fixtures-Systems of piping-House drainage-Connection of house drains and street sewers. Systems of sewerage-Quantity of storm sewage-Quantity of sanitary sewage-Sewers, types, materials, shape, construction, appurtenances, hydraulic design of sewers, sewage pumping, ejectors, sewer junctions-maintenance, inspection and ventilation of sewers.

MODULE IV

Natural methods of wastewater disposal: land disposal-Sewage farming-disposal by dilution-self-purification of streams-oxygen sag curve-dilution into sea, comparison of disposal methods. Air pollution: type of pollutants, standards, sources, health effects, meteorological aspects, , monitoring and air pollution control. Solid waste management: type, sources, characteristics, collection, vehicles for transportation and processing – Disposal: composting, sanitary land fill, incineration. Noise pollution: Sources, effects, control, noise survey and standards

References:

1. Garg S.K, Environmental & Engineering, Vol I & II, Khanna publications, 2001, New Delhi**.**
2. Birdic G.S &Birdic J.S, Water supply and Sanitary Engineering, DhanputRai& Sons,1998 , New Delhi
3. Peavy Rowe, Tchobanoglous, Environmental Engineering,McGraw Hill International Editions.(2017)
4. Veslind, Morgan & Heine - Introduction to Environmental Engineering, Cengage Learning (2009)
5. M.N.Rao & H.V.N.Rao, Air Pollution, Tata McGraw Hill Pvt.Ltd, New Delhi. (2007)
6. Mark.J.Hammer& Mark. J .Hammer Jr, Water and Wastewater Technology, Prentice Hall of India,Pvt Ltd,1998, New Delhi.4
7. CPHEEO, Manual on Water Supply and Treatment- Third edition,Ministry of Urban Development, Gov. of India (1999)

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0602 DESIGN OF STEEL STRUCTURES

Course Outcomes:On completion of the course, a student will be able to:

1. Apply the provisions in Indian standard codes of practice for the design of various steel structures
2. Design connections, tension and compression members.
3. Design beams and plate girders.
4. Design light gauge steel structures.
5. Design of continuous beams and simple frames using the concept of plastic design
6. Design of structural components using timber

MODULE I
Materials and specifications: rolled steel sections- types of structural steels – specifications-Limit state and working stress design concepts, **Types of connections** – *Bolted joints*-Types of bolted joints-load transfer mechanism-failure of bolted joints-efficiency of the joint-*welded joints*-advantages and disadvantages of welded joints – types of welds and their symbols -Design of welded and bolted connections.

MODULE II
Tension member: Net sectional area – permissible stresses – design of axially loaded tension member. **Compression member**: strength of an axially loaded compression member – effective length – maximum slenderness ratio – compression member with two rolled sections back to back – design of compression members – lacing and battening for built-up compression member – column base – slab base – gussetted base.

MODULE III

Beams: design procedure for laterally supported and unsupported beams – built up beams

Plate girders- design of section, curtailment of flange plate, bearing and intermediate stiffeners, connections, flange and web splices, Gantry girders (only design concept).

MODULE IV

Light gauge steel structures – Types of sections, Flat width ratio, Buckling of thin elements, Effective design width, Form factor, Design of tension, compression members and beams.

Plastic design- basic assumptions - shape factor, load factor- Redistribution of moments - upper bound lower bound and uniqueness theorems- analysis of simple and continuous beams, two span continuous beams and simple frames by plastic theory - static and kinematic methods, Plastic design- Design of section for Continuous beams and simple frames.

References:

1. Subramanian, N. *Design of steel structures*. Oxford University Press, 2011.
2. Arya, A.S. and Ajmani, J. L. *Design of Steel Structures*.Nemchand& Bros, 2011
3. Dayaratnam, P. *Design of Steel Structures.* Wheeler, 2004.
4. Chandak N.R., *Design of Steel Structures*., S.K Kataria & Sons, 2015.
5. Duggal, S.K. *Design of Steel Structures*. T.M.H. Publications, 2010
6. Sairam, K.S., Design of steel structures, Pearson, 2013.

Use of IS: 800 – 2007, IS:801 – 1975, IS:811 – 1987 and structural steel table are permitted in the examination hall.

Type of Questions for Semester End Examination

Question nos. I and II [with sub sections (a), (b), …] (18 marks each with option to answer either I or II) from Module I.

Question nos. III and IV [with sub sections (a), (b), …] (18 marks each with option to answer either III or IV) from Module II.

Question nos. V and VI [with sub sections (a), (b), …] (18 marks each with option to answer either V or VI) from Module III.

Question nos. VII and VIII [with sub sections (a), (b),] (18 marks each with option to answer either VII or VIII) from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0603 ADVANCED METHODS OF STRUCTURAL ANALYSIS

Course Outcomes: On completion of the course, a student will be able to:

1. Interpret the concepts of structure-based flexibility matrix method initiated from the compatibility equations in the method of consistent deformation for statically indeterminate plane structures.

2. Apply the element-based flexibility matrix approach to analyze rigid-jointed and pin-jointed plane structures.

3. Formulate stiffness matrices of basic beam and truss elements and analyze rigid and pin-jointed structures via structure-based and element-based stiffness methods, initiated from the equilibrium equations of the slope-deflection method.

4. Appreciate the direct stiffness method as a generalized approach which would in turn seed the concept of the finite element analysis of structures.

5. Relate analyze multi-storied rigid-jointed frames by approximate methods for lateral and vertical loads so as to check the output given by any structural analysis software.

MODULE I

Introduction to the Flexibility and Stiffness Matrix Methods: Concept of flexibility and stiffness coefficients, Review of determination of displacements and slopes in statically determinate beams, Development of the flexibility matrix method from the method of consistent deformation – compatibility equations, Development of flexibility matrix – Structure/system approach, Concept of element approach, Force Transformation matrix, Element flexibility matrices for truss and beam elements, Equivalent joint load vector, Development of structure flexibility matrix through element approach, Analysis of pin-jointed plane frames by flexibility matrix approach, Analysis of statically indeterminate beams and rigid jointed plane frames by flexibility method.

MODULE II

Analysis by Stiffness Matrix Method: Development of stiffness matrix method from the slope-deflection method – equilibrium equations, Structure approach and Element approach, Element stiffness matrices for truss and beam elements, Displacement transformation matrix, Development of structure stiffness matrix by element approach, Analysis of statically indeterminate beams, rigid jointed and pin-jointed plane frames by stiffness matrix approach, effect of fabrication errors or temperature changes, effect of support settlement.

MODULE III

Analysis by Direct stiffness Method: Local and global coordinate systems, Transformation of element stiffness matrices from local to global co-ordinates, Equivalent nodal forces and load vector, Global stiffness matrix, Application of direct stiffness method to two span continuous beams, plane frames, Advantages of direct stiffness method, Concept of finite element method introduced through the procedure of the direct stiffness method, Comparison of flexibility matrix and stiffness matrix methods.

MODULE IV

Approximate methods of multi-storey frame analysis: Vertical and lateral load analysis of multi- storey frames, assumptions for vertical load analysis, The Substitute frame method, assumptions for lateral load analysis, Portal method, Cantilever method, comparison of the methods.

References:

1. Weaver, W. J. and Gere, J. M. (2018), *Matrix analysis of framed structures*, CBS Publishers, New Delhi.
2. Pandit, G. S. and Gupta, S. P. (2008), *Structural analysis – A Matrix Approach*. Tata McGraw Hill, New Delhi.
3. Kessimeli A. (2011), Matrix Analysis of Structures, Brooks/Cole Publishing Co.
4. Mukhopadhyay, M. and Sheik, A. H. (2009), *Matrix and Finite Element Analysis of Structures*, Ane Books Pvt. Ltd.
5. Wang, C. K. (2010), *Intermediate Structural Analysis*. McGraw Hill International Edition.
6. Punmia, B. C. and Jain, A. K. (2005), *Theory of Structures*. Laxmi Publications (P) Ltd.
7. Krishnamoorthy, C. S. *Finite Element Analysis – Theory and Programming*. (1994), Tata McGraw Hill Publishing Company Limited, New Delhi, India.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0604 GEOTECHNICAL ENGINEERING – II

Course Outcomes: On completion of the course, a student will be able to:

1. Determine the earth pressure on retaining structures and apply the knowledge on the design of sheet pile walls
2. Apply the knowledge on soil exploration methods to carry out soil investigation for any Civil engineering construction.
3. Estimate the bearing capacity of soils by different methods
4. Estimate the probable settlements beneath foundations
5. Estimate pile and pile group capacity for any type of soil

MODULE I

Earth Pressure-General and local states of plastic equilibrium – Rankines and coulomb's theories for active and passive conditions- influence of surcharge – Rebhann's and Culmann's graphical methods for active earth pressure
Sheet pile walls: Types and uses of sheet piles – Design of cantilever and anchored sheet pile walls (Free earth support only).

MODULE II

Site investigation and soil exploration: objectives - planning - reconnaissance - methods of subsurface exploration - test pits - Auger borings - rotary drilling - depth of boring - bore log - soil profile- Field tests - S.P.T, Cone Penetration Tests, Plate load test, field vane shear test, field CBR test, geophysical methods (in brief) - sampling - disturbed and undisturbed samples – soil investigation report.

MODULE III

Foundation -Functions of foundations - requisites of satisfactory foundations - definition of shallow and deep foundation - different types of foundations -selection of type of foundation.
Bearing capacity: ultimate bearing capacity and allowable soil pressure - Terzaghi's equation for bearing capacity for continuous , circular and square footings - bearing capacity factors and charts - Skempton's formulae - effect of water table on bearing capacity – IS recommendation.
Settlement analysis: distribution of contact pressure – estimation of immediate and consolidation settlement – effects, causes and remedial measures of total and differential settlement – permissible total and differential settlements as per IS recommendation -
Design considerations –Proportioning of shallow foundations.
Raft foundations: governing criteria for allowable bearing pressure - floating foundations.

MODULE IV

Pile foundations: Classification of piles based on material, shape, mode of load transfer, method and effect of installation –selection of type of piles - determination of capacity of axially loaded single vertical pile (static and dynamic formulae) - determination of capacity from penetration test

resuls - pile load tests (IS methods) - negative skin friction - pile spacing and group capacity – settlement of pile groups.
Caissons and cofferdams: different types – different shapes of Well foundations- component parts –forces acting on Well foundations- design considerations of well foundations - sinking of wells and remedial measures for tilts and shifts – types and uses of cofferdams.

References:

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1. Ranjan, G.andRao,A.S.R.*Basic and Applied Soil Mechanics*. New Age International Publishers, 2007.
2 Bowles, J. E. *Foundation Analysis and Design*. McGraw Hill, 1997.
3 Tomlinson, M.J., *Pile Design and Construction Practice, Point Publications, London, 2008*.
1. Kurian, N. P.*Design of foundation system*.Narosa Publication, 1994.
2. Das, B.M.*Principles of Foundation Engineering*. Thomson Learning, 2011.
3. Varghese, P. C.*Foundation Engineering*. Prentice Hall of India, 2005.

Note: *Structural designs of foundations are not contemplated in this course.*

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0605 CONSTRUCTION MANAGEMENT

Course Outcomes: On completion of the course, a student will be able to:

1. Understand principles of effective leadership.
2. Read and interpret construction documents and specifications.
3. Create schedules; bar charts, critical path networks.
4. Identify types of float and the use of float to manage projects.
5. Correlate manpower and cost loading to schedule.
6. Understand the uses and working of various equipments involved in construction.
7. Identify all activities and issues related to planning, financing, procuring, constructing, and managing the built environment.

MODULE I

Organization and Management:Concept of organization, characteristics of organization,elements of organization, organizational structures, organization charts, Types of organization formal line, military or scalar organization, functional organization, line and staff organization, project organization, matrix organization, management by objectives.
Organizational conflict, group Dynamics, Organizational change, motivation and leadership, Authority and responsibility, span of control, Delegation of authority. – Centralization and decentralization.

MODULE II

Construction Planning:Objects of planning – stages of construction – Construction team – resources of construction industry – planning and scheduling – scheduling using bar charts - limitations of bar chart – Material, Labour, Equipment, Financial schedules.

Construction Contracts- Contracting procedure-Types of contracts-tenders– prequalification procedure - earnest money deposit – security deposit - contract document

MODULE III

Network Techniques– Difference between CPM and PERT – development of a network – representation of various activities and events in a CPM network – Network logic – network calculation-Float- Slack –Critical path– Crashing the programme – Time cost trade off – Resource Smoothing-leveling.

MODULE IV

Construction Equipments: Earth Moving and Excavating– Bull dozer, Scraper, power shovel, dragline, Clam shells, – Hauling and Conveying equipments – Trucks , Cranes, Pile driving Equipment, Aggregate crushers.

Introduction to Equipment Economics:Owning and Operating Costs, Factors for selection of equipment.

References:

1. Srinath, L. S. *An Introduction to Project Management*. Tata McGraw Hill publications. 1995
2. Arora and Bindra. *Building construction Planning Techniques and methods of construction*. Dhanpatrai & Sons. 2010
3. Peurifoy and Schexnayder.*Construction Planning, Equipment and Methods*. Tata McGraw Hill. 2010
4. Gahlot and Dhir. *Construction Planning and Management*. New Age International .2018
5. Khanna, O.P. *Industrial Engineering and Management*. Dhanapat Rai Publications. 2018
6. Mazda, F.. *Engineering management*. Addison Wesley, Longman Ltd. 1998

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.

Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.

Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.

Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0606 (IE) SUSTAINABLE CONSTRUCTION TECHNIQUES

Course Outcomes: On completion of the course, a student will be able to:

1. Identify and understand the concept of sustainability in construction practices
2. Compare the buildings based on the concept of green building rating systems.
3. Identify and understand the usability of locally available materials in building construction.
4. Understand various innovative techniques of cost reductions for superstructure
5. Understand various innovative techniques on alternative roofing
6. Gain knowledge on various mud construction techniques
7. Identify and understand the usability of waste materials in building construction

MODULE I

Sustainable construction - Green buildings – Various rating systems for the assessment of sustainability- LEED, GRIHA, Life cycle Analysis *(Field case study on rated building projects- Group assignment)*

MODULE II

General cost Reduction Techniques in building projects.

Innovative techniques for foundation- ground improvement by rope drains- sand piles- Brick arch foundation- stub foundation.

Locally available building materials and their usability, Applications of bamboo in building construction *(Field case study on bamboo construction- Group assignment)*

MODULE III

Innovative techniques for walls- Lato blocks, cellular concrete blocks, Solid /hollow concrete blocks, Stabilized Soil Blocks, Stone masonry blocks.

Straw-bale technology, Rat trap bond masonry.

Innovative techniques for roofing- Filler slabs -Funicular Shells-Precast reinforced concrete channel units- Reinforced brick panel roofing system

(Field case study /Practice session on any of the innovative wall / roof options - Group assignment)

MODULE IV

Mud Construction – Mud as building and building material – Field tests for identification of suitable soil for mud construction- Techniques for mud stabilization. Techniques of mud construction- finishes and protective treatments.

Prefabricated building components – advantages of prefabrication, Ferro-cement products, Applications of Waste materials in building process

(Field case study on Mud construction / prefabricated construction- Group assignment)

References:

1. Rao,M. A.G. and Murthy, R. D.S.Appropriate Technologies for Low cost housing.
2. Rai, M. and Jaisingh, M.P.Advances in building materials and construction. CBRI Rookie Publications.
3. Jagadish, K. S, Sustainable Building Technologies, I.K International Publishing House Pvt. Ltd, 2019.
4. Jagadish, K. S. *Building with stabilized mud*. IK International Pvt Ltd, 2007.

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.

Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.

Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.

Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19 – 201 -0607 TRAFFIC ENGINEERING AND MANAGEMENT

Course Outcomes: On completion of the course, a student will be able to:

1. Acquire comprehensive knowledge of traffic surveys.
2. Achieve knowledge on design of road intersections and signals.
3. Outline various traffic control and traffic management measures.
4. To make of an appropriate traffic flow theory for traffic characteristics and to determine the capacity of highways.
5. Summarize methods of economic evaluation.

MODULE I

Traffic Engineering: Definition, Functions.

Road User and the Vehicle: Human factors governing road user behavior - Vehicular characteristics.

Traffic Surveys: Speed, Journey time and delay study – Methods-Moving observer method, Presentation of data- grouping of speed data, cumulative frequency curve, problems. Vehicle volume counts and classifications - methods Parking surveys. Uses of photographic techniques in traffic survey.

Origin- Destination Surveys: methods, zoning and presentation of results.

MODULE II

Traffic Controls: Different types of traffic signs and markings. Traffic signals - design, coordinated signals-time-distance diagram -area traffic control-Other traffic control aids and street furniture.

Intersections And Interchanges –Types-Planning and layout

Traffic Safety: Accidents-causes and prevention.

Parking: Parking problems – desirable parking space standards for different land use -common methods of on-street parking, off-street parking facilities, parking surveys

Traffic Management: Travel demand management, scope of traffic management measures-restrictions on turning movements and one-way streets.

Highway Lighting: Importance of highway lighting, design factors, spacing between lighting units.

MODULE III

Highway Capacity And Level Of Service: Definitions - PCU-LOS concept, Factors affecting capacity and LOS. Capacity of highways, urban streets, rotary, weaving sections and signalized intersections.

Theory Of Traffic Flow: Fundamental diagram of traffic flow-Relationship between speed and concentration.

MODULE IV

Transportation Economics: Cost and benefits of transport project, basic principles and methods of economic evaluation, rate of return method s and discounting cash flow methods– worked out problems. Road user cost-Motor Vehicle operation cost.

References:

1. Khadiyali, L.R. *Traffic Engineering and Transport Planning*. Khanna Publishers, 2011.
2. Roess, R. P., Prassas, E. S. and McShane, W. R. *Traffic Engineering*. 4th edition. Pearson, 2010.
3. May, A.D. *Traffic Flow Fundamentals*. First edition. Pearson.1989.
4. Mannering,F. L., Washburn, S. S. and Walter P. K. *Principles Of Highway Engineering And Traffic Analysis*. 5th edition. Wiley India Pvt Ltd. 2012
5. Slinn, M., Matthews, P. and Guest, P. *Traffic Engineering Design: Principles and Practice*. Butterworth-Heinemann, 1998.
6. Chakroborty, P. and Das, A. *Principles of Transportation Engineering*. Prentice Hall India Learning Private Limited,2004.
7. Recommended Practice for Traffic Rotaries - IRC 65-1976
8. Guidelines for capacity of roads in rural areas -IRC 64-1990
9. Guidelines for design and installation of Road Traffic Signals -IRC 93- 1985

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0608 AIR POLLUTION CONTROL AND MANAGEMENT

Course Outcomes: On completion of the course, a student will be able to:

1. Identify sampling and analysis techniques for air quality assessment
2. Identify the plume behavior for atmospheric stability conditions
3. Demonstrate an ability to design various air pollution controlling devices
4. Assess the air quality monitoring and management
5. Recall the legislations and regulations in air pollution management

MODULE I
Sources and effects of Air pollution : Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming - ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

MODULE II
Dispersion of Pollutants: Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models - Applications.

MODULE III
Air Pollution Control : Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

MODULE IV
Air Quality Management **:**Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality.

References:

1. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New Yark, 1997.
2. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi,1991.
3. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill,New Delhi, 1985.
4. Garg, S.K., "Environmental Engineering Vol. II", Khanna Publishers, New Delhi , 1979.
5. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.
7. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.
8. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 1996.
9. Noel, D. N., Air Pollution Control Engineering, Tata McGraw Hill Publishers, 1999

10. Stern, A.C., Fundamentals of Air Pollution, Academic Press, 1984

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

CE19-201-0609 GROUND WATER ENGINEERING

Course Outcomes: On completion of the course, a student will be able to:

1. Evaluate groundwater resources using geophysical methods
2. Estimate aquifer parameters
3. Model regional groundwater flow
4. Design water wells

MODULE I
HYDRAULICS OF GROUND WATER FLOW

Characteristic of Ground water -Ground water column – Permeability - Darcy's Law - Types of aquifers -Storage coefficient - Specific field - Transmissivity - Governing equations of ground water flow - Steady state flow - DupuitForchheimer assumptions - Velocity potential - Flow nets

MODULE II
ESTIMATION OF AQUIFER PROPERTIES

Pumping test - Unsteady state flow – Theis' method – Jacob's method – Chow's method - Theis' recovery method Image well theory – Effect of partial penetrations of wells - Collector wells.

MODULEIII
GROUND WATER EXPLORATION AND ARTIFICIAL RECHARGE

Surface Investigations of Ground water: Geologic methods, Remote Sensing, Geophysical exploration, Electric Resistivity method, Seismic Refraction Method;
Artificial Recharge of Groundwater : Concept of Artificial Recharge methods, Recharge mounds, Induced Recharge, water spreading, flooding, basins, ditching, modification of natural channels, irrigation, recharge pits, shafts and recharge wells.

MODULEIV
GROUND WATER DEVELOPMENT AND MANAGEMENT

Infiltration gallery –Water logging- Conjunctive use , Rainwater harvesting - Safe yield -Yield test – Geophysical methods –Saline intrusion , Sources of Salinity, Desalination, Remediation of Saline intrusion
Groundwater Modeling Techniques: Porous media models, Viscousfluid models, Membrane models, Thermal models, Electric Analog Models, Digital Computer Models

References:
1. Todd, D. K.*Ground Water Hydrology*. John Wiley and Sons.,2000

2. Rastogi, A. K*Numerical Ground Water Hydrology*.Penram InternationalPublishing (India) Pvt.Ltd.,2007
3. Karanth. *Ground Water Assessment, Development and Management.* Tata McGraw Hill Ltd.,2000
4. Raghunath, H.M. *Ground Water Hydrology*. Wiley Eastern Ltd.2000

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0610 ENVIRONMENTAL ENGINEERING LAB

Course Outcomes: On completion of the course, a student will be able to:

1. Analyze physic-chemical characteristics of water and wastewater
2. Examine the microbiological characteristics of water
3. Assess optimum dosage of coagulant
4. Assess available chlorine content in bleaching powder
5. Assess the quality of water and wastewater
6. Examine the microbiological characteristics of water

Experiments

1. Determination of solids (total, dissolved, organic, inorganic and settleable) in water.
2. Determination of turbidity and optimum coagulant dose.
3. Determination of acidity, alkalinity and pH of water.
4. Determination of hardness and chlorides in water.
5. Determination of iron in water.
6. Determination of sulphates and sulphides in water.
7. Determination of D.O and BOD of waste water.
8. Determination of COD of waste water
9. Determination of available chlorine in bleaching powder and the chlorine dose required to treat the given water sample.
10. Determination of oil and grease in wastewater.
11. Determination of coliforms in water.

References :

1. Standard methods for the examination of water and wastewater. 21st Edition, Washington: APHA. 2012
2. Sawyer, C. N., McCarty, P. L., and Perkin, G.F., Chemistry for Environmental Engineering and Science, 5th edition McGraw-Hill Inc., 2002
3. B. Kotaiah and Dr. N. Kumara Swamy, Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd., 1st Ed., 2007.

.Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

19-201-0611 COMPUTER APPLICATIONS IN CIVIL ENGINEERING - I

Course Outcomes: On completion of the course, a student will be able to:

1. Make use of with a civil engineering drawing software.
2. Draw all the relevant views of buildings using CAD software.
3. Outline the existing rules and regulations of buildings, stipulated by the National Building code and state building rules.
4. Prepare detailed structural drawings as per specifications given in the Indian codes.
5. Prepare an estimate of the materials required for construction from the CAD drawing.

Introduction of a Popular Drafting Package:Basic Commands and simple drawings.
From the given line sketch and specification, develop working drawings (plan, elevation and section) of the following buildings using CAD.

1. Single storied residential building with flat roof
2. Single storied residential building with sloping roof
3. Double storied building
4. Public Building- Commercial complex/Hospital building/Institution Building
5. Preparation of structural drawings for slabs, beams and columns

References:

1. National Building Code of India
2. Kerala Municipal Building Rules
3. Shaw and Kale.*Building Drawing*.
4. Prabhu, B. T. S.*Building Drawing and Detailing*, Spades, Calicut.
5. Malik, R. S.and Meo, G. S. *Civil Engineering Drawing*.
6. Verma, B. P. *Civil Engineering Drawing and House Planning*. Khanna Publishers,Delhi.

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

SEMESTER VII

19-201-0701 ENVIRONMENTAL ENGINEERING – II

Course Outcomes: On completion of the course, a student will be able to:

1. Demonstrate an ability to recognize different types of unit operations and processes involved in water and wastewater treatment plants
2. Able to design physio- chemical treatment methods for water and wastewater systems
3. Able to design of biological waste water treatment systems
4. Demonstrate Sludge handling and disposal techniques
5. Able to design conventional and advanced anaerobic systems in sustainable manner

MODULE I

General layout of water treatment plant. Sedimentation – plain sedimentation, theory of sedimentation, continuous flow sedimentation tanks. Theory of coagulation and flocculation, design of flash mixers, clarifiers and clarifloculators. Filtration - Theory of filtration, Classification of filters, design, construction, control, operation and maintenance of these units. Disinfection, methods of disinfection, chlorination. Miscellaneous treatment methods: color, odour and taste removal, iron and manganese removal, deflouridation, removal of hardness. Aeration, purpose of aeration.

MODULE II

Objectives of wastewater treatment - Effluent standards, KSPCB Standards, BIS Standards. Layout of conventional treatment plant - preliminary, primary, secondary and tertiary treatments in general. Preliminary process: screens - types of screens, design, disposal of screenings, grit chamber - function, design, construction and operation, disposal of grit , detritus tank, skimming tank - function, design and operation, disposal, Sedimentation: Design ,construction and operation, rectangular and circular tanks, disposal of sludge.

MODULE III

Biological process: principle and theory of biological treatment. Sewage filtration; Trickling filters - design, construction and operation. Activated sludge process: Design, construction and operation of conventional and extended aeration, aeration methods. Miscellaneous methods- Stabilization ponds, Oxidation ditch, Aerated lagoons, rotating biological contactors

MODULE IV

Sludge treatment and disposal: quantity of sludge, characteristics of sludge, sludge thickening, digestion, conditioning and disposal, design of sludge digesters only. Septic Tanks: Design (as per Ministry of urban development) construction, disposal of effluents, cleaning of tanks, Imhoff tanks. Sewage treatment by high rate anaerobic methods: Anaerobic digestion suspended growth, contact process, UASB, attached growth, filters, expanded bed- only basics .

References:

1. S.K. Garg , Sewage Disposal and Air Pollution Engineering – Environmental Engineering (Vol.II) – Khanna Publishers, New Delhi. 1999
2. Metcalf & Eddy, Inc., Waste water Engineering Treatment and Reuse, McGraw Hill International Editions, New Delhi.2003
3. Sawyer and McCarty, Chemistry for Environmental Engineering, McGraw Hill Education, 2017.

4. Fair, Geyer & Okun, Water and Waste water Engineering, 3rd edition John Wiley & Sons, 2010.
5. Mark J Hammer, Water and Waste water Technology, Prentice Hall India Learning Private Limited, 2012.
6. Vesilind P.A & William A. Worrell. Solid waste Engineering, CL Engineering, 2011.
7. Punmia B.C., Water supply Engineering, Laxmi Publications, 2016.
8. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous , Environmental Engineering, McGraw Hill Inc., New York ,1985
9. P.N. Modi , Sewage treatment & Disposal and waste water Engineering – Environmental Engineering (Vol.II) – Standard Book House, 2008

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0702 QUANTITY SURVEYING AND VALUATION.

Course Outcomes: On completion of the course, a student will be able to:

1. Prepare the estimate of the quantities for different items of works in all stages of building construction
2. Assess the quality and quantity of materials, required for a project with given specifications.
3. Prepare the bar bending schedule for R.C.C works
4. Prepare the schedule of rates for different items of work
5. Prepare the earthwork estimation for road works.
6. Conduct the valuation of a property.

MODULE I

Estimate-Types of estimate - Revised estimate, supplementary estimate, maintenance estimate, detailed estimate, approximate estimate - plinth area method, cubic rate method, unit rate method, bay method, approximate quantity from bill method, comparison method, Preparation of detailed estimates and abstracts for RCC single storey buildings - centre line method and long wall - short wall method, Detailed specifications for common building materials and items of work as per I.S specifications.

MODULE II

Estimation of earth work for road works - Preparation of bar bending schedule and estimation of quantities for R C.C footings -Columns – Beams and slabs, Calculation of quantities of materials and analysis of rates for various items of work in building construction-rubble work, brick work, PCC, RCC, plastering, pointing etc., Introduction to data book and schedule of rates, Preparation of abstract of estimate of buildings.

MODULE III

Valuation –purpose – principle, Explanation of different technical terms, Types of values.Gross income – net income – Outgoings, Depreciation – methods of calculating depreciation – straight line method – constant percentage method, sinking fund method – and quantity survey method.

MODULE IV

Methods of valuation of property – rental method – direct comparison with capital cost – valuation based on profit – valuation based on cost – development method – depreciation method valuation

of land – comparative method – abstractive method- belting method- valuation of based on hypothetical building schemes. Valuation of agricultural land,Free hold and leasehold properties – gilt edged securities. Different forms of rent and rent fixation.

References:

1. Dutta, B.N. Estimating and Costing in Civil Engineering (Theory &Practice), UBS PUBLISHERS' DISTRIBUTORS (P) LTD,2016
2. Chakraborti, M..Estimating, Costing, Valuation and Specifications in Civil Engineering, SatyaPrakashan, New Delhi; 2017 edition
3. Ranagawala. Valuation of Real Properties,Charotar Publishing House; 10 edition (2015).

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0703 DESIGN OF CONCRETE STRUCTURES – II

Course Outcomes: On completion of the course, a student will be able to:

1. Recommend the type of footing based on load to be transferred and soil characteristics
2. Perform design of shallow and deep foundations and retaining wall based on load and soil characteristics
3. Perform the design of water retaining structures.
4. Understand the concepts of pre-stressing in concrete structures and identify the materials for pre-stressing.
5. Analyze a pre-stressed concrete section and estimate losses of pre-stressing and design of prestressed beams

MODULE I
Footings- Design of Isolated footings- axial and eccentric loading- Design of Combined footings- rectangular and trapezoidal footings.
Design of pile and pile cap
Structural design of piles, pile caps and grade beams.

MODULE II
Retaining walls – Types- cantilever and counterfort; Design of cantilever retaining walls
Water tanks – design of circular, square and rectangular water tanks at ground level- design of overhead water tank (excluding supporting structure).

MODULE III
Pre-stressed Concrete – General principles- systems of prestressing- materials for prestressing - **Analysis of sections for flexure**: Stresses in concrete due to prestress – stresses in concrete due to loads – stresses in steel due to loads – discussion on moment curvature relationship of a prestressed concrete beam

MODULE IV

Loss of prestress: Significance – Lump sum estimate – elastic shortening of concrete – time dependent losses – loss due to creep of concrete – loss due to shrinkage of concrete – loss due to steel relaxation – loss due to anchorage take up – loss or gain due to bending of members – practical

considerations for frictional loss – theoretical considerations for frictional loss – total amount of losses elongation of tendons- Code provisions

Design of sections for flexure: Preliminary design – general concepts of elastic design – elastic design with no tension in concrete – elastic design allowing tension – elastic design allowing and considering tension – ultimate design – arrangement of steel and prestressing in stages.

References:

1. Varghese, P. C. *Limit State Design of Reinforced Concrete*. Prentice Hall of India Ltd, 2008.
2. Ashok K Jain, A. K. *Reinforced Concrete - Limit State Design*. Nem Chand Brothers, Roorkee, 2012.
3. Pillai, S.U. and Menon, D. *Reinforced Concrete Design*. Tata McGraw Hill Publishing Company Limited, New Delhi, India, 2009.
4. Varghese , P.C, *Design of Reinforced Concrete Foundation* PHI Learning Pvt Ltd, 2010.
5. Krishnaraju, N. *Prestressed Concrete*. Tata McGraw- Hill, 2012.
6. Lin, T.Y.and Burns, N.H. *Design of prestressed concrete structures*. John Wiley & Sons, New York, 2009

Relevant IS Codes are permitted in the Examination Hall

Type of Questions for Semester End Examination

Question nos. I and II [with sub sections (a), (b), …] (18 marks each with option to answer either I or II) from Module I.

Question nos. III and IV [with sub sections (a), (b), …] (18 marks each with option to answer either III or IV) from Module II.

Question nos. V and VI [with sub sections (a), (b), …] (18 marks each with option to answer either V or VI) from Module III.

Question nos. VII and VIII [with sub sections (a), (b), …] (18 marks each with option to answer either VII or VIII) from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0704 (IE) GROUND IMPROVEMENT TECHNIQUES

Course Outcomes: *On completion of this course, a student will be able to:*

1. *Identify challenging ground conditions in engineering practice.*
2. *Compare and contrast the different ground improvement methods feasible for a given site.*
3. *Select site specific method of improvement and its design.*
4. *Assimilate knowledge for promoting wider use of techno – economical techniques such as grouting, reinforced soil structures, etc.*

MODULE I

Introduction to Ground Modification: Need and objectives of Ground Improvement, Classification of Ground Modification Techniques – Geotechnical problems in alluvial, lateritic and black cotton soils - suitability and feasibility - Emerging Trends in ground improvement.

Mechanical Modification: Methods of compaction, Shallow compaction, Deep compaction techniques – Vibro-flotation, Blasting, Dynamic consolidation, pre-compression and compaction piles, Field compaction control. Case studies / field Visits.

MODULE II

Hydraulic Modification: Methods of dewatering – open sumps and ditches, Well-point system, Electro-osmosis, Vacuum dewatering wells; pre-loading without and with sand drains, strip drains and rope

drains, Design of vertical drains – Design and Construction of stone columns in soft clays, encased stone columns. Case studies / field Visits.

MODULE III

Physical and chemical modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen - Case studies.

Introduction to grouts and grouting- basic functions -Classification of grouts -Grout ability Ratio. Rheological properties of grouts.

Methods of grouting – Permeation grouting, Compaction grouting, jet grouting, Hydro fracturing. Grouting technology – ascending and descending stages.

Grouting applications: seepage control in soil and rock under dams- seepage control in soil for cut off walls –stabilization grouting for underpinning- case studies / field visits.

MODULE IV

Earth Reinforcement- Concept of reinforced earth –Reinforcing materials- Backfill – construction of reinforced earth wall- Stability analysis of reinforced earth retaining walls- external stability analysis, internal stability analysis (brief mention about the methods only) - application areas of reinforced earth structures - Case Studies.

Geosynthetics: Classification - Functions of geotextiles as separators, reinforcement, filters and in drainage - damage and durability of geotextiles - Natural Geotextiles and their applications - Case Studies / field visits.

References:

1. Koerner, R.M, Construction and Geotechnical methods in Foundation Engineering, Mc.Graw-Hill Pub. Co., New York, 1985.
2. Manfred R. Haussmann, Engineering principles of ground modification, Pearson Education Inc. New Delhi, 2008.
3. Bell F G, Engineering Treatment of Soils, E& FN Spon, New York, 2006.
4. Leonards,G. A.,Foundation Engineering ,McGraw Hill Book Co.
5. Purushotham Raj P,Ground Improvement Techniques, Laxmi Publications..
6. Koerner, R.M ,Designing with Geosynthetics, Prentice Hall,2005.
7. Jie Han ,Advances in Ground Improvement, Allied Pub., 2009.
8. Shashi K.Gulhati & Manoj Datta ,Geotechnical Engineering , Tata McGraw Hill

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.

Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.

Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.

Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0705 BRIDGE ENGINEERING

Course Outcomes: On completion of this course a student will be able to

1. Design slab culverts, T-beam bridges and steel bridges for railways.
2. Design substructures for all types of bridges.
3. Perform inspection and maintenance of bridges.
4. Design steel girders for railway steel bridges.

MODULE I

Investigation for Bridges: Investigation stages – classification of bridges – investigations – estimates – Major bridges – coverage – topographic details – catchments area map – hydrologic

particulars – geotechnical details – seismology of the area - navigation requirements – construction resources – particulars of nearest bridges – traffic forecast – Major bridges – factors for choice of ideal site –techno economic feasibility – project report preparation – preparation of drawings.

MODULE II

Loading standards: components of bridge structure – need for loading standard – loading requirement – railway loading standards – road bridge loadings.

Construction of bridges: Setting out of pier and abutments – setting out of single span bridge – setting out of multi span bridge – Open excavation in dry condition – foundation below water table – pile foundations – precast driven piles – cast in situ piles – load test on piles – well foundation – sinking of wells – construction of super structure.

MODULE III

Concrete Bridges for Road Transport: Design of simply supported solid slab bridge – Dispersion of load along the span – design of slab – Design of Girder Bridge – Design of deck slabs – design of longitudinal girders – Courbon's method – Design of bearings.

Steel Bridge for Railways: Steel girder design.

MODULE IV

Inspection of Bridges: Necessity for inspection of bridges – inspection procedures – aspects of inspection – testing of bridges – assessment of safe load bearing capacity

Maintenance of Bridges: Substructure maintenance – super structure maintenance – bearings – girders.

References:

1. Ponnuswamy, S. *Bridge Engineering*., Tata McGraw Hill Publishing Company Ltd.,2007
2. Aswani, M. G.,Vazirani, V.N. and Ratwani, M.M. *Design of Concrete Bridges*. , Khanna Publishers.2014
3. Victor, D. J., Essentials of Bridge Engineering, S Chand. 2007.

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.

Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.

Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.

Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201 -0706 PAVEMENT ANALYSIS AND DESIGN

Course Outcomes: On completion of the course, a student will be able to:

1. Identify the pavement components and their functions.
2. Enable to carry out the design of bituminous mixes.
3. Calculate stresses and ESWL in flexible pavements and design the flexible pavement.
4. Calculate the stresses and design rigid pavements by IRC method.
5. Evaluate performance of pavements.

MODULE I

Introduction:types and component parts of pavements - Functions of various layers of pavements- prime coat, tack coat, seal coat- factors affecting design and performance of pavements - comparison between highway and airport pavements – functions and significance of sub grade properties – various methods of assessment of sub grade soil strength for pavement

design - cause and effects of variations in moisture content and temperature - depth of frost penetration - design of bituminous mixes by Marshall method.

MODULE II

Stress analyses and methods of flexible pavement design: stresses and deflections in homogeneous masses - Burmister theory - wheel load stresses - ESWL of multiple wheels - repeated loads and EWL factors - empirical, semi - empirical and theoretical approaches for flexible pavement design - group index, CBR, -IRC method ,triaxial, Mcleod and Burmister layered system methods.

MODULE III

Rigid Pavements: Westergaard's approach-Bradbury's stress coefficients-IRC method of design. Temperature Stresses in Concrete pavements-Warping stress-Frictional Stress-Combination of stresses. Joints in Concrete pavements-Necessity-requirements-Types-Expansion joints-Contraction Joints-Construction joints, Design of joints-dowel bars and tie bars.

MODULE IV

Pavement evaluation: structural and functional evaluation of flexible and rigid pavements - pavement distress - evaluation of pavement structural condition by Benkelman beam rebound deflection, design of flexible pavement overlay using BBD data.

References:

1. Huang, Y.H. *Pavement Analysis and Design*. Pearson Education, 2008.
2. Khanna, S.K., Justo and Raghavan, V. *Highway Engineering*. Khanna Publishers, 2014.
3. IRC: 37-2012 Guidelines for the Design of Flexible Pavements, The Indian Roads Congress, New Delhi.
4. IRC: 58-2011 *Guidelines for the Design of Plain Jointed Rigid Pavements for Highways*, The Indian Roads Congress, New Delhi.
5. IRC 81-1981 *Tentative Guidelines for Strengthening of Flexible Pavements by Benklman Beam Deflections Techniques*.
6. Mallick, R.B. and T. El-Korchi. *Pavement Engineering – Principles and Practice*. CRC Press, 2013.
7. Ministry of Road Transport and Highways. *Specifications for Road and Bridge Works*, Fifth Edition, Indian Roads Congress, New Delhi, India.
8. Papagiannakis, A.T. and Masad, E.A. Pavement Design and Materials. John Wiley and Sons, New Jersey, USA, 2008.
9. Yoder, E.J. and Witczak, M.W. Principles of Pavement Design. Second Edition, John Wiley and Sons, New York, 2011.

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0707 ARCHITECTURE AND TOWN PLANNING

Course Outcomes: On completion of this course a student will be able to gain knowledge

1. In traditional and modern architecture.
2. In the basic concepts of vastuvidya
3. In applying the principles of vastuvidya in site selection residential building planning

4. About evolution of towns, surveys, zoning, and planning town/city leading towards the development of a modern town.
5. In land use planning and prepare master plan with respect to planning regulations.

MODULE I

Principles of Architectural Design: Definition of Architecture – factors influencing architectural development, Qualities of Architecture, Creative and Design Principles in architecture Characteristic features of a style –historical examples from Neolithic, Egyptian, Roman and Gothic architecture.

MODULE II

Basics of Vastuvidya

Definition of Vastuvidya –resource materials-division of Silpins and their roles-Basic units of measurements- Different types Hastas-Purushapramanam- Vertical Proportion and Thalam concept.

Concept of Vastu :VastuPurusha mandala and prime Khandas and Padas. Concept of Veedhi. Application Khandas, Padas and Veedhi in Planning house and other structures.

MODULE III : Planning and vastuvidya

Investigation of land- Different types of tests for suitability-Determination of Cardinal direction-Classification of Trees and position of trees in compound – Restriction of house construction with respect to Temples, Paddy fields, Rivers, Mountains, Sea etc.

Concept of Digyoni- Its determination and application in planning rooms and building proportions. – Sala classification _Ekasala, Dwisala ,Trisala&Chatussala. –Different types of Chatussala-Position of rooms -Kitchen. Bed Rooms etc in Residential houses- Position of wells and ponds – Position of Gates

MODULE IV

Town Planning Theory: Evolution of towns – problems of urban growth- ideal towns –garden city movement – concept of new towns -comprehensive planning of towns. Re- planning of existing towns.

Survey –Necessity- Collection of data- types-uses-Methods-drawings-reports.

Zoning-Objects- principles-importance-advantage-transition zone-economy of zoning-zoning powers.

Master Plan – Objects- –Necessity- Collection of data- drawings- features- Planning standards-Report

References:

1.Fletcher, B.A. History of world Architecture. Architectural Press, 1996.

2. Pickering, E. Architecture Design. John Wiley and Sons, 1949.

3. Hiraskar, G.K. Great Ages of World Architecture. Dhanpat Rai Publishing Co Pvt Ltd, 2018

4. A Text book of Vastuvidya : Dr A Achuthan & Dr Balagopal Prabhu, Vastu Vidya Parthishtanam ,Calicut, 1996.

5. Rangwala, S. C.Town Planning. Charotar Publishing House. 2003

6. Agarwala, S. C.Architecture & Town Planning. DhanpatRai& Co (P) Ltd. 2013.

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0708 FINITE ELEMENT METHOD

Course Outcomes: On completion of this course a student will be able to

1. Conceive the requirement of approximate solution in engineering.
2. Develop one-dimensional finite element formulations for simple civil engineering applications.
3. Understand clearly two-dimensional finite element formulation in the domain of linearly elastic and isotropic solid mechanics and convergence requirements.
4. Conceive the idea of iso-parametric formulation and mapping in the finite element procedure.
5. Practice various numerical integration procedures which are essential part of the FEM and understand assembly and imposition of boundary conditions in the FEM.
6. Extend the basics of the FEM to three-dimensional problems and to higher order elements and their employment in the method.

MODULE I

Fundamental Concepts: Mathematical model of an engineering problem – boundary value and initial value problems, Requirement of approximate solution, the basic procedure of the finite element method explained through the problem of total elongation of a tapering bar, the idea of approximation and interpolation, concept of finite elements.
One-dimensional finite element procedure: Weighted residual problem with special mention to Galerkin method, Strong and weak formulation of the governing equations, Essential and natural boundary conditions, One-dimensional elements – two-noded and three-noded Lagrangian bar elements, Beam element (Hermitian element), development of shape functions, application to cable problem, column buckling problem, General truss element, solution of a truss problem.

MODULE II

Two-dimensional finite element procedure through elastic solid mechanics: Revisiting the equilibrium equations, compatibility equations, strain-displacement equations and constitutive equations (assuming isotropy) for plane stress and plane strain problems, Displacement function, Convergence and compatibility requirements, Finite element formulation through the principle of stationary potential energy.
Element properties: Three-noded triangular elements, area co-ordinates, development of shape functions, 4-noded square element in the natural coordinate system, shape functions, iso-parametric, sub-parametric and super-parametric elements, the concept of mapping in FEM, Serendipity elements, computation of nodal load vector.

MODULE III

Numerical integration: Importance of numerical integration in the FEM, Trapezoidal rule, Simpson's rule, Error term, Newton-Cotes rule, Gauss-Legendre rule, Changing limits of integration, Multiple integrals (integration in two and three dimensions), Numerical integration over quadrilateral elements, Numerical integration over triangular elements.
The concept of Assembly in the FEM: Degrees of freedom in element level and global level, Element stiffness matrices, global stiffness matrices, algebraic equations involving the matrices, assembly procedure explained through with one and two-dimensional examples.

Imposition of boundary conditions and solution: The method of imposing boundary conditions in an FE formulation, Solution of equations – Gauss elimination and Gauss-Siedel methods, Newton-Raphson method.

MODULE IV

Three-dimensional finite element formulation: Galerkin formulation of linearly elastic problems, basic three-dimensional elasticity equations, three-dimensional linear finite elements – rectangular prism, triangular prism, tetrahedron, element properties.

Higher order 2D and 3D elements in the FEM: Six-noded triangle, nine and eight-noded quadrilateral, static condensation, twenty-noded brick element, applicability of the elements.

Reference:

1. Cook, R. D., Malkus, D. S., Plesha, M. E. and Witt, R. J. , *Concepts and Applications of Finite Element Analysis*, John Wiley & Sons, Inc.,2002
2. Zienkiwicz, O. C., Taylor, R. L. and Zhu, J. Z.,.*The finite element method: Its basis and fundamentals*. Elsevier.,2006.
3. Krishnamoorthy, C. S., *Finite Element Analysis – Theory and Programming*.Tata McGraw- Hill, New Delhi.,1994.
4. Reddy, J. N. .*An Introduction to the Finite Element Method*, Tata McGraw-Hill.,2005

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0709 PRINCIPLES OF MANAGEMENT

Course Outcomes: On completion of the course, a student will be able to:

1. Inculcate the ability of formulating, analysing, and solving management problems through the application of scientific management.
2. Introduce the importance of Productivity and Project Management.
3. Get exposed to personnel, marketing and financial management.
4. Understand the principles of economics and IPR aspects.

MODULE I

Basic concept of Management: Introduction, definitions of managements, characteristics of management, levels of management, management skills, scientific management - Contributions of Gilbreth and Gantt.

Functions of Management: Planning, forecasting, organizing, staffing, directing, motivating, controlling, co-coordinating, communicating, decision making.

Organization: Introduction, definition of organization, system approach applied to organization, necessity of organization, elements of organization, process of organization, principles of organization, formal and informal organization, organization structure, types of organization structure.

Forms of Business Organization: Concept of ownership organization, types of ownership, Individual ownership, partnership, joint stock company, private and limited company, co-operative organizations, state ownership, public corporation.

MODULE II

Productivity and Production: Measurement of productivity, productivity index productivity improvement procedure, Organization by product function.

Inventory control: Classification, Functions, inventory models, inventory costs, EOQ, Materials Requirement Planning – Objectives, Functions and methods.

Project Management: Functions, Characteristics and feasibility studies.

MODULE III

Personnel Management: Introduction, definition, objectives, characteristics, functions, principles and organization of personnel management, Recruitment and training methods.

Markets and Marketing: Introduction, the market, marketing information, market segmentation, consumer and industrial markets, pricing, sales, physical distribution, consumer behaviour and advertisement.

Financial Management: the basic concepts of financial accounts, inflation, profitability, budgets and controls, cost accounting, valuation of stock, allocation of overheads, standard costing, marginal costing, Break even point.

MODULE IV

Economics: Principles of economics, problem of scarcity, demand, supply, utility, time value of money, inflation and deflation, determination of price, Consumer Optimization, Consumer Response, Consumer Demand Curve.

IPR Aspects: General introduction to IPR, eligibility for patent, patent information and prior art search, procedure for filing patent application, rights of patent owner and duration, ownership of patent and commercialization, assignment, licensing and technology transfer, designs and Utility models.

References:

1. Mazda, F. *Engineering Management*. Pearson, 1997.
2. Koontz and O'Donnell. *Essentials of Management*. McGraw Hill, 1986.
3. Kotlar, P. *Marketing Management*. Pearson Education India, 2015.
4. Chandra, P. *Finance Management*. 5th edition. TMH, 2007.
5. Monks, J.G. *Operations Management*. MGH, 1996.
6. Cornish, W.R. and Llewellyn, *Intellectual Property.* 6th edition. Sweet & Maxwell,London., 2007
7. WIPO, *Intellectual Property – A powerful tool for economic growth*.
8. Hunt, D., Nguyan, L. and Rodgers, M. ,*Patent Searching: Tool and Techniques*. John Wiley and Sons.,2007
9. Sulivan, N. F. *Transfer of Technology*. Cambridge University Press.
10. Lipsey, R. and Chrystal,A. *Economics*. Oxford University Press.
11. Karl, C. E. and Fair, R. C. .*Principles of Economics*. 8th edition. Pearson Education.,2009
12. Mankiw, N. G. *Principles of Economics*. 3rd edition. Thomson South-Western.,2005

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.

Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.

Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.

Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0710 INDUSTRIAL WASTE ENGINEERING and MANAGEMENT

Course Outcomes: On completion of the course, a student will be able to:

1. Identify the effects of industrial wastewaters and stream quality criteria for public water supply and effluent standards.
2. Recognize the importance on the effect of wastewater discharge on stream.
3. Identify and propose treatment schemes for industrial wastewater.
4. Identify the characteristics of industrial wastewaters and formulate environmental management plan.

MODULE I

Effect of industrial waste on stream and land. Stream quality criteria for public water supply and effluent standards, characterization, Variation in waste water flow rates and constituents, Objective of wastewater treatment, Plant analysis and design, General layout of an effluent treatment plant, Volume reduction, Strength reduction, Neutralization, Equalization and Proportioning.

MODULE II

Disposal of treated waste into rivers. De-oxygenation and Re- oxygenation in river and Streams, Development of Oxygen sag model, Application of Streeter Phelp's equation, Ocean disposal, Water reclamation and reuse.

MODULE III

Physico–chemical treatment methods: Application of sedimentation, coagulation, flocculation, adsorption, chemical precipitation, ion exchange, reverse osmosis and electro-dialysis process. Biological treatment methods: Theory and principle, modification of activated sludge process, bio-tower, rotating biological contactors, stabilization pond, aerated lagoon, sequencing batch reactors, High rate anaerobic treatment: anaerobic contact process, anaerobic rotating biological contractors, Anaerobic Expanded/Fluidized bed reactors, Upflow anaerobic sludge blanket reactor.

MODULE IV

Sources, Characteristics, waste treatment flow sheets for selected industries such as textiles, tanneries, dairy, sugar, paper, distilleries, refineries, fertilizer. Waste management techniques, Control of Volatile organic compounds by bio- filtration, Environmental management through ISO 14000, Auditing for waste minimization, Eco-labeling and Life CycleAssessment.

References:

1. MetcalfandEddy.*WastewaterEngineering,Treatment,DisposalandReuse*.TataMcGraw Hill Publications, 1991.
2. Nemerow, H. N.*Liquid Waste from Industry – Theory, Practice and Treatment*. Addison-wesley,1971.
3. Rao, M.N. and Datta, A.K. *Waste Water Treatment*. Oxford IBH Publication,2017.
4. Eckenfelder, W.W.*Industrial Water Pollution Control*. McGraw Hill Publication,1999.

5. Arcevala and Asolekar.*Waste water Treatment for pollution control and Reuse*. Tata McGraw Hill Publications, 2017.
6. Nemerow, N. L. *Industrial Waste Treatment*. Butterworth-Heinemann.,2007

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0711 INTRODUCTION TO AQUACULTURE ENGINEERING

Course Outcomes: On completion of the course, a student will be able to:

1. Understand the basics in aquaculture and the need for employing the principles of engineering for attaining sustainability.
2. Identify the major cultivable species of finfish and shellfishes, and based on the specialties of the aquaculture environment and recognize the right species suitable for culture.
3. Interpret or identify the specific environment management measures required for a particular culture system and the species concerned.
4. Understand specific brood stock management (engineering as well as biological) options for sustained production. (One can seek the help of an aqua - culturist for selecting the biological options).
5. Understand the design of bunds for grow out systems, need based recirculating aquaculture systems, integrated multitrophic aquaculture system, aquaponics, raceways, different forms of mariculture operations - cage culture, raft culture and rope culture.
6. Summarize the engineering options for establishing integrated disease management and preventive health care.
7. Relate to responsible aquaculture through engineering technology.

MODULE I
Major cultivable species of finfish and shell fishes in India: Fresh water fishes, fresh water prawns, fresh water mussels, fresh water eels, brackish water fishes, brackish water shrimps, pearl oysters, brackish water mussels, edible oysters, crabs, clams, sea cucumbers, lobsters, sea urchins (Species to be specified) and recent advancements in the area;
Aquaculture environment: Importance of environmental health in the health management of fishes, environmental parameters and their significance in aquaculture - dissolved oxygen, temperature, salinity, turbidity, ammonia, nitrite, nitrate, hydrogen sulphide, pH, alkalinity, hardness, carbon dioxide, iron, phosphates, micro-nutrients in aquaculture, phyto and zooplankton and sustainable pond productivity, water colour, Soil texture, soil pH, redox potential, organic matter and organic carbon, strategies in aquaculture environment management and recent advancements in the area.

MODULE II
Brood stock development: Characteristics of good quality brood stock and selection, Collection and transportation of brood stock, Configuration of brood stock maintaining systems, breeding operations, brood stock nutrition and health management and recent advancements in the area;
Seed production technology: Basic engineering designs of finfish and shellfish hatcheries, natural and induced breeding, spawning, hatching, larval development to marketable size, feeds at

various stages, water quality management, health management issues, high density seed production strategy with novel engineering technologies and recent advancements in the area

MODULE III. Grow out system: Extensive, semi - intensive and intensive systems, basic engineering designs of grow out systems with sluice gates, specialized systems - zero water exchange aquaculture system, recirculating aquaculture system, integrated multitrophic aquaculture system, aquaponics, raceways, mariculture - cage culture, raft culture and rope culture - engineering designs and operations and recent advancements in the area; **Health Management:** Nutritional requirements of the cultured finfish and shell fishes, feed formulation and manufacturing, types of feeds available and manufacturing companies in India and abroad, marketing strategies adopted, feed management in aquaculture for optimizing production, major health issues - infectious and non infectious diseases, protozoan and metazoan parasitic infestations, integrated disease management and preventive health care and recent advancements in the area.

MODULE IV. Basic engineering designs of sustainable aquaculture production systems: Concepts and technologies for Zero Water Exchange Aquaculture Production System (ZWEAPS), Recirculating Aquaculture System (RAS) Integrated Multitrophic Aquaculture (IMTA), Aquaponics and Raceways - concepts and engineering designs and recent advancements in the area, Modular Systems of the above, Backyard RAS and hatcheries - design specialties and sustaianability.

Reference:

1. Ayyappan, S Handbook of Fisheries and Aquaculture, Publisher - Indian Council of Agricultural Research, New Delhi. ISBN: 978-81-7164-106-2 , 2006
2. Lawson T.B Fundamentals of Aquacultural Engineering, CBS Publishers, ISBN: 8123905327, 978-8123905327 , 1997
3. Wheaton F.W. Aquacultural Engineering, Medtec Publishers, ISBN: 13-9789385998782, 10- 9385998781. , 2017
4. Lekang Odd -Ivar Aquaculture Engineering, Wiley-Blackwell, 2013

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0712 COMPUTER APPLICATIONS IN CIVIL ENGINEERING - II

Course Outcomes: On completion of the course, a student will be able to:

1. Identify the available open source software tools used for specific problems in Civil Engineering.
2. Familiarize with a structural analysis and design software
3. Undertake structural analysis and design of multi storeyed buildings.
4. Familiarize with a construction management software and develop capabilities to plan and schedule construction activities with the help of such software.
5. Interpret the results available through computer output with the theory learnt in classrooms.

Using STAAD/ETAB or Equivalent package

1) Analysis and Design of truss system
2) Analysis and Design of steel frames
3) Analysis and Design of RC frame
4) Analysis and Design of combined steel truss and RC frame (Auditorium)
5) Design of footings

Using Primavera or MS project or equivalent package

Identification of activities and preparation of bar chart and
Network diagram of following projects

1) Construction of multi-storey building
2) Installation of new water supply scheme
3) Construction of high way

References: *Reference Manual of software packages.*

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

19-201-0713 STRUCTURAL ENGINEERING AND BUILDING TECHNOLOGY LAB

Course Outcomes: On completion of the course, a student will be able to:

1. Visualize the failure patterns of balanced, under-reinforced and over-reinforced beams the information of which could be employed in building construction.
2. Practice certain non-destructive methods of testing strength of concrete structures.
3. Conceive the idea of comfort level in a room due to various factors, like temperature, humidity, radiation and ventilation.
4. Visualize at least three modes of oscillation of building frames subjected to base movement and hence study their dynamic characteristics.

LIST OF EXPERIMENTS

1) Testing of under reinforced and over reinforced flexural reinforced concrete beams.
2) Non Destructive testing of Concrete – rebound hammer test.
3) Non Destructive testing of Concrete – ultrasonic pulse velocity test.
4) Dynamics of scaled building frame model subjected to harmonic base motion.
5) Dynamics of single storied building frame model having planar asymmetry subjected to harmonic base motion.
6) Determination of relative humidity and Effective temperature in a room.
7) Determination of ventilation in a room due to stack effect & wind effects
8) Determination of Intensity of Light
9) Determination of solar radiation
10) Measurement of sound levels in a hall.

Note : 50% marks is earmarked for Continuous Evaluation, and 50% marks for Semester End Examination. The Semester End Examination to be conducted by a minimum of two examiners – one, not below the rank of an Associate Professor. A candidate shall secure a minimum of 50% marks in the aggregate and 40% minimum in the Semester End Examination for a pass.

19-201-0714 ENTREPRENEURSHIP DEVELOPMENT

Course Outcomes: On completion of the course, a student will be able to:

1. Develop awareness about the importance of entrepreneurship opportunities available in the society.
2. Get acquainted with the challenges faced by the entrepreneur.

Exercises:

1. To study the types of entrepreneurs and the factors affecting entrepreneurial growth.
2. To make an assessment of the major motives influencing an entrepreneur.
3. To make an overview of the various stress management techniques.
4. How to identify and select a good business opportunity?
5. Preparation of a techno economic feasibility report for a given project.
6. Preparation of a preliminary project report for a given project.
7. To identify the various sources of finance and management of working capital.
8. Carry out the costing and break even analysis of a proposed project.
9. Preparation of a PERT / CPM chart for the various activities involved in a project.
10. To make a study of the various causes and consequences of sickness in small business and identify corrective measures.

References:

1. Rajeev, R. *Entrepreneurship*. Second edition. Oxford Latest Edition. , 2011
2. Gordon, E.and Natarajan, K. *Entrepreneurship Development*. Fourth edition, Himalaya. , 2007
3. Coulter. . *Entrepreneurship in Action*. Second edition, PHI. , 2008
4. Jain, P. C. .*Handbook for New Entrepreneur*. Oxford University Press. ,2003
5. Khanka, S. S. *Entrepreneurial Development*. Fifth edition, S. Chand and Co. , 2013

19-201-0715 PROJECT- PHASE I

Course Outcomes: On completion of this course a student will be able to

1. Conduct literature survey in a relevant area of one's course of study and finally identify and concentrate on a particular problem.
2. Formulate a project proposal through extensive study of literature and / ordiscussion with learned resource persons in industry and around.
3. Generate a proper execution plan of the project work to be carried out in Phase II through thorough deliberations and improve presentation skills.

Each batch comprising of around 5 students shall identify a project related to the curriculum of study. At the end of the semester, each student shall submit a project synopsis comprising of the application and feasibility of the project.

Guidelines for evaluation:

1. Attendance and Regularity		10
2. Theoretical knowledge and individual involvement		15
3. Quality and contents of project synopsis		15
4. Presentation		10
	Total	50 Marks

***Note**: Evaluation will be done by the respective project guide and project coordinator.*

19-201-0716 INDUSTRIAL INTERNSHIP

Course Outcomes: On completion of the course, a student will be able to:

1. Connect the theory learnt from the syllabus to the work in the training undergone.
2. Appreciate the importance of field experience in addition to classroom learning.
3. Collaborate with experienced engineers in the industry and work with them.

Students have to visit at least one industry relevant to Civil Engineering as part of industrial training and spend minimum duration of 2 weeks after the completion of 4th semester and before the commencement of 7th semester. A report of the same should be submitted at the beginning of the 7th semester and evaluation shall be conducted based on the report, presentation and viva.

SEMESTER VIII

19-201-0801 EARTHQUAKE ENGINEERING

Course Outcomes: On completion of this course a student will be able to

1. Develop an insight into the causes for the occurrence of earth quakes, characteristics of earth quake ground motion and how the strong motion data help generating design earth quake motions.
2. Understand the importance of the structural configuration of buildings to make it earth quake resistant and thereby mitigate the damages caused.
3. Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response.
4. Analyze the response of a structure due to earth quake ground motion.
5. Practice guidelines for an efficient seismic resistant design and construction.

MODULE I

Earthquake Ground Motion: Causes of earthquake- Seismic waves-Intensity and Magnitude of earthquake- seismic zones in India-**strong motion**-source effect-path effect-site effect-use of strong motion data; strong motion characteristics-**Response spectrum**-types of response spectra-design spectrum-Damage potential of Earthquakes- Seismic Test Methods.

MODULE II

Seismic Damage in RC buildings: Causes – Damage to Structural and nonstructural Elements - **Seismic Resistant Building Architecture**: Seismic effects on structures-Inertia forces-deformations-horizontal and vertical shaking-Importance of architectural features-effects of irregularity-Lateral load resisting systems-**Building Characteristics**-Mode shapes and fundamental period, Building frequency and ground period, Damping, Ductility, Seismic weight, Hyperstaticity, Non structural elements, foundation soil/Liquefaction, foundations-Quality of construction and materials.

MODULE III

Structural Dynamics: Dynamic analysis, Types of dynamic loading, Structural vibrations, Free vibrations and forced vibrations- Response of the system towards loading, Degrees of freedom, SDOF and MDOF systems-Vibration analysis of SDOF systems- Free vibration of un-damped SDOF system- free vibration of viscously damped SDOF systems - Forced vibration of SDOF systems-harmonic excitation-base motion-principles of vibration isolation-determination of damping coefficient, Vibration measuring instruments, Response of a system to support motion.

MODULE IV

Lateral Loads: IS 1893 based determination of design lateral forces in multi-storey RC buildings. **Soil structure interaction effects**: direct approach-sub structure approach (description only).

Ductility requirements of RC buildings: displacement ductility-rotational ductility-considerations based on IS13920 in flexural members, columns, joints of frames (description only).

References:

1. Agarwal, P. and Shrikhande, M.*Earthquake Resistant Design of Structures*. Prentice Hall of India Pvt Ltd, New Delhi, 2011.
2. Duggal. *Earthquake Resistant Design of Structures*. Oxford University Press, 2013.
3. Park, R. and Paulay, T. *Reinforced Concrete Structures*. John Wiley. 1975.
4. Chopra, A. K. *Dynamics of Structures*. Pearson Education Pvt. Ltd, 2007.
5. Paz, M. *Structural Dynamics: Theory and Computation*. CBS Publishers & Distributors, New Delhi, 2006.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0802 DESIGN OF SPECIAL STRUCTURES

Course Outcomes: On completion of this course a student will be able to

1. Understand the basics of design of special RC structures, piles and pile cap, flat slabs and folded plates and appropriate use of them in building construction.
2. Make use of shell geometry and associated theory and design certain spatial structures.
3. Outline the design of power plant and power transmission structures.
4. Identify the necessity of pile foundation depending on soil profile and design pile and pile cap
5. Design concrete members reinforced with non corrosive FRP bars in place of steel as conventional bars.

MODULE I
Design of Special RC Elements
Design of RC walls - Ordinary walls and shear walls - Design of Corbels - Deep beams and grid floors.

MODULE II
Design of Flat Slabs and Folded Plates
Design of flat slabs. Design of folded plates- Folded Plate structures - structural behaviour - Types - Design by ACI - ASCE Task Committee method

Design of Shell Structures
Membrane theory of shells-Classification of shells - Types of shells - Structural action-Membrane theory - Shells of revolution and shells of translation - Examples - Limitations of membrane theory.

MODULE III
Design of Power Plant Structures

Bunkers and Silos - Chimneys and Cooling Towers - High Pressure boilers and piping design – Nuclear containment structures.

MODULE IV

Structural design with FRP bars

Fibre Reinforced Polymer (FRP) bars-Introduction- Materials and manufacturing-Properties of FRP reinforcing bars-Design basis for FRP reinforced concrete, under reinforced section, over reinforced section, Design of FRP reinforced flexural members, Design procedure for Serviceability, design for shear and FRP reinforcement detailing.

Timber structures: Classification - allowable stresses - design of beams for flexure, shear and bearing - deflection criteria - design of solid and built-up columns-flitched beams – formwork design.

References:

1. Purushothaman, P.(1986). *Reinforced Concrete Structure Structural Elements: Behavior Analysis and Design*.TataMcGraw Hill.
2. Krishnaraju, N. *Advanced Reinforced Concrete Design*. CBS Publishers and Distributors.1986
3. Ramasamy, G. S. *Design and Construction of Concrete Shells Roofs*. CBS Publishers.1986
4. Subramanian, N. *Principles of Space Structures*. Wheeler Publishing Co.1999
5. Santhakumar, A. R. and Murthy, S. S. *Transmission Line Structures*. Tata McGraw Hill. 1992
6. Thomlinson, M.J. and Boorman, R. *Foundation design and construction*. 4th edition, ELBS Longman.1995
7. Varghese , P.C., *Design of Reinforced Concrete Foundation* PHI Learning Pvt Ltd.2010

Note: *Relevant IS codes are permitted during the Examination.*

Type of Questions for Semester End Examination

Question nos. I and II [with sub sections (a), (b), …] (18 marks each with option to answer either I or II) from Module I.

Question nos. III and IV [with sub sections (a), (b), …] (18 marks each with option to answer either III or IV) from Module II.

Question nos. V and VI [with sub sections (a), (b), …] (18 marks each with option to answer either V or VI) from Module III.

Question nos. VII and VIII [with sub sections (a), (b),] (18 marks each with option to answer either VII or VIII) from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0803 SOLID WASTE MANAGEMENT

Course Outcomes: On completion of this course a student will be able to

1. Identify the sources and composition of solid waste and integrated waste management approach which is beneficial for society.
2. Demonstrate an ability to choose sustainable technologies for storage, transport and processing of solid wastes.
3. Identify the types and design of cost effective technologies for landfill disposal and its operation
4. Develop a student's skill in hazardous waste management.

MODULE I

Solid wastes: Types and sources – need for solid waste management – Elements of integrated waste management – Salient features of Indian legislations on management and handling of municipal solid wastes, Solid Waste generation rates and variation: Composition, physical, chemical and biological properties of solid wastes –waste sampling and characterization plan – Source reduction of wastes – Recycling and reuse – waste exchange

MODULE II

Storage, Collection and Transport of wastes: Handling and segregation of wastes at source – storage and collection of municipal solid wastes – analysis of collection systems – need for transfer and transport – transfer stations - Optimizing waste allocation.

Waste Processing Technologies : Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of composting – thermal conversion technologies and energy recovery – incineration.

MODULE III

Municipal Solid Waste Disposal : Waste disposal options – Disposal in landfills – Landfill Classification, types and methods – site selection – design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – closure of landfills- landfill remediation

MODULE IV

Household hazardous waste management: Definition and identification of hazardous wastes, sources and characteristics-hazardous wastes in municipal waste-minimization of hazardous waste- compatibility, handling and storage of hazardous waste-collection and transport, Regulatory requirement for identification, characterization and disposal of hazardous, nonhazardous and domestic wastes.

References:

1. Tchobanoglous, G., Theisen, H. and Vigil, S. A. *Integrated Solid Waste Management*. McGraw-Hill International edition, New York., 1993
2. CPHEEO. *Manual on Municipal solid waste management*. Central public Health and Environmental Engineering Organization, Government of India, New Delhi., 2000
3. Michael, D. LaGrega, Buckingham, P. L.and Jeffrey, C.E. *Environmental resources Management, Hazardous waste Management*. McGraw-Hill International edition, New York., 2011
4. Peavy, H.S., Rowe, D. R. and Tchobanoglous, G. *Environmental Engineering*. McGraw Hill, New York., 1985
5. Vesilind, P. A., Worrell, W. and Reinhart, D.*Solid Waste Engineering*. Brooks/Cole Thomson Learning Inc., 2002
6. Wentz, C. A. *Hazardous waste Management*. McGraw-Hill Publication, 1989.

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)

Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.

The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0804 CONSTRUCTION SAFETY AND FIRE ENGINEERING

Course Outcomes: On completion of this course, a student will be able to:

1. Recognize the importance of managing safety and health in construction and key legislation.
2. Report workplace accidents.
3. Understand correct working procedures and employee welfare provisions.

4. Identify types of hazards and ways to prevent accidents in different types of construction.

5. Understand the chemistry of fire and fire prevention methods.
6. Understand various standards to protect building and human life from fire hazards.

MODULE I

Introduction to Construction Industry and Safety: Basic concepts – accident – injury –lost time accidents, reportable accident, frequency rate, severity rate, incidence rate.
Technological, Organization and Behavioral Aspects of safety in construction, Human factors that are Impediments to safety in construction, Roles of different groups in ensuring safety, health, welfare and social security, Steps to be taken in construction sites in case of accidents, Introduction to ergonomics and its relevance to construction.

MODULE II

Safety in various construction operations such as soil excavation, rock blasting, dewatering, piling, demolition, working at heights-ladders and scaffolds, working in confined spaces, Safety in electrical works at construction site.
Safety in storage, stacking and handling of construction materials-cement, lime, aggregates, bricks and blocks, steel, glass, paint and varnish, flammable and hazardous materials used at sites.
Safety in the operation of construction equipments- excavators, trucks, tower cranes, mobile cranes, lifting tackles, chain and pulley, Personal protective equipment's for construction.

MODULE III

Classification of fire. Effect of high temperature on the properties of concrete, steel, masonry, wood, Fire damage to concrete, steel, masonry and timber, Repair techniques to the fire damaged reinforced concrete columns, beams, slabs and to the steel structural members.

MODULE IV

Design principles of fire resistant walls.
Classification of buildings based on occupancy, types of construction as per National Building code of India; Fire zones; General Requirements of fire protection for all individual occupancies. Life safety aspects of building fires – Exit Requirements as per NBC of India. Requirements other than general requirements for buildings of different occupancy classification.

References:

1. Vaid, K. N. *Construction Safety Management*. National Institute of Construction Management and Research, 1988.
2. Smith and Harmathy. *Design of Buildings for Fire Safety*. ASTM International, 1976.
3. National Building Code of India, Part –IV and VII
4. Linger, L. *Modern Methods of Material Handling*.
5. Merchant, E. W. *A Complete Guide to Fire and Buildings*.
6. Jain, V. K.*Fire Safety in Buildings*. New Age International (p) Ltd., New Delhi, 2010.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0805 REMOTE SENSING AND GIS

Course Outcomes: On completion of the course, a student will be able to

1. Understand the concepts and foundations of remote sensing.
2. Learn visual image interpretation.
3. Understand spatial data modeling and analytical modeling
4. Obtain output from new maps.

MODULE I

Remote sensing: Definition-Components of Remote sensing - Energy, Sensor, Interacting Body - Active and passive Remote Sensing – Platforms - Aerial and Space Platforms-Balloons, Helicopters, Aircraft and Satellites - Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) - EMR spectrum-visible, Infra Red (IR), near IR, Middle IR, Thermal IR and Microwave - Black Body Radiation – Planck's law - Stefan-Boltzman law.

EMR Interaction with Atmosphere and Earth Materials : Atmospheric characteristics-Scattering of EMR - Raleigh, Mie, Non–selective and Raman Scattering - EMR Interaction with Water vapour and ozone – Atmospheric Windows – Significance of Atmospheric windows - EMR interaction with Earth Surface Materials, Radiance, Irradiance, Incident, Reflected, Absorbed and transmitted energy -Reflectance – Specular and diffuse reflection surfaces - Spectral Signature – Spectral Signature curves EMR interaction with water, soil and earth surface.

MODULE II

Optical and Microwave Remote Sensing : Satellites – Classification based on orbits - Sun Synchronous and Geo Synchronous - based on purpose - Earth Resources Satellites, communication satellites, weather satellites, spy satellites – Satellite sensors - Resolution-Spectral, Spatial Radiometric and Temporal Resolution, description of Multispectral Scanning, Along and Across Track Scanners - Description of sensors in Landsat , SPOT, IRS series- Current Satellites – Radar- Speckle-Back Scattering – Side Looking Airborne Radar - Synthetic Aperture Radar – Radiometer

- Geometrical characteristics.

MODULE III

Geographic Information system (GIS) : GIS – Components of GIS – Hardware, Software and Organizational Context - Data-Spatial and Non – Spatial, Maps - Types of Maps, Projection - Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structure, Analysis using Raster and Vector data-retrieval, Reclassification, Overlaying , Buffering – Data Output – Printers and Plotters.

MODULE IV

Visual Interpretation of Satellite Images – Elements of Interpretation - Interpretation Keys Characteristics of Digital Satellite Images, Image enhancement, Filtering , Classification – Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS, Urban Applications – Water resources – Urban Analysis - Watershed Management - Resources Information systems.

References:

1. Lillesand, T. M., Kiefer, R. W.and Chipman, J. W. *Remote Sensing and Image Interpretation*. John Wiley & Sons, 2015.
2. Sabins, F.F. *Remote Sensing Principles and Interpretation*. W.H. Freeman & Co, 2007.
3. Burrough and McDonnel. *Principles of GIS*. Oxford University Press, 2016.
4. Heywood, J., Cornelius, S. and Carver, S. *An Introduction to GIS*. Pearson Education, 2011.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0806 RETROFITTING AND REHABILITATION OF STRUCTURES

Course Outcomes:On completion of the course, a student will be able to:

1. Assess strength and materials deficiency in concrete structures.
2. Assimilate knowledge on the materials and techniques used in the repair of structures.
3. Suggest methods and techniques used in repairing / strengthening existing masonry structures.
4. Suggest methods and techniques used in repairing / strengthening existing concrete structures.
5. Apply cost effective retrofitting strategies for repairs of floors and steel structures.

MODULE I

Concept of Repairing – retrofitting – strengthening – rehabilitation – restoration – remoulding Repair materials/ methods: – Repair methodology, issues related to material Technology - Desired properties of repair materials – materials for repair – new repair systems / products. Distresses in concrete structures – Deterioration of structures – causes and prevention – crack repair techniques – Repair techniques/ materials for structures – repair of structural components.

MODULE II

Retrofitting of Masonry buildings: Failure mode of masonry buildings – out-of-plane failure – in-plane failure – diaphragm failure – failure of connection – methods of retrofitting – cement or epoxy injection– using wire mesh and cement mortar – re construction of bulged portion of masonry wall
– grouting with cement – pointing with mortar – shotcreting – using FRP fabric – using RC and steel frames – adding reinforcements to masonry – stitching of wall corners – use of tie rods – Prestressing of masonry – external binding or jacketing – Splint and bandage technique – Inserting new walls – exterior supplemental elements – strengthening of parapets.

MODULE III

Retrofitting of RC structure: Global retrofitting methods – adding new shear walls – adding steel bracing – adding infill walls – non-conventional methods – seismic base isolation – Supplemental damping devices; Member or local retrofit methods – jacketing/confinements –jacketing of columns using steel sections – reinforced concrete jacketing – FRP jacketing – beam jacketing – beam column joint jacketing – slab column connection – foundation – cost comparison of different methods.

MODULE IV

Repair of Concrete Floors: Surface preparation – thin bonded toppings – reinstating joint sealants – Crack repair – crack cleaning and resin injection – crack cutting and mortar filling – application of cement/sand screed – use of toppings Retrofitting of Steel Structure: Rain water protection –

drainage in structural members – preparation of surface by sand blasting – protective coatings – Cathodic protection – Sacrificial metal – adding additional plates strengthening the joints – concrete jacketing .

References:
1. Allen RTL, Edwards SC and Shaw JDN, Repair of concrete structures, Tylor&Francis
2. Bhatttachargee, J. Concrete Structures, Repair, Rehabilitation and Retrofitting. CBS Publishers, 2017.
3. Varghese. P. C, Maintenance, Repair & Rehabilitation & Minor works of Buildings, Prentice Hall of India Pvt Ltd, New Delhi, 2014.
4.Agarwal, P. and Shrikhande, M. *Earthquake Resistant Design of Structures*. Prentice Hall of India Pvt Ltd, New Delhi, 2011.
5. Santhakumar, A. R. *Concrete Technology*. Oxford University Press, New Delhi, 2006.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0807 CONSTRUCTION ENGINEERING AND MATERIALS MANAGEMENT

Course Outcomes: On completion of this course a student will be able to

1. Understand various type of temporary structures in construction.
2. Identify the quality standards in highway and general construction.
3. Demonstrate their abilities in key areas such as Purchase Management, Inventory Control, Logistics, Warehousing and Human Resource Management.
4. Demonstrate their abilities to organize Stores and warehouses, Monitor, indentify and control inventory.

MODULE I

Formwork: Requirements of a good formwork – Loads on form work – guiding points in the design of form work – column form work –formwork for beams and floors – form work for deck slabs in bridges.
Scaffolding/ Falsework, Shoring and Underpinning: Scaffolding – parts of scaffolding – types of scaffolding – points to be kept in view of scaffolding – shoring – types of shoring – underpinning
– methods of underpinning.
Construction dewatering- Coffer dams- Temporary sheeting and bracings.

MODULE II

Quality control: Introduction to IRC and MOST standards – General system Requirements, Field Laboratory, Material specifications, Introduction to ISO 9000/IS 14000 Series – Relevance to Construction, Overview, Interpretation of important clauses, Elements / System Requirements of ISO 9001 – Quality Policy, Quality System, Contract Review Process, Design control Control of documents, Purchasing Standards, Product Identification and Traceability, Process Control

Standards to prevent nonconformities, Inspection and Testing Standards, Standards for personnel training. Building the ISO System – Quality Manual, Procedure Manual, Quality Documentation. Implementation – Quality System Management, Auditing, follow up audits.

MODULE III

Materials Management Introduction: Scope, Objectives and functions, phases in materials management, requisition, procurement and distribution, Procurement: Purchase procedure, tender, earnest money, security deposit, purchase order, Vendor rating. Receipt: Invoice, cash memo, inspection. Storage: Methods of storage, bin, rack, piling and special arrangements, stock verification Issue: issue vouchers, FIFO & LIFO systems, imprest stores, consumable stores, custody stores.

MODULEIV

Materials Management and Inventory Control:
Selective control techniques of inventory- Inventory, Inventory control, Inventory classification & Management, Inventory control, its objectives and how to achieve them, Functions of inventories, Economics order Quantity, Inventory models- Simple EOQ model EOQ model with stock out, Inventory model under risk ABC analysis.

References:

1. Peurifoy, R. L., Ledbetter, W. B. and Schexnayder, C. J. *Construction planning equipment and method*. McGraw Hill Publishing company, 1995.
2. Singh, G. *Building construction Engineering*. Standard Book House, 2017.
3. Gopalakrishnan, P.and Sunderesan, M. *Materials Management- an Integrated Approach*. PHI Learning Pvt. Ltd, 2004.
4. Starr and Miller. *Inventory Control- theory and practice*. PHI Learning Pvt. Ltd, 1962.
5. MOST Standards Hand Book , RDSO Standards , CPWD Standards.
6. O'Brein. *Construction Inspection Hand Book*. Springer US, 1989.
7. Deb, A. *Materials Management*. Academic Publishers, 1969.
8. Khanna, O.P. *Industrial Engineering and Management*. Dhanpat Rai Publications, 2018.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0808 GEOENVIRONMENTAL ENGINEERING

Course Outcomes:

On completion of this course, the student will be able to

1. *Classify the different types of waste and predict its impact on the environment*
2. *Distinguish the various contaminant transport mechanisms*
3. *Describe and apply the insitu/exsitu treatment techniques based on the field conditions*
4. *Select a suitable clay liner based on norms and site requirements*
5. *Understand risk assessment of contaminated sites.*

Module I

Fundamentals of Geoenvironmental Engineering: multiphase behavior of soil – role of soil in geoenvironmental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – case histories on geoenvironmental problems.
Wastes : sources ,generation and classification of wastes- physical, chemical and geotechnical characterization of waste - characteristics and classification of hazardous wastes- generation rates. Ground water contamination- sources of ground water contamination- potential problems in soils due to contaminants.

Module II

Soil-Water-Contaminant Interaction: Soil minerology characterization and its significance in determining soil behavior – soil-water interaction and concepts of double layer – forces of interaction between soil particles.
Concepts of unsaturated soils – importance of unsaturated soil in geoenvironmental problems – measurement of soil suction – water retention curves – water flow in saturated and unsaturated zone.
Soil-water-contaminant interactions and its implications – Factors effecting retention and transport of contaminants.

Module III

Waste Containment System: Evolution of waste containment facilities and disposal practices – Site selection based on environmental impact assessment – different role of soil in waste containment – different components of waste containment system and its stability issues – property evaluation for checking soil suitability for waste containment – design of waste containment facilities.

Module IV

Contaminant Site Remediation: Site characterization – risk assessment of contaminated site – remediation methods for soil and groundwater – selection and planning of remediation methods – some examples of in-situ remediation.

References:

1. Daniel D.E,"Geotechnical Practice for Waste Disposal" ,Chapman and Hall,1993
2. Koerner, R.M ,"Designing with Geosynthetics", Prentice Hall,2005
3. Reddi L.N and Inyang H. I,"GeoenvironmentalEngineering : Principles and Applications", Marcel Dekker Inc Publication,2000
4. Yong R. N,"Geoenvironmental Engineering: Contaminated soils, Pollutant Fate, Mitigation", Lewis Publications,2000
5. Sarsby R,"Environmental Geotechnology", Chapman and Hall,2000
6. BachiA ,"Design Construction and Monitoring of landfills", John Wiley and Sons.
7. Rao G. Vand Sasidhar R. S, "Solid Waste Management and Engineered Landfills".SaimasterGeoenvironmental Services Pvt. Ltd. Publications,2009
8. Datta M,"Waste disposal in engineered landfills', Narosha publications,1997
9. Gulathi S. and Datta M,"Geotechnical Engineering" ,Tata MC Graw-Hill,2005
10. GopalRanjan, Rao, A.S.R,"Basic and Applied Soil Mechanics" , New Age International Pvt. Ltd.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0809 DESIGN OF HYDRAULIC STRUCTURES

Course Outcomes: On completion of the course, the student will be able to:

1. Analyse and design gravity dams
2. Analyse and design earth and rockfill dams
3. Analyse and design Arch dams
4. Design spillways and energy dissipation structures
5. Design of penstocks and surge tanks

MODULE I

Introduction - Classification of dams, Gravity dams, Earth dams, Arch dam, Buttress dam, Steel dams, Timber dams, selection of site for dam, selection of type of dam, investigations of dam sites, Engineering surveys, Geological investigations, Types of hydropower plants, site selection for power plant, General arrangement of a hydropower project.

Principles of Design of Hydraulic Structures - Hydraulic structures on permeable foundations, Theories of subsurface floor, Khosla's method of independent variables, Exit gradient, Location of Hydraulic jump, water surface profiles, scour due to subsurface flow, Design Principles, Energy dissipation principles.

MODULE II

Gravity Dams - Types of storage head works, Forces acting on gravity dams, Analysis of gravity dams, Profile of a gravity dam, Design of gravity dam, joints in gravity dam, Galleries in gravity dam, Adits and shafts, Construction of gravity dam, Foundation Grouting, Instrumentation of gravity dams.

MODULE III

Arch Dams – Types of arch dams, Methods of design of arch dams

Earth dams - Types of earth dams, Causes of failure of earth dams, Seepage analysis, phreatic line, flow net construction, criteria for safe design of gravity dams, typical cross sections of earth dams, Stability analysis, Seepage control, design of filters.

MODULE IV

Spillways and energy dissipation systems - Essential requirements of spillways, Required spillway capacity, component parts of spillway, Types of spillways, Design of Ogee spillway, Design of shaft spillway, Design of siphon spillway, Design of stilling basins. Hydropower structures - Storage power plant, Runoff River plant, Pumped storage plant, Water conveyance systems, Tunnels and Penstocks, Gates, Surge tanks, Power house layout.

References:

1. Golze, A. R., Handbook of Dam Engineering, Von Rostrand Reinhold Co., 1977
2. Sharma, H.D., Concrete Dams, CBIP Publication, 1998.
3. Siddiqui, I H, Dams and Reservoirs: Planning, Engineering, Oxford University Press, USA, 2009.
4. Novak, P., Moffat, A. I. B., Nalluri, C and Narayan, R., Hydraulic Structures, Taylor & Francis, 2006.
5. Modi P.M., Irrigation Water Resources and Hydropower Engineering, Standard Publishing Company, New Delhi, 2000.
6. Arora K.L. Irrigation Water Resources Engineering, Standard Book Publishing Co., Delhi, 1996.

Type of Questions for Semester End Examination (SEE)

PART - A (8 x 3 = 24 marks)

Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.

PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0810 BUILDING SERVICES ENGINEERING

Course Outcomes: On completion of the course, the student will be able to:

1. Calculation of energy costs per standard units, the annual energy cost and the economic thickness of the thermal insulation in Buildings
2. Calculation of energy requirement for heating, ventilation, air conditioning, and determination of air flow rates, air changes, size of air ducts and heater-cooler loads
3. To assess the rate of moisture diffusion to building structure and its damage potential
4. Demonstrate an ability to design various services like hot and cold water supply systems, drainage systems for soil and stormwater
5. Assess the natural and artificial illumination requirements to minimize total energy consumption and environmental noise impact and its control

MODULE I

Built environment: comfort equation – comfort measurement – external environment – environmental measurements – temperature – dry temperature – comfort criteria.
Energy economics: energy audits – unity brackets – calorific value of fuel – energy cost – fuel cost – economic thickness and thermal insulation – accounting energy economic system – low energy building.
Heat loss calculation: thermal resistance of materials – thermal transmittance – heat loss from building – thermal transmittance measurements.

MODULE II

Ventilation and air conditioning: requirements – natural and mechanical system – removal of heat gains – psychometric cycles – air conditioning systems – vapor compression refrigeration – absorption refrigeration cycle – ventilation rate measurements – ventilation duct works – chlorofluorocarbons – sick building syndrome – air temperature profile.
Hot and cold water supply: water treatment – service lines – pipe sizing – allocation of sanitary appliances – materials – solar heating.
Soil and waste system: fluid flow in waste pipes – pipework design – discharge unit per pipe sizing – materials – testing – maintenance.

MODULE III

Surface water drainage: flow load – roof drainage – disposal of surface water.
Below ground drainage: design principle – access provisions – external load on buried pipe lines – materials – sewage lifting pump.
Condensation in buildings: sources – condensation and mould growth – vapour diffusion – temperature gradient – dew point temperature – installation.
Gas piping: sizing – flue system – ignition and safety controls.

MODULE IV

Lighting: natural and artificial illumination – maintenance – utilization factor – glare and reflection – lumen design method – air handling luminaries – colour temperature – lamp types – control.
Room acoustics: acoustic principles – sound power and pressure level – absorption of sound – reverberation time – plant sound power level – transmission of sound – outdoor sound pressure level – sound pressure level in the intermediate space and target room – noise rating.

References

1. Chadderton D.V.Building Services Engineering, Taylors & Francis Group.2013
2. Macquiston, Faye C.Heating, Ventilating and Air Conditioning Analysis and Design, John Wiley.2005
3. Cavanaugh W.J.Architectural Acoustics: *Principles and Practice*, John Wiley.2009
4. Hand Book on Water Supply and Drainage W*ith Special Emphasis on Plumping*, Bureau of Indian Standards, SP 35 : 1987
5. V. K Jain .Hand Book on Design and Installation of Services in Building Complexes and High Rise Buildings, Khanna Publications, Delhi.2015
6. Panchdhari, A.C. Water Supply and Sanitary Installations, *Design, Construction and Maintenance*, New Age International Publishers, New Delhi.2000
7. S. K Garg . Water Supply Engineering, Khanna Publications, Delhi.2017

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0811 ENVIRONMENTAL IMPACT ASSESSMENT.

Course Outcomes: On completion of the course, the student will be able to:

1. Identify the environmental attributes to be considered for the EIA study.
2. Formulate objectives of the EIA studies.
3. Identify the methodology to prepare rapid EIA.
4. Prepare EIA reports and environmental management plans.

MODULE I

Introduction: Concepts of environmental impact analysis, key features of Nationalenvironmental policy act, Environmental protection acts, EIA methodologies – Screeningand scoping - matrix and network methodologies for impact identification, description ofthe affected environment – environmental indices, Rapid EIA and Comprehensive EIA.

MODULE II

Prediction and Assessment of Impact on Air and Water Environment: Basicinformation on air quality, sources and effects of air pollutants, key legislations andregulations, impact prediction approaches, assessment of significance of impacts,identification and incorporation of mitigation measuresAssessment of impact on water quality (surface and ground water), Vegetation andwildlife.

MODULE III

Prediction and Assessment of Impact on Noise & Social Environment: Basicinformation on noise, key legislation and guidelines, impact prediction methods,assessment of significance of impacts, identification and incorporation of mitigationmeasures, Environmental Risk Analysis, Definition of Risk, Consequence Analysis.

MODULE IV

Decision Methods for Evaluation of Alternative: Development of decision matrix.

Public participation in environmental decision making, techniques for conflictmanagement and dispute resolution, verbal communication in EIA studies.

References:

1. Canter, L.W. *Environmental impact assessment*. McGraw-Hill.1997
2. Marriott, B. B.*Environmental Impact Assessment: A Practical Guide*. McGraw-Hill Professional.1997
3. Peter Morris, P.and Therivel, .*Methods of Environmental Impact Assessment*. Routledge.2001
4. Denver Tolliver, D.*Highway Impact Assessment*. Greenwood Publishing Group.1993
5. Jain, R. K., Urban, L. V., Stacey, G. S. and Balbach, H. E. *Environmental Assessment*. McGraw-Hill Professional.,2001
6. Relevant IRC and CPCB codes.
7. Anjaneyalu, Y. *Environmental Impact Assessment Methodologies*. B.S. Publications, Hyderabad.2002
8. Canter, R.L.*Environmental Impact Assessment*. McGraw Hill Inc., New Delhi.,1991
9. *Environmental Assessment Source book* , Vol.I, II & III., The World Bank, Washington, D.C.,1991
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Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
Question nos. II, III with sub sections (a), (b)-----12 marks each with option to answer either II or III from Module I.
Question nos. IV, V with sub sections (a), (b)-----12 marks each with option to answer either IV or V from Module II.
Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0812 SUSTAINABLE BUILT ENVIRONMENT

Course outcomes: On completion of this course, the student will be able to:

1. Identify and frame issues of sustainable development through the integration of theoretical knowledge from several disciplines relating to sustainability
2. Provide knowledge necessary to apply green technologies in sustainable building construction and materials; and different rating systems.
3. Gain knowledge and understanding of world water problems and sustainable water management
4. Understand the critical linkage of waste management and resource recovery in achieving sustainability
5. Identify challenges and strength of various energy conservation technologies
6. Analyze and provide solutions to use resources efficiently and effectively to solve sustainability challenges and to manage risk to minimize adverse impact to people or the environment from local, national and global perspectives

MODULE -I
Evolution of sustainable development
History of Sustainable Development, Sustainable development Goals
Global issues in sustainability- International SD issues-SD in developing countries

Dimensions of sustainability-Climate change - causes and effects-water supply and demand - energy - generation options and economic effects- sustainable cities – land use, density and transport issues- pollution and waste management -ecology and biodiversity

MODULE - II

Sustainable materials and construction

Sustainable construction techniques and selection of materials -Alternative materials for construction – Environmental impact of building materials, water efficiency -Energy in building materials and buildings, Embodied Energy.

Passive cooling/heating concepts, building form and orientation, internal and external shading devices, ventilation, evaporative and nocturnal cooling, earth–air tunnel, sky-therm system, solar chimney-based hybrid system

Green building Concept – different green building materials and products -Various rating systems for the assessment of sustainability in different countries. Green building rating systems such as LEED , GRIHA, BEE , ECBC etc.

MODULE - III

Sustainable water and waste management

Surface water hydrology: hydrological cycle- different types of freshwater resources, their usage - critical issue of water quality - water pollution problems- concept of sustainablemanagement of water resources- integrated water resources management- worlddemand for water, water conflicts and future perspectives

Waste minimization and pollution prevention strategies- Waste management hierarchy -emerging issues –municipal solid waste- management and techniques- zero waste- life cycle assessment- reuse and resource recovery - Environmental Protection Act (1986); Regulatory standards for industrial wastewaters and atmospheric emissions; Hazardous and biomedical waste management- Integrated waste management.

MODULE - IV

Sustainable energy and environment

Introduction to Energy Conservation- Need for Energy Conservation -Energy Sources, Supply & Demand-Buildings & Lighting Systems – energy auditing

Biomass technology- Liquid biofuels-Other Renewable Energy Technologies - Geothermal, wave energy, tidal energy, ocean thermal energy

Energy , environment&climate change -Regional and global environmental issues- , - depletion of ozone layer, global warming, Green House Gases Emission,Environmental and ecological audits; Environmental performance assessment- Environmental Pollution & Control Technologies.

References

1. Montoya, Michael. Green Building Fundamentals: Practical Guide to Understanding and Applying 2011
2. Fundamental Sustainable Construction Practices and the LEED® System, Second Edition. Publisher: Prentice Hall 2016
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4. S K Jain and V P Singh. 'Water Resources Systems: Planning and Management'. Elsevier, 2003
5. Christensen, T.H. (ed.) Solid Waste Technology and Management. Wiley, Chichester, West Sussex, UK.,2011
6. WC Turner and Steve Doty: Energy Management Handbook, Fairmont Press Inc.,2012

7. Energy & Environment – J.M. Fowler, (McGrawHill) 1984
8. Allan Johansson, Clean Technology, 1st edition CRC Press, 1992

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
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Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
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19-201-0813 AQUACULTURE ENGINEERING IN PRACTICE

Course outcome: On completion of this course, a student would be able to

1. Recognize and recommend the specific environment management measures and the engineering technology required for specific culture system and the species concerned.
2. Recommend specific brood stock management (engineering as well as biological) options for sustained production. (One can seek the help of an aqua - culturist for selecting the biological options).
3. Design bunds for grow out systems, Design need based recirculating aquaculture systems, integrated multitrophic aquaculture system, aquaponics, raceways, different forms of mariculture operations - cage culture, raft culture and rope culture.
4. Provide the engineering options for establishing integrated disease management and preventive health care and solar power as the energy option in aquaculture.
5. Identify and provide the most appropriate water pumping system, aeration system, solid waste removal system, soluble waste removal system and waste water management technology required for specific culture system.

MODULE I

Culture system designing - Zero water exchange culture systems, Recirculating aquaculture systems, Integrated Multitrophic Aquaculture Systems, Aquaponics and Raceways as brood stock and larval production systems and grow out production systems- designing based on production requirement, species intended to be cultured, water and soil chemistry; Adoption of solar power - for the culture operations and recent advancements in the area.

MODULE II

Water pumping systems - Different categories, pumping in continuous and discontinuous mode and selection of the appropriate type for energy efficiency and performance, problems of corrosion in saline waters and mitigation and recent advancements in the area.

MODULE III

Aeration equipments - air pumps, air compressors, air blowers, air injectors in Venturi technology, paddle wheel aerators, micro bubble aeration - Principles and practices for efficiency in aeration, design modification for cost effectiveness and efficiency, determination of oxygen demand in a system based on biomass and feed quantity and selection of appropriate aeration system and system management and recent advancements in the area.

MODULE IV

Solid waste removal system - Settling / Sedimentation, Filters - membranes, sponge, cartridges, bags; Fixed bed -slow and rapid sand filters and particle bed filters, drum filters, bead filters,

diatomaceous earth filters, centrifuges and hydro - clones; Chemical filters - Adsorption, Foam fractionation, Ion exchange and recent advancements in the area; **Soluble waste removal system** - Removal of ammonia nitrogen through biological filtration - Principle and practice - different category of biological filters - packed bed, fluidized bed, stringed bed - designing activation, kinetics, scaling up and construction based on requirements and recent advancements in the area ; **Prevention of impacts of aquaculture in the environment** through the adoption of appropriate waste water management engineering options and recent advancements in the area.

References:

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2. Anon . *Inland Aquaculture Engineering, Publisher - Food & Agricultural Organization.,2017*
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Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
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PART - B (4 x 12 = 48 marks)
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19-200-0814 CONSTITUTIONAL LAW
(common to all branches)

Course Outcomes:
On completion of this course the student will be able to:
1. Configure the preamble and fundamental rights.
2. Actuate the governance and functioning of constitutional functionaries.
3. Describe the functions of legislative bodies.
4. Decipher the judiciary system and its role in governance.

Module I: Introduction

Constitution Law – Constitutional Assembly Debates – Constitution of India – Basic Features of Indian Constitution – Preamble – Structure and Content of Indian Constitution

Module II: Fundamental Rights

Rights – Fundamental Rights – Definition of State – Fundamental Rights under Indian Constitution – Right to Equality – Untouchability – Title – Right to Life Cultural and Educational Rights of Minorities - Enforcement of Fundamental Rights

Module III: Directive Principles of State Policy & Fundamental Duties

DPSP's – Relationship between DPSP and Fundamental Rights – Conversion of DPSP into Fundamental Rights – Role of Judiciary – Judicial Activism – PIL - Fundamental Duties

Module IV: Constitutional Organs

Legislative Organs – Parliament – Lok Sabha, Rajya Sabha - State Legislatures - Executive Organs - President, Vice President, Council of Ministers - Judicial Organs – Supreme Court and High Courts – Other Constitutional Bodies – Election Commission - Comptroller and Auditor General of India, etc.

References:

1. Durga Das Basu, Introduction to the Constitution of India, 24th Edition. Prentice – Hall of India Pvt. Ltd. New Delhi, 2019.
2. D.C. Gupta, Indian Government and Politics, 8th Edition. Vikas Publishing House, 2018.
3. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes. Universal Law Publication, 2015.

Type of Questions for Semester End Examination (SEE)
PART - A (8 x 3 = 24 marks)
Question No. I (a) to (h) – Eight short answer questions of 3 marks each with two questions from each of the four modules.
PART - B (4 x 12 = 48 marks)
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Question nos. VI, VII with sub sections (a), (b)-----12 marks each with option to answer either VI or VII from Module III.
Question nos. VIII, IX with sub sections (a), (b)-----12 marks each with option to answer either VIII or IX from Module IV.
The maximum marks that can be awarded for the Semester End Examination (SEE) will be only 60, even though the questions are for 72 marks.

19-201-0815 SEMINAR

Course Outcomes: On completion of this course a student will be able to:

1. Identify and familiarize with some of the good publications and journals in their field of study.
2. Acquaint oneself with preparation of independent reports, name them based on a central theme and write abstracts, main body, conclusions and reference identifying their intended meaning and style.
3. Understand effective use of tools of presentation, generate confidence in presenting a report before an audience and improve their skills in the same.
4. Develop skills like time management, leadership quality and rapport with an audience.

Students shall individually prepare and submit a seminar report on a topic of current relevance related to the field of Civil Engineering. The reference shall include standard journals, conference proceedings, reputed magazines and text books, technical reports and URLs. Each students shall evaluated by a team of internal experts comprising of 3 teachers based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the seminar report.

19-201-0816 PROJECT- PHASE II

Course Outcomes: On completion of this course a student will be able to

1. Realize various steps involved in conducting a project work, like literature survey, methodology adopted – field study / survey / experiments / numerical work, analysis of the data to arrive at final results and conclusions, etc.
2. Initiate a habit of proper report writing with all of its major components, proper style of writing and preparation of a distinct abstract and carved out conclusions.
3. Conceive the pros and cons of working in a team and the wonderful results which could evolve through team-work.
4. Present and defend self-prepared and corrected report (with the help of project guide) of a self-created work to a peer audience.

Each batch of students shall develop the project started during the VII semester.

- A detailed project report in the prescribed formal shall be submitted at the end of the semester. All test results and relevant design and engineering documentation shall be included in the report.
- The work shall be reviewed and evaluated periodically.

The final evaluation of the project shall be done by a team of minimum 3 internal examiners including the project guide and shall include the following.

- Presentation of the work
- Oral examination
- Quality and content of the project

report

Guidelines for evaluation:

i. Regularity and progress of work	50
ii. Work knowledge and involvement	50
iii. End semester presentation and oral examination	50
iv. Project Report – Presentation style and content	50
Total	200 marks

Note: Points (i) and (ii) to be evaluated by the respective project guide and the project coordinator based on continuous evaluation. (iii)-(iv) to be evaluated by the final evaluation team comprising of 3 internal examiners including the project guide.

19-201-0817 COMPREHENSIVE VIVA - VOCE

Course Outcomes: On completion of this course a student will be able to

1. Refresh all the subjects covered during the programme.
2. Gain good knowledge of theory and practice.
3. Develop oral communication skills and positive attitude.
4. Face technical interviews with confidence.

Each student is required to appear for a viva-voce examination at the end of the complete course work. The examination panel shall comprise of two internal examiners and one external examiner appointed by the University. The examiners shall evaluate the students in terms of their conceptual grasp of the course of study and practical/analysis skills in the field. The students shall produce the seminar report and project reports duly attested by the institutional authorities, before the examiners