# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

**(Deemed to be University under section 3 of the UGC Act, 1956)**

## SCHOOL OF ENGINEERING AND TECHNOLOGY

## DEPARTMENT OF CIVIL ENGINEERING

# CURRICULUM

# AND

# SCHEME OF EXAMINATION

## (B.TECH IN CIVIL ENGINEERING)

## BATCH: 2023-27

# FOREWORD

This is to certify that this booklet contains the entire Curriculum and Scheme of Examination of B.Tech in Civil Engineering being offered at School of Engineering and Technology of this University. This has been duly vetted and finally approved by the Academic Council of the University vide **43.05** held on **05.08.2023** respectively and changes, if any deemed appropriate, shall be duly incorporated after the necessary approval by the Academic Council.

This Curriculum and Scheme of Examination of B.Tech in Civil Engineering shall be implemented w.e.f. AY 2023-27.

**Prof. (Dr.) Brijesh Kumar**
**Dean-Academics, MRIIRS**

**Date:**

# Preamble

Civil Engineering includes analyzing, planning, designing and constructing buildings, infrastructure elements like Highways, bridges and Hydraulic structures. Additionally, the discipline involves protecting society and environmental health through sewage systems and water treatment facilities. The curriculum for B.Tech Civil Engineering has been benchmarked against the Model Curriculum by AICTE with training and education aligned to roll out highly-aware, sustainability-minded generation joining the workforce globally. The mandatory credits to earn the degree are 160 with core comprising of basic sciences and Civil Engineering specific subjects covering fundamentals.

Infrastructure in the cities are upgraded and managed by using Information and Communication Technologies (ICT) to make them sustainable in the long run as smart city needs smart governance and smart businesses. Smart buildings, zero energy buildings, smart water systems, and smart electricity grids, waste management protocols, will all be part of the future connected cities, in addition to mobility solutions. Environmental protection has to be at the forefront of the infrastructure design, this can be achieved by promotion of reuse and recycling of waste. Promotion of green technologies not only in water reuse and recycling and increasing availability of clean drinking water for everyone is to be enforced but application of same in all realms of Civil Engineering is to be incorporated in producing sustainable green design.As a result, engineering education must broaden to encompass infrastructure, environmental knowledge, technology, sensors, and data science.

B.Tech Civil Engg (Hons.) with specialization in Smart Infrastructure and B.Tech Civil Engg(Hons.) with specialization in Green Technology and Sustainability Engineering within the sanctioned intake were introduced from batch 2023-27 onwards. These specializations have been adopted based on AICTE's Approval Process Handbook 21-22. It is stated that under Graduate Degree Courses in EMERGING / MULTIDISCIPLINARY AREAS shall be allowed as specialization from the same department. The minimum additional Credits for such Courses shall be in the range of 18-20 (including credit transferred from the SWAYAM platform) and the same shall be mentioned in the degree, as specialization in that particular area. So a student will earn minimum 180 credits to get Honours degree in these specializations. The additional 18-20 credits should be earned from the following courses included in the curriculum as core courses or Discipline/Multidisciplinary/Open Electives.

Besides "Engineering Graphics and Design" in 1st Semester, keeping up with the times, Computer Aided Analysis and Design courses start from 3$^{rd}$ semester onwards laying emphasis on National standards relating to technical drawings, Analysis and also to develop Parametric Structural design. Typical softwares used in Civil Engineering like STAAD, ETABS and Primavera are included as part of courses like "Structural Engineering" and "Construction Engineering & Management".

There are ample opportunities available to students to opt both for discipline electives and cross discipline electives/MOOCs floated at the University level. The Discipline elective baskets contain courses from all streams of Civil Engineering viz. Structural Engineering, Geotechnical Engineering, Environmental Engineering, Water Resources and Transportation Engineering along with advanced subjects like "Prestressed Concrete", correlated courses like "Environmental Geo-technology", "Energy Science and Engineering" , "Environmental Impact Assessment and Life Cycle Analyses", "Engineering Materials for Sustainability" and "Sustainable Construction Methods" to explore sustainable options aligned towards UN Sustainable Development Goals (SDGs). The sustainability agenda has been given impetus to inculcate a sense of social responsibility amongst the budding Civil Engineers.

The Curriculum has been further adapted and designed according to the regional requirements of Faridabad.Smart Cities focus provides one with just that, guiding one through a customized curriculum, hands on training and interactive industrial experiences outside of the classroom. Corresponding Census housing data and is oriented towards smart city development through courses like “Masonry Structures” and “Urban Transportation Planning”, “Intelligent Transportation Systems”, “Solid and Hazardous Waste Management”, “Airport Planning and Design” and “Geographic Information Systems and Science”.

Faridabad is located in Zone IV and thus is prone to earthquakes and its eastern boundary is prone to floods. This vulnerability has been taken into account and subjects like “Disaster Preparedness and Planning”, “Disaster management”, “Earthquake Engineering”, “Repairs & Rehabilitation of Structures” have been included in the curriculum.

Impetus on innovation and research starts from $3^{rd}$ semester onwards to $4^{th}$ and $5^{th}$ semester through courses “Design, Thinking and Innovation-I”, II and III. The students are required to identify societal, regional issues, conduct literature survey, devise methodologies for solutions and ultimately publish research papers and thus, add to the knowledge of existing literature in varying fields. Industrial Training has been kept before $3^{rd}$, $5^{th}$ and $7^{th}$ semesters for the students to understand Industry requirements and have hands-on experience. The project work starts from $6^{th}$ Semester as Phase I and then in $7^{th}$ Semester for implementation of recognized contemporary civil engineering problems. The research publications, project work and industrial experience greatly enhance the employability, problem solving skills with lifelong lesson enrichment after due deliberations.

“Civil Engineering Societal and Global Impact” teach the students professional relations, civic responsibilities, and ethical obligations for engineering practice. Roles of all stakeholders in the process-owners, developers, designers, consultants, architects, contractors, and suppliers are stressed upon through these courses. Courses based on Quantitative Aptitude and Personality Development in the curriculum equip the students with communication skills, and get them acquainted with the culture of institution and human values. Foreign language courses are introduced in $5^{th}$ semester and $6^{th}$ semester to increase their employability options abroad. Mandatory Courses on Constitution of India and Environmental science have been included to increase the general awareness as responsible citizens.

# INDEX

# SCHOOL OF ENGINEERING AND TECHNOLOGY

## DEPARTMENT OF CIVIL ENGINEERING

### VISION AND MISSION OF THE DEPARTMENT

**VISION**

To produce highly competent Civil Engineers of International standards for catering to local, national and global needs and to provide state-of-the-art consultancy, research and development in various fields of Civil Engineering.

**MISSION**

**$M_1$** To provide a rigorous hands-on engineering education integrated in a student-centered environment to equip them with life-long learning skills necessary for professional practice.

**$M_2$** To prepare our students to be the technical, business and global leaders of tomorrow by inculcating team work and communication skills.

**$M_3$** To promote research, development and consultancy through constant interaction with industry and research organizations.

**$M_4$** To inculcate ethical values and professionalism.

**ABOUT THE DEPARTMENT**

The Civil Engineering department was established in the year 2009. Initially the department offered only UG program along with a diploma integrated program in Civil Engineering. The PG was started from 2012 onwards with specialization in Structural Engineering. The department added two more PG programs of Construction Management and Transportation Engineering in 2015 and 2016 respectively. The department boasts of an alumni base of over 1000+ students well placed in various companies of national and international repute.

Presently department offers following programs:

- B.Tech(Civil Engineering)
- B.Tech Civil Engg (Hons.) with specialization in Smart Infrastructure.
- B.Tech Civil Engg(Hons.) with specialization in Green Technology and Sustainability Engineering
- M.Tech (Civil Engineering with specialization in Structural Engineering/Construction Management/Transportation Engineering), 2 year
- M.Tech (Civil Engineering with specialization in Structural Engineering/Construction Management/Transportation Engineering), 3 year
- PhD (Civil Engineering)

The offered programs follow the CBCS and the model curriculum floated by AICTE. Further, the course curriculums have been specially tailored to fulfill the growing global outlook and focuses on upcoming technologies in the field of Civil Engineering, to cater to the needs of the industry and R&D organizations.

A blend of highly qualified and experienced faculty members from length and breadth of country, having M.Tech/Ph.D. degree from IIT, NIT, DTU, JMI and other Institutes of National reputes. Faculty members of Civil Engineering Department have 100+ papers published in various national & international journals of repute.

The Department has fully equipped Labs with state-of-the-art equipment. Structure Lab, Soil Mechanics Lab, Transportation Engineering lab, Concrete Technology lab, Survey Lab, CADD & STADD PRO lab, Fluid Mechanics Lab, Environmental Engineering Lab, Engineering Geology Lab. A departmental library, IT facilities and adequate research infrastructure helps the students to pursue research and innovation.

The department bridges industry academia interface through regular site visits, expert talks, workshops, and training programs as well as faculty development programs. Students are also encouraged to engage in extracurricular and co-curricular activities, essential for overall development, nurturing of team spirit and developing organizational skills to keep themselves abreast with current developments in the area of Civil Engineering.

**PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

The Department of Civil Engineering keeping in view interests of all their stakeholders have formulated the Program Educational Objectives (PEO's) that are comprehensive statements describing the career and professional accomplishments that the program is preparing the learner for.

PEO's of B.Tech Program in Civil Engineering are:

**PEO 1:** To prepare learners with a solid foundation in mathematics, sciences, and technical skills needed to analyze and design civil engineering problems.

**PEO 2:** To prepare learners for meaningful work by applying their strong Civil Engineering business, leadership, and communication skills to meet the expectations of their employers.

**PEO 3:** To prepare learners to apply knowledge, strong reasoning, and quantitative skills to design and implement creative and sustainable solutions.

**PEO 4:** To prepare learners to effectively use modern equipments & programming tools to solve real life problems that are technically sound, economically feasible and socially acceptable.

**PEO 5:** To prepare learners for successful professional career, to excel in higher studies and or to become entrepreneur.

**PEO 6:** To prepare learners to become responsible citizens by serving the community locally, nationally, and internationally.

**"Mission of the Department-PEO Matrix"**

| PEO Statements | | Mission 1 | Mission 2 | Mission 3 | Mission 4 |
|---|---|---|---|---|---|
| **PEO 1:** | To prepare learners with a solid foundation in mathematics, sciences, and technical skills needed to analyze and design civil engineering problems. | **3** | **2** | **3** | **1** |
| **PEO 2:** | To prepare learners for meaningful work by applying their strong Civil Engineering business,leadership, and communication skills to meet the expectations of their employers. | **3** | **3** | **2** | **2** |
| **PEO 3:** | To prepare learners to apply knowledge, strong reasoning, and quantitative skills to design and implement creative and sustainable solutions. | **3** | **3** | **3** | **2** |
| **PEO 4:** | To prepare learners to effectively use modern equipments & programming tools | **3** | **3** | **3** | **2** |

| | | | | | |
|---|---|---|---|---|---|
| | to solve real life problems that are technically sound, economically feasible and socially acceptable. | | | | |
| **PEO 5:** | To prepare learners for successful professional career, to excel in higher studies and or to become entrepreneur. | **3** | **3** | **3** | **3** |
| **PEO 6:** | To prepare learners to become responsible citizens by serving the community locally, nationally, and internationally. | **3** | **3** | **3** | **3** |

**PROGRAM OUTCOMES (POs)**

a. Apply the knowledge of mathematics, science, engineering fundamentals, and Engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.
c. Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
j. Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.
k. Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.
l. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

m. An ability to identify, analyze and design civil engineering problems and use of relevant codal provisions
n. An ability to pursue research, higher studies, consultancy and face competitive examinations that offers challenging and rewarding careers in civil engineering

**Mapping of PEOs, POs & PSOs**

| POs/PSOs<br>PEOs | a | B | c | d | e | f | g | h | i | j | k | L | m | n |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PEO 1** | 3 | 3 | 2 | 2 | 1 | 1 | 1 | - | - | - | - | 1 | 1 | 2 |
| **PEO 2** | - | - | 1 | - | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 2 |
| **PEO 3** | 3 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | 1 | 3 | 3 |
| **PEO 4** | - | - | 1 | 1 | 1 | 2 | 2 | 2 | - | 2 | - | 3 | 3 | 3 |
| **PEO 5** | 1 | 1 | 2 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | - | 3 |
| **PEO 6** | 1 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | - | - | 2 | 2 | 3 | - |

## SEMESTER SYSTEM AND CHOICE BASED CREDIT SYSTEM

Credit based system of study and student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grade obtained by the student, grade point average is calculated

**(a) Course credits assignment**

Each course has a certain number of credits assigned to it depending upon its duration in periods for lecture, tutorial and laboratory/clinical practice in a week. A few courses/activities are without credit (s) and are referred to as Audit Pass Courses (APC) but are mandatory to pass as a partial fulfillment of award of degree.

**(b) Earning of credits**

At the end of every course, a letter "Grade" shall be awarded in each course for which a student has registered. On obtaining a minimum Pass Grade, student shall accumulate the course credits as Earned Credits. A student's performance shall be measured by the number of credits that he/she has earned and by the weighted grade point average. Grades obtained in the audit courses shall not be counted for computation of grade point average, however shall be mandatory to pass as a partial fulfillment of award of degree.

For Award of Degree of a programme**B.Tech(Civil Engineering)**, he/she has to earn minimum **160 credits** during the **4 year duration** of the programme **in 8 semesters**.
The total credits required to be earned have been further classified under two baskets of courses: "Compulsory Courses Basket", and "Elective Courses Basket". The **total 129 credits required** to be earned under "Compulsory Courses Basket" and minimum **31 credits** under "Elective Courses Basket".
The minimum additional Credits for B.Tech Civil Engg (Hons.) with specialization in Smart Infrastructure and B.Tech Civil Engg(Hons.) with specialization in Green Technology and Sustainability Engineering shall be in the range of 18-20 (including credit transferred from the SWAYAM platform) and the same shall be mentioned in the degree, as specialization in that particular area. So a student will earn minimum 180 credits to get Honours degree in these specializations.
The additional 18-20 credits should be earned from the courses included in the curriculum as core courses or Discipline/Multidisciplinary/Open Electives mentioned under the specializations.

All courses under "Compulsory Courses Basket", are required to be qualified and cleared/pass by each and every student enrolled under the programme and are semester-wise listed in the study scheme along with credits assigned to each course.

Under Elective Courses Basket, there will be three types of courses:

- Semester-wise courses offered by the department itself
- Open/Inter-disciplinary courses offered at the Institute/University level notified from the office of Dean-Academics.
- Massive Open Online Courses (MOOCs) available on SWAYAM Platform or any other platform as recommended by UGC/AICTE and notified from the office of Dean-Academics.

Each course shall have credits assigned to it. Student shall be required to register courses every semester for as many courses/credits specified under "Elective Courses Basket" depending upon his/her interest, capability/pace of learning and availability of time slot (without any clash in time table) so as to earn all required total credits under the "Elective Courses Basket" during the entire programme duration.

However, for registration of courses [including courses under "Compulsory Courses Basket", "Elective Courses Basket" and Previous Semester Courses (wherein he/she was declared in-eligible on the basis of attendance or he/she could not clear the course within permissible given chances)], if any, the maximum limit in a semester shall be 30 credits.

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| **Programme: B.Tech(Civil Engineering)** | | | | | | |
| **Study Scheme at a Glance (2023-27)** | | | | | | |
| **Compulsory Courses** | | | | | **Elective Courses** | |
| **Type of Courses** | | | | | | |
| **Fundamental** | **Core** | **Ability Enhancement Courses (AEC)** | **Skill Enhancement Courses (SEC)** | **HSMC** | **Open Electives** | **Domain Specific Elective Courses** |
| **Sem1** | **Sem1** | **Sem1** | **Sem1** | **Sem1** | **Sem1** | **Sem1** |
| Chemistry for Engineers | | Programming for Problem Solving lab | Workshop/Manufacrturing Practices | EVS | Student may choose courses from open elective basket | |
| Mathematics - 1 | | | AI for Engineering | Professional Communication-I | | |
| Programming for Problem Solving | | | | | | |
| Chemistry lab | | | | | | |
| | | | | | | |
| | | | | | | |
| **Sem 2** | **Sem 2** | **Sem 2** | **Sem 2** | **Sem 2** | **Sem 2** | **Sem2** |
| Physics for Engineers | Engg Graphics & Design | | Biology for Engineers | Constitution of India | Student may choose courses from open elective basket | |
| Mathematics - 2 | | | | Professional Communication - II | | |

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| Basic Electrical and Electronics Engineering | | | | | | ……… |
| Physics lab | | | | | | |
| Basic Electrical Engg lab | | | | | | |
| | | | | | | |
| **Sem3** | **Sem3** | **Sem3** | **Sem3** | **Sem3** | **Sem3** | **Sem3** |
| | Engineering Mechanics for Civil Engineers | Quantitative Aptitude | Summer Internship-I | Universal Human Values | Student may choose courses from open elective basket | Building Services |
| | Disaster Preparedness & Planning | | Design, Thinking and Inoovation-I | | | Sensor Technology |
| | Smart Infrastructure Engineering | | | | | Biomimetics |
| | Surveying and Geomatics | | | | | IOT enabled Smart Infrastructure |
| | Computer-aided Civil Engineering Drawing Lab | | | | | |
| | Surveying & Geomatics Lab | | | | | |
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*Training undertaken by students during the Summer vacation after second Semester(4 weeks minimum) will be evaluated as a III Semester subject.

| Sem4 | Sem4 | Sem4 | Sem4 | Sem4 | Sem4 | Sem4 |
|---|---|---|---|---|---|---|
| Energy Science & Engineering | Introduction to Fluid Mechanics | QAPD-I | Design, Thinking and Innovation -II | Sports and Yoga | Student may choose courses from open elective basket | Smart Materials |
| Building Construction | Introduction to Solid Mechanics | | | | | Introduction to Sustainable development |
| | Materials, Testing & Evaluation | | | | | Transformation to Green Buildings |
| | Transportation Engineering | | | | | Introduction to Smart Cities |
| | Design of Concrete Structures-I | | | | | Intelligent Buildings |
| | Introduction to Fluid Mechanics Lab | | | | | |
| | Solid Mechanics Lab | | | | | |
| | Materials, Testing & Evaluation Lab | | | | | |
| | Transportation Engineering Lab | | | | | |
| | | | | | | |
| **Sem5** | **Sem5** | **Sem5** | **Sem5** | **Sem5** | **Sem5** | **Sem5** |
| | Environmental Engineering - I | QAPD-II | Summer Internship-II | | Student may choose courses from open elective basket | Hydraulic Engineering |
| | Geotechnical Engineering | French- I | Design, Thinking and Innovation-III | | | Pavement Materials |
| | Structural Analysis-I | German-I | | | | Design of hydraulic structures |
| | Environmental Engineering Lab | Spanish-I | | | | Engineering Materials for Sustainability |

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| | Geotechnical Engineering Lab | | | | | Green and Renewable Energy |
| | Concrete Technology | | | | | Sustainable Architecture |
| | Structural Engineering Lab | | | | | Planning and Design of Sustainable Transport Systems |
| | Smart Infrastructure: Design and Simulation | | | | | AI/ML in Infrastructure Engineering |
| *Training undertaken by students during the Summer vacation after fourth Semester(4-6 weeks) will be evaluated as a V Semester subject. | | | | | | |
| | | | | | | |
| **Sem6** | **Sem6** | **Sem6** | **Sem6** | Sem6 | Sem6 | Sem6 |
| | Estimation & Costing and Valuation | QAPD-III | Project Phase-I | | Student may choose courses from open elective basket | Traffic Engineering and Management |
| | Environmental Engineering - II | French- II | | | | Geotechnical Design |
| | Hydrology & Water Resources Engineering | German-II | | | | Construction Project Planning & Systems |
| | Construction Engineering & Management | Spanish-II | | | | Environmental Systems |
| | Design of steel Structures | Entrepreneurship and Startups | | | | Open Channel flow |
| | | | | | | Railway Engineering |
| | | | | | | Digital Twin and Asset Management |
| | | | | | | Pavement Management and Maintenance System |

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| | | | | | | Prefabricated Structures |
| | | | | | | Building Information Modelling |
| | | | | | | |
| **Sem7** | **Sem7** | **Sem7** | **Sem7** | **Sem7** | **Sem7** | Masonry Structures |
| | Structural Analysis-II | **General Proficiency** | Project Phase-II | | Student may choose courses from open elective basket | Highway Construction and Management |
| | Foundation Engineering | | **Summer Internship-III** | | | Urban Transportation Planning. |
| | | | | | | Environmental Laws and Policy |
| | | | | | | Physico-Chemical Processes for Water and Wastewater Treatment |
| | | | | | | Engineering Risk & Uncertainty |
| | | | | | | Bridge Engineering |
| | | | | | | Disaster Risk Reduction |
| | | | | | | Advanced Design of Concrete Structures |
| | | | | | | Metro Systems & Engineering |
| | | | | | | Infrastructure Planning and Management |
| | | | | | | Construction Safety |
| | | | | | | Airport Planning and Design |

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| | | | | | | Construction Equipment& Automation |
| | | | | | | Air, Noise Pollution and Control |
| | | | | | | Environmental Geo-technology |
| | | | | | | Intelligent Transportation Systems |
| | | | | | | Port and Harbour Engineering |
| | | | | | | Construction Productivity |
| | | | | | | Sustainable Construction Methods |
| | | | | | | Solid and Hazardous Waste Management |
| | | | | | | Prestressed Concrete |
| | | | | | | Repairs & Rehabilitation of Structures |
| | | | | | | Environmental Impact Assessment and Life Cycle Analyses |
| | | | | | | Earthquake Engineering |
| | | | | | | Geographic Information Systems and Science |
| | | | | | | Fire Resistant construction |
| | | | | | | Heritage Conservation |
| | | | | | | Water Auditing |
| | | | | | | |
| **Sem8** | **Sem8** | **Sem8** | **Sem8** | **Sem8** | **Sem8** | |

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| | | | **Summer Internship-IV** | | | Airport Planning and Design |

In addition to above Domain Specific Electives,Interdisciplinary, Generic, on-line courses (MOOCs) to be offered, shall be notified by the Academic Branch of the University well before start of Semester / Academic Session.

**Minimium credits required through compulsory courses: 129**
**Minimium credits required through Elective courses: 31**

$The LTP distribution, Evaluation Scheme and pre-requisite(s) for Elective courses are given. The course code will depend upon the elective(s) chosen by the student. In addition to above Domain Specific electives, Interdisciplinary, Generic, on-line courses (MOOCs) to be offered, shall be notified by the Academic Branch of the University well before start of Semester / Academic Session.

@The weekly load will depend upon the electives chosen by the student.

**Additional Notes**

**Note 1**

A candidate would need to earn a minimum of 160 credits (compulsory courses + elective courses) for the award of UG degree (B.Tech) in Civil Engineering.

There shall be a requirement to earn extra 20 credits (Total 180 credits) for Honours degree in Civil Engineering with specialisation in Smart Infrastructure/Green Technology and Sustainability Engineering in accordance with AICTE norms.

**Note 2**

Project Phase-I will be the initial phase of the B.Tech Project that is extended to 7th semester as Project Phase-II. Also it can be extended experimental work of the research undertaken in DTI-I, DTI-II and DTI-III.

Project Phase-II can be the any one of the following:
(i) an independent project
(ii) an industrial project in any industry of his/her choice, following which the student has to undergo Summer Internship-IV in the same industry.

# Study Scheme 2023-27

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| | | | | | | | | | | | | | **Annexure 4** |
| **MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES** | | | | | | | | | | | | | |
| **(Deemed to be University under section 3 of the UGC Act 1956)** | | | | | | | | | | | | | |
| **FACULTY OF ENGINEERING & TECHNOLOGY** | | | | | | | | | | | | | |
| **STUDY SCHEME FOR FIRST YEAR B.TECH 2023-27 BATCH** | | | | | | | | | | | | | |
| **SEMESTER-I** | | | | | | | | | | | | | |
| **(Common for All B.Tech. Programmes) B.Tech. (CSE N): Group A & B.Tech CSE (SPL) and Non-CSE branches: Group B** | | | | | | | | | | | | | |
| **Course Type** | **Subject Code** | **Title of Course** | **Pre-requisite Course, if any** | | **Periods/Week** | | | | **Marks** | | | **Duration of Exam** | **Credits** |
| | | | **Title** | **Code** | **L** | **T** | **P** | **Total** | **Int./ Continuous** | **End Sem.** | **Total** | | |
| BSC | BPH-106 | Physics for Engineers (Group A) | NA | NA | 3+1# | 0 | 0 | 4 | 100 | 100 | 200 | 3 hrs | 3 |
| BSC | BCH-106 | Chemistry for Engineers (Group B) | NA | NA | 2+1 # | 0 | 0 | 3 | | | | | 2 |
| BSC | BMA-101/ BMA-102/ BMA-103 | Mathematics-I (For CSE only)/ Mathematics-1(All Branches except CSE & BT)/ Mathematics for Biotechnology-I (For BT only) | NA | NA | 3+1# | 1 | 0 | 5 | 100 | 100 | 200 | 3 hrs | 4 |
| ESC | BEE-103 | Basic Electrical and Electronics Engineering (Group A ) | NA | NA | 3 | 0 | 0 | 0 | 100 | 100 | 200 | 3 hrs | 3 |
| ESC | BCS-101A | Programming for Problem Solving (Group B) | NA | NA | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| ESC | BCS-100A / BBT-100A | Artificial Intelligence for Engineers (Group A) / Biology for Engineers (Group | NA | NA | 2 | 0 | 0 | 2 | 100 | 100 | 200 | 3 hrs | 2 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B) | | | | | | | | | | | |
| ESC | BME-101A / BME-102 | Engg Graphics & Design (Group A)/ Workshop/Manufacturing Practices (Group B) | NA | NA | 0 | 0 | 4 | 4 | 100 | 100 | 200 | 3 hrs | 2 |
| BSC | BPH-151A / BCH-151A | Physics lab (Group A)/ Chemistry lab (Group B) | NA | NA | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hrs | 1 |
| ESC | BEE-151A / BCS-151A | Basic Electrical Engg lab (Group A)/ Programming for Problem Solving lab (Group B) | NA | NA | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hrs | 1 |
| HSMC | CDC-PC-101 | Professional Communication - I | NA | NA | 2 | 0 | 0 | 2 | 50 | 50 | 100 | 2 hrs | 2 |
| HSMC | BHM-MC-001/ BCH-MC-002 | Constitution of India* (Group A)/ EVS** (Group B) | NA | NA | 1* | 1** | 0 | 1 | 50 | 50 | 100 | 2 hrs | AP |
| | | **Total (Group A/ Group B)** | | | | | | | **700** | **700** | **1400** | | **18/ 17** |
| **# NOTE: Contact hours per week have been increased due to bridge course.** | | | | | | | | | | | | | |
| **SEMESTER-II** | | | | | | | | | | | | | |
| **Course Type** | **Subject Code** | **Subject** | **Pre-requisite Course, if any** | | **Periods/Week** | | | | **Marks** | | | **Duration of Exam** | **Credits** |
| | | | **Title** | **Code** | **L** | **T** | **P** | **Total** | **Int./ Continuous** | **End Sem.** | **Total** | | |
| BSC | BPH-106 | Physics for Engineers (Group | NA | NA | 3+1# | 0 | 0 | 4 | 100 | 100 | 200 | 3 hrs | 3 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B) | | | | | | | | | | | |
| BSC | BCH-106 | Chemistry for Engineers (Group A) | NA | NA | 2+1 # | 0 | 0 | 3 | | | | | 2 |
| BSC | BMA-201/ BMA-202/ BMA-203 | Mathematics-2 (For CSE only)/ Mathematics-2 (All Branches except CSE & BT)/ Mathematics for Biotechnology-II (For BT only) | NA | NA | 3 | 1 | 0 | 4 | 100 | 100 | 200 | 3 hrs | 4 |
| ESC | BEE-103 | Basic Electrical and Electronics Engineering (Group B ) | NA | NA | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| ESC | BCS-101A | Programming for Problem Solving (Group A) | NA | NA | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| ESC | BME-101A / BME-102 | Engg Graphics & Design(Group B)/ Workshop/Manufacturing Practices(Group A) | NA | NA | 0 | 0 | 4 | 4 | 100 | 100 | 200 | 3 hrs | 2 |
| ESC | BCS-100A / BBT-100A | Artificial Intelligence for Engineers (Group B) / Biology for Engineers (Group A) | NA | NA | 2 | 0 | 0 | 2 | 100 | 100 | 200 | 3 hrs | 2 |
| BSC | BCH-151A / BPH-151A | Chemistry lab (Group A)/ Physics lab (Group B) | NA | NA | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hrs | 1 |
| ESC | BCS- | Programming for Problem Solving | NA | NA | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hrs | 1 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 151A / BEE-151A | lab (Group A)/ Basic Electrical Engg lab(Group B) | | | | | | | | | | | |
| HSMC | CDC-PC-102 | Professional Communication - II | NA | NA | 2 | 0 | 0 | 2 | 50 | 50 | 100 | 2 hrs | 2 |
| HSMC | BCH-MC-002 / BHM-MC-001 | EVS** (Group A)/ Constitution of India* (Group B) | NA | NA | 1* | 1** | 0 | 1 | 50 | 50 | 100 | 2 hrs | AP |
| | | **Total (Group A/ Group B)** | | | | | | | **700** | **700** | **1400** | | **17/ 18** |
| **# NOTE: Contact hours per week have been increased due to bridge course.** | | | | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Group-A CSE-N Group - B Civil | CC - MS | AIML - MS | GT-IBM | DFCS-IBM | ME | Mechatronics | ECE | ECE-AIOT | EEE | BT |
| CSE-N Civil | CC - MS | AIML - MS | GT-IBM | DFCS-IBM | ME | Mechatronics | ECE | ECE-AIOT | EEE | BT |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SEMESTER III** | | | | | | | | | | | | | |
| **Course Type** | **Course Code** | **Title of Course** | **Pre-requisite Course, if any** | | **Periods/Week** | | | | **Marks** | | | **Duration of Exam** | **Credits** |
| | | | **Title** | **Code** | **L** | **T** | **P** | **Total** | **Int./ Cont. Evaluation** | **End Semester Exam** | **Total** | | |

| Compulsory Subjects | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROJ | **Proj-CE-300 A** | **Summer Internship-I** | None | | **2 Weeks** | | | | **50** | | **50** | | **1** |
| ESC | BCE-DS-302A | Engineering Mechanics for Civil Engineers | None | | 2 | 1 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| CORE | BCE-DS-303 | Disaster Preparedness & Planning | None | | 2 | 0 | 0 | 2 | 100 | 100 | 200 | 3 hours | 2 |
| CORE | BCE-DS-403 | Surveying & Geomatics | None | | 2 | 1 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| CORE | BCE-DS-304 | Smart Infrastructure Engineering | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| CORE | BCE-DS-351A | Computer-aided Civil Engineering Drawing Lab | None | | 0 | 0 | 4 | 4 | 100 | 100 | 200 | 2 hours | 2 |
| CORE | BCE-DS-453 | Surveying & Geomatics Lab | None | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | 1 |
| PROJ | DTI-300 | Design, Thinking and Innovation-I | None | | 0 | 1 | 0 | 1 | 50 | 0 | 50 | | 1 |
| HSMC | BHM-MC-004 | Quantitative Aptitude | None | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | AP |
| HSMC | BHM-320 | Universal Human Values | None | | 1 | 1 | 0 | 2 | 50 | 50 | 100 | 2 hours | 2 |
| | | **TOTAL** | | | **12** | **4** | **8** | 24 | **850** | **650** | **1500** | | **18** |
| | | | | | | | | | | | | | |

*Refer to the aforementioned list of choice-based course-basket offered at the Department level. Further, under the elective courses, besides the Interdisciplinary/ Generic papers, on-line courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester at University. Student shall be required and allowed to opt for such offered courses as per limit of maximum credits and for the category of elective courses as per the University Rules.

**Note:A student may register for courses leading to a minimum of 18 credits and a maximum of 28 credits.**

**Discipline Elective Courses***

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Domain Specific | BCE-DS-321 | Building Services | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| Domain Specific | BCE-DS-322 | Sensor Technology | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| Domain Specific | BCE-DS-323 | Biomimetics | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| Domain Specific | BCE-DS-324 | IOT enabled Smart Infrastructure | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |

**SEMESTER IV**

| Course Type | Course Code | Title of Course | Pre-requisite Course, if any | | Periods/Week | | | | Marks | | | Duration of Exam | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Title | Code | L | T | P | Total | Int./ Cont. Evaluation | End Semester Exam | Total | | |
| **Compulsory Courses** | | | | | | | | | | | | | |
| CORE | BCE-DS-401 | Introduction to Fluid Mechanics | Engineering Mechanics for Civil Engineers | BCE-DS-302A | 2 | 0 | 0 | 2 | 100 | 100 | 200 | 3 hours | 2 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CORE | BCE-DS-402 | Introduction to Solid Mechanics | Engineering Mechanics for Civil Engineers | BCE-DS-302A | 2 | 0 | 0 | 2 | 100 | 100 | 200 | 3 hours | 2 |
| CORE | BCE-DS-404A | Materials, Testing & Evaluation | None | | 1 | 1 | 0 | 2 | 100 | 100 | 200 | 3 hours | 2 |
| ESC | BCE-DS-405/ BCE-DS-407 | Energy Science & Engineering/Building Construction | None | | 1 | 1 | 0 | 2 | 100 | 100 | 200 | 3 hours | 2 |
| CORE | BCE-DS-406 | Transportation Engineering | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| CORE | BCE-DS-605A | Design of Concrete Structures-I | None | | 2 | 0 | 2 | **4** | 100 | 100 | 200 | 3 hours | 3 |
| CORE | BCE-DS-451 | Introduction to Fluid Mechanics Lab | None | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | 1 |
| CORE | BCE-DS-452 | Solid Mechanics Lab | None | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | 1 |
| CORE | BCE-DS-454A | Materials, Testing & Evaluation Lab | None | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | 1 |
| CORE | BCE-DS-455 | Transportation Engineering Lab | None | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | 1 |
| PROJ | DTI-400 | Design, Thinking and Innovation-II | Design, Thinking and Innovati | DTI-300 | 0 | 1 | 0 | 1 | 50 | | 50 | | 1 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | on-I | | | | | | | | | | |
| HSMC | BHM-MC-006 | QAPD-I | None | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | AP |
| HSMC | BHM-MC-002 | Sports and Yoga | None | | 2 | 0 | 0 | 2 | 100 | 0 | 100 | 1 hour | AP |
| | **TOTAL** | | | | **11** | **3** | **12** | 26 | **900** | **850** | **1750** | | **19** |
| | | | | | | | | | | | | | |
| *Refer to the aforementioned list of choice-based course-basket offered at the Department level, further, under the elective courses, besides the Program/Interdisciplinary/ Open/Generic papers, on-line courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester at University. Student shall be required and allowed to opt for such offered courses as per limit of maximum credits and for the category of elective courses as per the University Rules. | | | | | | | | | | | | | |
| **Note:A student may register for courses leading to a minimum of 19 credits and a maximum of 28 credits.** | | | | | | | | | | | | | |
| **Discipline Elective Courses*** | | | | | | | | | | | | | |
| Domain Specific | BCE-DS-421 | Smart Materials | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| Domain Specific | BCE-DS-422 | Introduction to Sustainable development | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| Domain Specific | BCE-DS-423 | Transformation to Green Buildings | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| Domain Specific | BCE-DS-424 | Introduction to Smart Cities | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| Domain Specific | BCE-DS-425 | Intelligent Buildings | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

| SEMESTER V | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Type** | **Course Code** | **Title of Course** | **Pre-requisite Course, if any** | | **Periods/Week** | | | | **Marks** | | | **Duration of Exam** | **Credits** |
| | | | **Title** | **Code** | **L** | **T** | **P** | **Total** | **Int./ Cont. Evaluation** | **End Semester Exam** | **Total** | | |
| **Compulsory Courses** | | | | | | | | | | | | | |
| PROJ | **Proj-CE-500** | **Summer Internship-II** | None | **4-6 weeks** | | | | | **100** | | **100** | | **2** |
| CORE | BCE-DS-502 | Geotechnical Engineering | None | | 2 | 0 | 0 | 2 | 100 | 100 | 200 | 3 hours | 2 |
| CORE | BCE-DS-505A | Structural Analysis-I | None | | 1 | 0 | 2 | 3 | 100 | 100 | 200 | 3 hrs | 2 |
| CORE | BCE-DS-506A | Concrete Technology | None | | 2 | 0 | 0 | 2 | 100 | 100 | 200 | 3 hours | 2 |
| CORE | BCE-DS-507 | Environmental Engineering - I | None | | 2 | 0 | 0 | 2 | 100 | 100 | 200 | 3 hours | 2 |
| CORE | BCE-DS-508 | Smart Infrastructure: Design and Simulation | None | | 0 | 0 | 4 | 4 | 100 | 100 | 200 | 3 hours | 2 |
| CORE | BCE-DS-552 | Geotechnical Engineering Lab | None | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | 1 |
| CORE | BCE-DS-553 | Structural Engineering Lab | | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | 1 |
| CORE | BCE-DS-652 | Environmental Engineering Lab | | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | 1 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CORE | DTI-500 | Design, Thinking and Innovation-III | Design, Thinking and Innovation-II | DTI-400 | 0 | 1 | 0 | 1 | 50 | 0 | 50 | 2 hours | 1 |
| HSMC | BHM-MC-008 | QAPD-II | None | | 0 | 0 | 2 | 2 | 50 | 50 | 100 | 2 hours | AP |
| **Total** | | | | | **7** | **1** | **14** | 22 | **850** | **700** | **1550** | | **16** |
| | | | | | | | | | | | | | |
| **Discipline Elective Courses*** | | | | | | | | | | | | | |
| Domain Specific | BCE-DS-501 | Hydraulic Engineering | Introduction to Fluid Mechanics | BCE-DS-401 | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hours | 3 |
| Domain Specific | BCE-DS-521 | Pavement Materials | Transportation Engineering | BCE-DS-406 | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-522 | Design of hydraulic structures | Introduction to Fluid Mechanics | BCE-DS-401 | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-523 | Engineering Materials for Sustainability | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-524 | Green and Renewable Energy | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-525 | Sustainable Architecture | None | | 2 | 0 | 2 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-526 | Planning and Design of Sustainable | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Transport Systems | | | | | | | | | | | |
| Domain Specific | BCE-DS-527 | AI/ML in Infrastructure Engineering | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Generic Elective -I | HM-506 | French- I | None | | 2 | 0 | 0 | 2 | 50 | 50 | 100 | 1.5 hrs | 2 |
| Generic Elective -I | HM-507 | German-I | None | | 2 | 0 | 0 | 2 | 50 | 50 | 100 | 1.5 hrs | 2 |
| Generic Elective -I | HM-508 | Spanish-I | None | | 2 | 0 | 0 | 2 | 50 | 50 | 100 | 1.5 hrs | 2 |

$The LTP distribution, Evaluation Scheme and pre-requisite(s) for Elective courses are given above. The course code will depend upon the elective(s) chosen by the student.

@The weekly load will depend upon the electives chosen by the student .

*Refer to the aforementioned list of choice-based course-basket offered at the Department level. Further, under the elective courses, besides the Interdisciplinary/ Generic papers, on-line courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester at University. Student shall be required and allowed to opt for such offered courses as per limit of maximum credits and for the category of elective courses as per the University Rules.

**Note:A student may register for courses leading to a minimum of 16 credits and a maximum of 28 credits.**

**SEMESTER VI**

| Course Type | Course Code | Title of Course | Pre-requisite Course, if any | | Periods/Week | | | | Marks | | | Duration of Exam | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Title | Code | L | T | P | Total | Int./ Cont. Evaluation | End Semester Exam | Total | | |
| **Compulsory Courses** | | | | | | | | | | | | | |
| PROJ | **PROJ-CE-600A** | **Project Phase-I** | None | | **0** | **0** | **2** | **2** | **100** | **-** | **100** | **2 hrs** | **1** |
| CORE | BCE- | Estimation & | None | | 1 | 0 | 2 | **3** | 100 | 100 | 20 | 3 | 2 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DS-601A | Costing and Valuation | | | | | | | | | 0 | hours | |
| CORE | BCE-DS-603 | Hydrology & Water Resources Engineering | None | | 2 | 1 | 0 | **3** | 100 | 100 | 200 | 3 hours | 3 |
| CORE | BCE-DS-604A | Construction Engineering & Management | None | | 2 | 0 | 2 | **4** | 100 | 100 | 200 | 3 hours | 3 |
| CORE | BCE-DS-627A | Design of Steel Structures | Engineering Mechanics for Civil Engineers | BCE-DS-302A | 2 | 0 | 2 | 4 | 100 | 100 | 200 | 3 hrs | 3 |
| CORE | BCE-DS-606 | Environmental Engineering - II | None | | 2 | 0 | 0 | **2** | 100 | 100 | 200 | 3 hours | 2 |
| HSMC | BHM-MC-009 | QAPD-III | None | | 0 | 0 | 2 | **2** | 50 | 50 | 100 | 2 hours | AP |
| HSMC | BHM-520 | Entrepreneurship and Startups | None | | 2 | 0 | 0 | **2** | 100 | 100 | 200 | 3 hours | 2 |
| | **TOTAL** | | | | **11** | **1** | **10** | **22** | **750** | **650** | **1400** | | **16** |
| **Discipline Elective Courses*** | | | | | | | | | | | | | |
| Domain Specific | BCE-DS-621A | Traffic Engineering and Management | Transportation Engineering | BCE-DS-406 | 2 | 0 | 2 | 4 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-622 | Geotechnical Design | Geotechnical Engineering | BCE-DS-502 | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-623A | Construction Project Planning & Systems | None | | 2 | 0 | 2 | 4 | 100 | 100 | 200 | 3 hrs | 3 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Domain Specific | BCE-DS-624 | Environmental Systems | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-625 | Open Channel flow | Introduction to Fluid Mechanics | BCE-DS-401 | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-626A | Railway Engineering | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-629 | Prefabricated Structures | Design of Concrete Structures | BCE-DS-605A | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-630 | Building Information Modelling | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-631 | Digital Twin and Asset Management | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-632 | Pavement Management and Maintenance System | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Generic Elective -II | HM-606 | French- II | French-I | HM-506 | 2 | 0 | 0 | 2 | 50 | 50 | 100 | 1.5 hrs | 2 |
| Generic Elective -II | HM-607 | German-II | German-I | HM-507 | 2 | 0 | 0 | 2 | 50 | 50 | 100 | 1.5 hrs | 2 |
| Generic Elective -II | HM-608 | Spanish-II | Spanish-I | HM-508 | 2 | 0 | 0 | 2 | 50 | 50 | 100 | 1.5 hrs | 2 |
| $The LTP distribution, Evaluation Scheme and pre-requisite(s) for Elective courses are given above. The course code will depend upon the elective(s) chosen by the student. | | | | | | | | | | | | | |

@The weekly load will depend upon the electives chosen by the student .

**Note:A student may register for courses leading to a minimum of 16 credits and a maximum of 28 credits.**

*Refer to the aforementioned list of choice-based course-basket offered at the Department level. Further, under the elective courses, besides the Interdisciplinary/ Generic papers, on-line courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester at University. Student shall be required and allowed to opt for such offered courses as per limit of maximum credits and for the category of elective courses as per the University Rules.

**SEMESTER VII**

| Course Type | Course Code | Title of Course | Pre-requisite Course, if any | | Periods/Week | | | | Marks | | | Duration of Exam | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Title | Code | L | T | P | Total | Int./ Cont. Evaluation | End Semester Exam | Total | | |
| **Compulsory Courses** | | | | | | | | | | | | | |
| PROJ | **Proj-CE-710** | **Summer Internship-III** | None | **4-6 weeks** | | | | | **100** | | **100** | | **2** |
| PROJ | **Proj-CE-700A** | **Project Phase-II** | Project Phase-I | Proj-CE-600 | **0** | **0** | **10** | **10** | **200** | **100** | **300** | **2 hrs** | **5** |
| Core | **GP-CE-700** | **General Proficiency** | | | | | | | | | | | **AP** |
| Core | BCE-DS-702A | Structural Analysis-II | None | | 2 | 0 | 2 | **4** | 100 | 100 | 200 | 3 hrs | 3 |
| Core | BCE-DS-703A | Foundation Engineering | None | | 2 | 0 | 2 | **4** | 100 | 100 | 200 | 3 hrs | 3 |
| DE/OE/GE | $ | Electives | None | | | | | **0** | | | | | |
| **TOTAL** | | | | | **4** | **0** | **12** | **16** | **400** | **300** | **70** | | **13** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | **0** | | |
| | | | | | | | | | | | | | |
| **Discipline Elective Courses*** | | | | | | | | | | | | | |
| Domain Specific | BCE-DS-721 | Masonry Structures | Materials, Testing & Evaluation | BCE-DS-404A | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-722A | Highway Construction and Management | Transportation Engineering | BCE-DS-406 | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-723 | Urban Transportation Planning. | Transportation Engineering | BCE-DS-406 | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-724 | Environmental Laws and Policy | Environmental Engineering-I | BCE-DS-507 | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-725 | Physico-Chemical Processes for Water and Wastewater Treatment | Environmental Engineering-II | BCE-DS-606 | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-726 | Engineering Risk & Uncertainty | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-728A | Bridge Engineering | None | | 2 | 0 | 2 | 4 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-729 | Disaster Risk Reduction | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS- | Advanced Design of Concrete | Design of | BCE-DS- | 2 | 0 | 2 | 4 | 100 | 100 | 200 | 3 hrs | 3 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 730 | Structures | Concrete Structures | 605A | | | | | | | | | | |
| Domain Specific | BCE-DS-731 | Metro Systems & Engineering | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-732 | Construction Safety | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-733 | Infrastructure Planning and Management | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-821 | Airport Planning and Design | Transportation Engineering | BCE-DS-406 | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-822 | Construction Equipment& Automation | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-823 | Air, Noise Pollution and Control | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-824A | Environmental Geo-technology | None | | 2 | 0 | 2 | 4 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-825A | Intelligent Transportation Systems | Transportation Engineering | BCE-DS-406 | 2 | 0 | 2 | 4 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-826 | Port and Harbour Engineering | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-827 | Construction Productivity | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Domain Specific | BCE-DS-828 | Sustainable Construction Methods | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-829 | Solid and Hazardous Waste Management | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-830 | Prestressed Concrete | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-831A | Repairs & Rehabilitation of Structures | Concrete Technology | BCE-DS-506A | 2 | 0 | 2 | 4 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-832 | Environmental Impact Assessment and Life Cycle Analyses | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-833 | Earthquake Engineering | Engineering Mechanics for Civil Engineers | BCE-DS-302A | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-834 | Geographic Information Systems and Science | Surveying & Geomatics | BCE-DS-403 | 2 | 0 | 2 | 4 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-835 | Fire Resistant construction | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-836 | Heritage Conservation | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |
| Domain Specific | BCE-DS-837 | Water Auditing | None | | 3 | 0 | 0 | 3 | 100 | 100 | 200 | 3 hrs | 3 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| $The LTP distribution, Evaluation Scheme and pre-requisite(s) for Elective courses are given above. The course code will depend upon the elective(s) chosen by the student. | | | | | | | | | | | | | |
| @The weekly load will depend upon the electives chosen by the student . | | | | | | | | | | | | | |
| **Note: A student may register for courses leading to a minimum of credits 13 and a maximum of 28 credits.** | | | | | | | | | | | | | |
| *Refer to the aforementioned list of choice-based course-basket offered at the Department level. Further, under the elective courses, besides the Interdisciplinary/ Generic papers, on-line courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester at University. Student shall be required and allowed to opt for such offered courses as per limit of maximum credits and for the category of elective courses as per the University Rules. | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| **SEMESTER VIII** | | | | | | | | | | | | | |
| **Course Type** | **Course Code** | **Title of Course** | **Pre-requisite Course, if any** | | **Periods/Week** | | | | **Marks** | | | **Duration of Exam** | **Credits** |
| | | | **Title** | **Code** | **L** | **T** | **P** | **Total** | **Int./ Cont. Evaluation** | **End Semester Exam** | **Total** | | |
| PROJ | **Proj-CE-800A*** | **Summer Internship-IV** | | | **Minimum 20 weeks** | | | | **200** | **100** | **300** | **2 HOURS** | **10** |
| **OR** | | | | | | | | | | | | | |
| DE/OE/ME | $ | Elective(s) | | | | | | | | | | | |
| **Total** | | | | | | | | | **200** | **100** | **300** | | **10** |
| $The LTP distribution, Evaluation Scheme and pre-requisite(s) for Elective courses are given above. The course code will depend upon the elective(s) chosen by the student. | | | | | | | | | | | | | |
| @The weekly load will depend upon the electives chosen by the student . | | | | | | | | | | | | | |
| *Refer to the aforementioned list of choice-based course-basket offered at the Department level. Further, under the elective courses, besides the Interdisciplinary/ Generic papers, on-line courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester at University. Student shall be required and allowed to opt for such offered courses as per limit of maximum credits and for the category of elective courses as per the University Rules. | | | | | | | | | | | | | |

| Semester Wise Credits Distribution | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **Semester** | **BSC/ ESC/ HSMC Courses** | **Core Courses/ Project/ Internship** | **Program Electives** | **Multi-disciplinary Electives /Open/ Generic Elective** | **Total** |
| I | 17 | | | | 17 |
| II | 18 | | | | 17 |
| III | 3 | 15 | | | 18 |
| IV | 2 | 17 | | | 19 |
| V | | 16 | | 2 | 18 |
| VI | 2 | 16 | | 2 | 20 |
| VII | | 13 | | | 13 |
| VIII | | 10 | | | 10 |
| | **42** | **87** | **21** | **10** | **160** |

$The LTP distribution, Evaluation Scheme and pre-requisite(s) for Elective courses are given above. The course code will depend upon the elective(s) chosen by the student.

@The weekly load will depend upon the electives chosen by the student .

*Refer to the aforementioned list of choice-based course-basket offered at the Department level. Further, under the elective courses, besides the Multi-disciplinary/ Generic papers, on-line courses (MOOCs etc) and other approved courses shall be offered, which shall be notified well before start of the semester at University. Student shall be required and allowed to opt for such offered courses as per limit of maximum credits and for the category of elective courses as per the University Rules.

Minimum Credits to earn Degree in B.Tech Civil Engineering will be 160
To get a Degree in B. Tech (Civil Engineeringwith specialisation in Smart Infrastructure/Green Technology and Sustainability Engineering) with Honours, a student has to earn additional 18 - 20 Credits.

Project Phase-I will be the initial phase of the B.Tech Project that is extended to 7th semester as Project Phase-II. Also it can be extended experimental work of the research undertaken in DTI-I, DTI-II and DTI-III.

A student will earn minimum 180 credits to get Honours degree in the specializations. The additional 18-20 credits should be earned from the following courses included in the curriculum as core courses or Discipline/Multidisciplinary/Open Electives.

**B. Tech (Civil Engineeringwith specialisation in Smart Infrastructure**

| S.No | Title of the Course | Course Code |
|---|---|---|
| 1 | Sensor Technology | BCE-DS-322 |
| 2 | IoT Enabled Smart Infrastructure | BCE-DS-324 |
| 3 | Smart Materials | BCE-DS-421 |
| 4 | Introduction to Smart Cities | BCE-DS-424 |
| 5 | Introduction to SCADA Systems | BEE-DS-431 |
| 6 | Sustainable Architecture | BCE-DS-525 |
| 7 | Planning and Design of Sustainable Transport Systems | BCE-DS-526 |
| 8 | AI/ML in Infrastructure Engineering | BCE-DS-527 |
| 9 | Intelligent Buildings | BCE-DS-425 |
| 10 | Building Information Modelling | BCE-DS-630 |
| 11 | Digital Twin and Asset Management | BCE-DS-631 |
| 12 | Bridge Engineering | BCE-DS-728 A |

**B. Tech (Civil Engineeringwith specialisation in Green Technology and Sustainability Engineering**

| S.No | Title of the Course | Course Code |
|---|---|---|
| 1 | Building Services | BCE-DS-321 |
| 2 | Biomimetics | BCE-DS-323 |
| 3 | Introduction to Sustainable Development | BCE-DS-422 |
| 4 | Transformation to Green Buildings | BCE-DS-423 |
| 5 | Introduction to SCADA Systems | BEE-DS-431 |
| 6 | Engineering Materials for Sustainability | BCE-DS-523 |
| 7 | Green and renewable energy | BCE-DS-524 |
| 8 | Sustainable Architecture | BCE-DS-525 |
| 9 | Planning and Design of Sustainable Transport Systems | BCE-DS-526 |
| 10 | Environmental systems | BCE-DS-624 |
| 11 | Building Information Modelling | BCE-DS-630 |
| 12 | Pavement Management and Maintenance System | BCE-DS-632 |

| | | |
|---|---|---|
| 13 | Disaster Risk Reduction | BCE-DS-729 |
| 14 | Metro system and engineering | BCE-DS-731 |
| 15 | Infrastructure Planning and Management | BCE-DS-733 |
| 16 | Repairs & Rehabilitation of Structures | BCE-DS-831 |
| 17 | Geographic Information Systems and Science | BCE-DS-834 |
| 18 | Heritage Conservation | BCE-DS-836 |
| 19 | Cyber Security(Open Elective) | BCS-OE-003 |

| | | |
|---|---|---|
| 13 | Environmental laws and policy | BCE-DS-724 |
| 14 | Physico Chemical processes for water and waste water treatment | BCE-DS-725 |
| 15 | Engineering Risk and Uncetainty | BCE-DS-726 |
| 16 | Disaster Risk Reduction | BCE-DS-729 |
| 17 | Water Auditing | BCE-DS-837 |
| 18 | Solid Waste Management(Open Elective) | BCE-OE-001A |
| 19 | Green Chemistry and Sustainability(Open Elective) | BCH-OE-021 |

# SEMESTER-I

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCH-106: CHEMISTRY FOR ENGINEERS

| | |
|---|---|
| Credits 2 | Max. Marks : 200 |
| L-T-P 2+1-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3hrs | End Semester Exam : 100 |

**Pre-requisite: None**

**Course Type: Basic Sciences**

**Course Outcomes:** The course will enable the student to-

BCH-106.1. Apply fundamental principles to predict the structure, stereochemistry, bonding and general properties of materials.

BCH-106.2.Predict potential applications and practical utility of chemistry in different areas and propose suitable analytical techniques for practical applications.

BCH-106.3. Develop the understanding of water treatment techniques, electrochemical cells and combustion technology.

**Part A**

**Unit 1: Water Treatment Chemistry (5 Lectures)**

1.1 Impurities in water, Drinking Water quality standards,
1.2 Hardness, types and its determination by EDTA method,
1.3 Alkalinity and its determination,
1.4 Numerical problems based on hardness & alkalinity,
1.5 Water softening methods: zeolite, ion-exchange process,
1.6 Desalination of water: Reverse osmosis (RO) & Electro-dialysis process

**Unit 2: Electrochemical cells and Fuels (5 Lectures)**

2.1 Basic concepts of cells, Primary cells,
2.2 Secondary cells and batteries,
2.3 Fuel cells, Fuels and their types,
2.4 Combustion technology

**Unit 3: Phase Rule and its applications (4 Lectures)**

3.1 Terminology of Gibb's phase rule and problems based on phase rule equation,
3.2 One component system (water),
3.3 Two component Eutectic system (Pb-Ag),
3.4 Industrial applications of phase diagrams

**Part B**

**Unit 4: Atomic and molecular structure (5 Lectures)**

4.1 Limitations of classical mechanics in treating atomic and molecular phenomena,
4.2 Schrodinger equation, Particle in a box solution and their applications for conjugated molecules and nanoparticles,
4.3 Molecular orbital treatment for homo-nuclear diatomic molecules,
4.4 Bonding in Coordination Compounds: Crystal field theory

**Unit-5: Stereochemistry (4 Lectures)**
5.1 Structural isomers and stereoisomers,
5.2 Representations of 3 dimensional structures,
5.3 Enantiomers, diastereomers,
5.4 Absolute configurations and conformational analysis
**Unit6: Analytical Techniques (5 Lectures)**
6.1 Basic Principles of spectroscopy,
6.2 UV- VIS spectroscopy and its applications,
6.3 IR spectroscopy and its applications,
6.4 Principle and analytical applications of Atomic Absorption spectroscopy,
6.5 Brief overview of Inductively coupled plasma mass spectrometry

**Text Books/ Reference books/Web references:**


1. P. C. Jain and Monica Jain, Engineering Chemistry, 2017, DhanpatRai Publishing Company.
2. PrasantaRath, SubhenduChakroborty, Chemistry, 2018, Cengage Learning Publishers.
3. B. H. Mahan,2010, University Chemistry, Pearson Education.
4. C. N. Banwell, 2008, Fundamentals of Molecular Spectroscopy, McGraw Hill Education India.
5. GourkrishnaDasmohapatra, 2019, Chemistry-I, Vikas Publishing.
6. https://nptel.ac.in/courses/103/108/103108138/
7. https://nptel.ac.in/courses/122/101/122101001/


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B. Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Sessional-I | 30% |
| Sessional-II | 30% |
| Assignment/Tutorial | 20% |
| Class Work/ Quiz | 20% |

**Course articulation Matrix**

| CO Statement | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCH-106.1 | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | 2 | 1 | 1 |
| BCH-106.2 | 3 | 3 | 2 | - | 2 | 2 | 2 | - | - | - | - | 2 | 1 | 1 |
| BCH-106.3 | 3 | 3 | 2 | - | 2 | 2 | 2 | - | - | - | - | 2 | 1 | 1 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BMA-102: MATHEMATICS-1**
**(CALCULUS AND LINEAR ALGEBRA)**

| | |
|---|---|
| Credits 4 | Max. Marks : 200 |
| L-T-P 3+1-1-0 | Continuous Evaluation : 100 |
| Examination Duration 3hrs | End Semester Exam : 100 |

**Pre-requisites:** The students must have the knowledge of mathematical concepts of Intermediate level.
**Course Type:** Basic Sciences

**Course Objectives:**

It aims to equip the students with standard concepts and tools at an intermediate to advanced level The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines. More precisely, the outcomes are:

**BMA-101.1** Students will be able to demonstrate the use of differential and integral calculus in solving engineering problems.
**BMA-101.2** Students will be able to implement the concept of matrix in real life problems.
**BMA-101.3** Students will be able to apply the concept of linear algebra in computations.

**PART-A**

**Unit 1: Integral Calculus**
1.1 Evolutes and involutes
1.2 Evaluation of definite and improper integrals
1.3 Beta and Gamma functions and their properties
1.4 Applications of definite integrals to evaluate surface areas and volumes of revolutions.
**Unit 2: Differential Calculus**
2.1 Rolle's theorem
2.2 Mean value theorems
2.3 Taylor's and Maclaurin's theorems with remainders
2.4 Indeterminate forms and L'Hospital's rule
2.5 Maxima and minima.
**Unit 3: Matrices**
3.1 Matrices
3.2 Vectors: addition and scalar multiplication
3.3 Matrix multiplication
3.4 Linear systems of equations
3.5 Linear Independence
3.6 Rank of a matrix
3.7 Determinants, Cramer's Rule
3.8 Inverse of a matrix
3.9 Gauss elimination and Gauss-Jordan elimination.

**PART-B**

**Unit 4: Vector Spaces-I**
4.1 Vector Space

4.2 Linear dependence of vectors
4.3 Basis, dimension
4.4 Linear transformations (maps)
4.5 Range and kernel of a linear map
4.6 Rank and nullity
4.7 Inverse of a linear transformation
4.8 Rank-Nullity theorem
4.9 Composition of linear maps
4.10 Matrix associated with a linear map.

**Unit 5: Vector spaces-II**
5.1 Eigenvalues, eigenvectors
5.2 Symmetric, skew-symmetric, and orthogonal Matrices
5.3 Eigenbases.
5.4 Diagonalization
5.5 Inner product spaces
5.6 Gram-Schmidt Orthogonalization.

**Text Books/ Reference Books:**


1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, $9^{th}$ Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, $9^{th}$ Edition, John Wiley & Sons, 2006.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, $11^{th}$ Reprint, 2010.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
8. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B. Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Course Articulation Matrix:**

| CO Statement (BMA-101) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BMA-101.1 | 3 | 3 | 1 | 2 | 2 | -- | -- | -- | -- | -- | -- | 2 | 2 | 2 |
| BMA-101.2 | 3 | 3 | 1 | 2 | 2 | -- | -- | -- | -- | -- | -- | 1 | 2 | 2 |
| BMA-101.3 | 3 | 3 | 2 | 2 | 3 | -- | -- | -- | -- | -- | -- | 2 | 2 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCS-101A: PROGRAMMING FOR PROBLEM SOLVING

| | |
|---|---|
| Credits 4 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3hrs | End Semester Exam : 100 |

**Pre-Requisite:** None

**Course Type:** Engineering Science Course

**Course Outcomes:** The students will be able to-

BCS-101A.1. Formulate simple algorithms for arithmetic and logical problems with correct logic.

BCS-101A.2. Implement the conditional statement and ietration with understanding of concepts.

BCS-101A.3. Decompose a problem into functions and able to understand use of functions.

BCS-101A.4. Apply advance C programming techniques such as arrays, pointers, dynamic memory allocation, structures to develop solutions for particular problems.

**PART- A**

**Unit-1: Introduction to Programming**

1.1. Introduction to programming

1.2. Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

1.3. Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudo code with examples.

1.4. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

1.5. Expressions, Precedence and Associatively, Expression Evaluation, Type conversions

**Unit-2: Loops and Conditional Statements**

2.1 Arithmetic expressions and precedence

2.2 Conditional Branching; Writing and evaluation of conditionals and consequent branching

2.3 Iteration and loops

**Unit-3: Arrays and Structures**

3.1 Arrays (1-D, 2-D):1 D array and function–Passing individual array elements to a function, passing individual array elements address to a function, passing whole 1d array to a function, 2D array and function, Passing individual array elements to a function, passing individual array elements address to a function, passing whole 2d array to a function

3.2 Character Arrays and Strings

3.3 Structures; Defining Structures

3.4 Array of Structures

**PART –B**

**Unit-4: Functions**

4.1 Functions (including using built in libraries)

4.2 Parameter passing in functions

4.3 call by value.

4.4 Passing arrays to functions: idea of call by reference

4.5 Recursion, as a different way of solving problems.

4.6 Example programs, such as Finding Factorial, Fibonacci series.

**Unit-5: Basic Algorithms**

5.1 Iterative Searching (Linear and Binary Search)
5.2 Basic Sorting Algorithms with implementation (Bubble, Insertion and Selection)
5.3 Finding roots of equations
5.4 Notion of order of complexity through example programs (no formal definition required)

**Unit-6: Pointers and File Handling**

6.1 Idea of pointers, Defining pointers,Pointer to an array,Array of pointers,Pointers and two dimensional arrays
6.2 Use of Pointers in self-referential structures
6.3 Notion of linked list (no implementation)
6.4 File Handling :Working with text files and Binary Files,File operations using std. library and system calls–File management I/O functions

**Text Books / Reference Books:**


1. Byron Gottfried, 2015, Schaum's Outline of Programming with C: 2nd Ed., McGraw-Hill.
2. E. Balaguruswamy, 1998, Programming in ANSI C: 2nd Ed., Tata McGraw-Hill.
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language:, 2nd Ed., PHI.


**Software required/Weblinks:**

Turbo C
www.tutorialpoint.com
www.nptel.com
www.w3schools.com

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit) Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment/Tutorial | 20% |
| Class Work/ Performance | 10% |
| Attendance | 10% |

**COURSE ARTICULATION MATRIX :**

| CO Statement (BCS-101A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCS-101A.1 | 2 | 3 | 2 | - | 2 | - | - | - | - | - | - | 3 | 1 | 1 |
| BCS-101A.2 | 2 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | - | 1 |
| BCS-101A.3 | - | 1 | 2 | - | 1 | 2 | - | - | - | - | - | 1 | 3 | 2 |
| BCS-101A.4 | 3 | 3 | 1 | 3 | 2 | - | - | - | - | - | - | - | 3 | 1 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

## BBT-100A: BIOLOGY FOR ENGINEERS

| | |
|---|---|
| Credits 2 | Max. Marks : 200 |
| L-T-P 2-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3hrs | End Semester Exam : 100 |

**Pre-requisites:** None
**Course Type:** Engineering Science Course

**Course Outcomes:**
The students will be able to-

BBT-100A.1 Describe the taxonomic diversity of life forms and their functions.
BBT-100A.2 Assess the role of biomolecules in physiology and their applications for humankind.
BBT-100A.3 Illustrate the structural and functional organization of the human body.
BBT-100A.4 Apply the principles of biology and genetics for sustenance.

### PART-A

**Unit 1: The Living World**
1.1 Origin of Life
1.2 Structural Organization of life forms
1.3 Microbes in daily life
1.4 Cell- The unit of Life
1.5 Human Evolution

**Unit 2: Biomolecules and Applications**
2.1 Carbohydrates, Proteins, Lipids (Types and roles)
2.2 Nucleic acids and their types
2.3 Enzymes and mechanism of action
2.4 Applications of biomolecules (Bioplastics, Vaccines, Alternative Proteins, Biodiesel, Biosensors)
2.5 Bioengineering (Bioprinting, Bioimaging, Bioremediation, Biomimics)

### PART-B

**Unit 3: Human Organ Systems and Biodesign**
3.1 Brain as CPU
3.2 Heart as Pump System
3.3 Lungs as Purification System
3.4 Kidney as Filtration system
3.5 Muscular and skeletal systems as scaffolds

**Unit 4: Science of Genome**
4.1 DNA Replication and Central Dogma
4.2 DNA Sequencing and Applications
4.3 Mutations and Genetic Disorders
4.4 Computational Approach to Biology-Making sense of the Big Data, Types of Biological Dataset, Role of AI in Healthcare

**Text/ Reference Books:**
1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wileyand Sons
3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freemanand Company
4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering the entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each Unit). Students need to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment/Tutorial | 20% |
| Class Work/ Performance | 10% |
| Attendance | 10% |

**Course Articulation Matrix**

| CO Statement | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BBT-100A.1 | 1 | - | 1 | - | - | 1 | 1 | - | - | - | 3 | 1 | 1 | 2 |
| BBT-100A.2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | - | - | - | 3 | 3 | 2 | 2 |
| BBT-100A.3 | 3 | 3 | 2 | 2 | 2 | 3 | 1 | - | - | - | 2 | 3 | 2 | 2 |
| BBT-100A.4 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | - | - | 1 | 3 | 3 | 3 | 1 |

**MANAVRACHNAINTERNATIONALINSTITUTEOFRESEARCH&STUDIES**

(Deemedto beUniversity under section3oftheUGCAct1956)

**BME-102:WORKSHOP/MANUFACTURINGPRACTICES**

| | |
|---|---|
| Credits 2 | Max. Marks : 200 |
| L-T-P 0-0-4 | Continuous Evaluation : 100 |
| Examination Duration 3hrs | End Semester Exam : 100 |

**Prerequisites:basicknowledgeofScienceand MathematicsCourseType:EngineeringScienceCourse**

**CourseOutcomes**:

**Aftercompletionofthis coursethestudentswillbeableto**

BME-102.1 Learnthebasicmanufacturing/fabricationprocessesanddevelopskillstofabricate withtheir ownhand.

BME-102.2 Understandhowtooperatevarioustraditionalandmodernmachinetoolsusedinind ustries.

BME-102.3 Applyknowledgeofthedimensionalaccuraciesanddimensionaltolerances,basics ofvarious measuringinstruments,handtoolsandcuttingtools.

BME-102.4 Acquireknowledgeofsafetymeasurements

BME-102.5 Understand the impact of manufacturing engineering solution.

BME-102.6 Assemble different mechanicalcomponent/parts

**Lectures& Videos(10Hrs)**

**(i) DetailedContent**

1. ManufacturingMethods
   casting,forming,machining,joining,advancedmanufacturingmethods(3lectures).
2. CNCmachining,Additivemanufacturing(1lecture)
3. Fittingoperations&powertools(1lecture)
4. Electrical&Electronics(1lecture)
5. Carpentry(1lecture)
6. Plasticmoulding,glass cutting(1lecture)
7. Metalcasting(1lecture)
8. Welding(arcwelding &gaswelding),brazing(1lecture)

**(ii) WorkshopPractice:(60hours)**

1. Machineshop(10hours)
2. Fittingshop(8hours)
3. Carpentry(6hours)
4. Electrical&Electronics(8hours)
5. Weldingshop(8hours)(Arcwelding4hrs+gas welding4hrs)
6. Casting(8hours)

7. Smithy(6hours)
8. Plasticmoulding& GlassCutting(6hours)

**StudentsProjectFabrication**

Studentshavetofabricateproductfromtheassignedlistwiththeirown hands. They will alsogetpractical knowledge of the dimensional accuracies and dimensional tolerances possible with differentworkshopprocesses.Thefinalproductshouldbeassemblyofdifferentcomponentsfabricatedbydifferent workshoppractices.

For e.g. Tack-hammer; Project Display Stand; Pen stand, Screw Driver, Variable size Spanner, ElectricalExtension Board with electronic circuits or any other product which should involve multiple workshoppracticestofabricateasingleproduct.

Each student will be issued the drawings of the product assembly along with the drawing of the sub-partassembly,mentioningthe dimensions,tolerance,sub-productsused.

Students should follow the process planning sheet of the product and get involved in different workshoppracticestocompletethejobsforfinalsubmission.

Note: Each student should do more than one product to get hands on experience of all the workshoppractices.

**TextBooks:**

1. HajraChoudhuryS.K.,HajraChoudhuryA.K.andNirjharRoyS.K.,"ElementsofWorkshopTechnology",Vol.I2008andVol.II2010,Mediapromotersandpublishersprivatelimited,Mumbai.
2. KalpakjianS.AndStevenS.Schmid,"ManufacturingEngineeringandTechnology",$4^{th}$edition,PearsonEducationIndiaEdition,2002.
3. GowriP.HariharanandA.SureshBabu,"ManufacturingTechnology–I"PearsonEducation,2008.

**ReferenceBooks:**

1. RoyA.Lindberg,"ProcessesandMaterialsofManufacture",4thedition,PrenticeHallIndia,1998.
2. RaoP.N.,"ManufacturingTechnology",Vol.IandVol.II,TataMcGrawHillHouse,2017.

**Weblinks:**

https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-me21/

**InstructionsforsettingofPaper**Sevenquestionsaretosetintotal.Firstquestionwillbeconceptualcoveringentiresyllabusandwillbecompulsorytoattempt.ThreequestionswillbesetfromeachpartAandpartB(onefromeachunit).Studentneedstoattempttwoquestionsoutofthreequestionsfromeachpart.Eachquestionwillbeof20marks.

**AssessmentTools:**

Surprisequestionsduringlab/ClassPerformanceTermendexamination/viva

**CourseArticulationMatrix**

| CO Statement | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BME-102.1** | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 1 | - |
| **BME-102.2** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **BME-102.3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 |
| **BME-102.4** | 2 | 2 | 2 | 2 | 3 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 |
| **BME-102.5** | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | - | 2 |
| **BME-102.6** | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | - | - |

**MANAV RACHNA INTERNATIONAL INSTITUE OF RESEARCH & STUDIES**

(Deemed to be University under section 3 of the UGC Act 1956)

**BCH-151A: CHEMISTRY LAB**

Credits 1 | Max. Marks : 100
L-T-P 0-0-2 | Continuous Evaluation : 50
Examination Duration 2hrs | End Semester Exam : 50

**Pre-requisite: None**
**Course Type: Basic Sciences Courses**

**Course Outcomes:** The students will be able to:

BCH-151A.1. analyze the need and utility of the experiments.

BCH-151A.2. do precise quantitative measurements using volumetric glassware, analytical balance, and prepare standards solutions independently.

BCH-151A.3. carry out experiments to check the hardness, alkalinity and chloride content of different water samples and interpret the results.

BCH-151A.4. employ the basic methods/techniques to measure surface tension, viscosity, conductance, emf, saponification value of different samples.

**List of Experiments:**

1. Preparation and standardization of volumetric solutions.
2. Determination of viscosity using Ostwald Viscometer.
3. Determination of hardness of water by EDTA method.
4. Determination of alkalinity of water.
5. Determination of strength of solution by Conductometric titration.
6. Determination of Ferrous ion concentration using Potentiometer.
7. Determine the percentage composition of given mixture of sodium hydroxide and sodium chloride.
8. Determination of viscosity of lubricating oils using Redwood viscometers.
9. Determination of chloride content of water.
10. Determination of surface tension using Stalagmometer.
11. Determination of saponification value of oils.
12. Determination of the partition coefficient of a substance between two immiscible liquids.

**Text Books/ Reference books/Web references:**

1, Sunita Rattan, 2011, Experiments in Applied Chemistry, S.K.Kataria& sons.

2. Shailendra K.Sinha,2014, Physical Chemistry A Laboratory Manual, Alpha Science International Limited.

3. https://vlab.amrita.edu/index.php?sub=2&brch=190

4.https://vlab.amrita.edu/index.php?sub=2&brch=193&sim=575&cnt=1

**Instructions for Exam:** One experiment out of 10 given randomly needs to be performed in exams.

**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Viva-I | 30% |
| Viva-II | 30% |

| | |
|---|---|
| File/Records | 20% |
| Class Work/ Performance | 20% |

**Course articulation Matrix**

| CO Statement | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCH-151A.1 | 3 | 3 | 2 | 1 | 1 | - | 1 | 1 | 1 | 1 | - | 2 | 1 | 1 |
| BCH-151A.2 | 3 | 3 | 2 | 1 | 2 | - | 1 | 1 | 1 | 1 | - | 2 | 1 | 1 |
| BCH-151A.3 | 3 | 3 | 2 | 1 | 2 | - | 2 | 1 | 1 | 1 | - | 2 | 1 | 1 |
| BCH-151A.4 | 3 | 3 | 2 | 1 | 1 | - | 1 | 1 | 1 | 1 | - | 2 | 1 | 1 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**

(Deemed to be University under section 3 of the UGC Act 1956)

**BCS-151A: PROGRAMMING FOR PROBLEM SOLVING LAB**

| | |
|---|---|
| Credits 1 | Max. Marks : 100 |
| L-T-P 0-0-2 | Continuous Evaluation : 50 |
| Examination Duration 2hrs | End Semester Exam : 50 |

**Co-Requisite:** Programming for problem solving
**Course Type:** Engineering Science Course

**Course Outcomes:** Students will be able to-

| | |
|---|---|
| BCS-151A.1. | Formulate the algorithms for simple problems in C language. |
| BCS-151A.2. | Understanding of syntax errors as reported by the compilers as well as logical errors. |
| BCS-151A.3. | Write iterative as well as recursive programs,implementing of arrays, strings and structures and various graph traversing algorithms. |
| BCS-151A.4. | Declare pointers of different types and able to understand the concept of file handling. |

**NOTE:**The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

**List of Practicals:**

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value,call by refrence
Lab 7: Simple functions
Tutorial 8: Recursion, structure of recursive calls
Lab 8: Recursive functions
Tutorial 9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 9: Programming for solving Numerical methods problems
Tutorial 10: Pointers, structures and dynamic memory allocation
Create a menu for student attendance monitoring system.
Lab 10: Pointers and structures

Tutorial 11: File handling
Lab 11: File operations
Create a database for an organization having the details of employees

**Software required/Weblinks:**
Turbo C
www.tutorialpoint.com
www.nptel.com
www.w3schools.com
**Note:** At least 5 more exercises to be given by the teacher concerned.

**Distribution of Continuous Evaluation:**

| | |
|---|---:|
| Viva- I | 30% |
| Viva- II | 30% |
| File/Records | 20% |
| Class Work/ Performance | 10% |
| Attendance | 10% |

**Evaluation Tools:**
Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

**COURSE ARTICULATION MATRIX :**

| **CO Statement (BCS-151A)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCS-151A.1 | 2 | 1 | 2 | 2 | - | - | - | - | - | - | 2 | 1 | 2 | - |
| BCS-151A.2 | 3 | - | - | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 |
| BCS-151A.3 | 3 | 1 | 2 | 3 | - | 1 | - | - | - | - | - | - | 1 | 2 |
| BCS-151A.4 | 2 | 3 | 1 | 2 | 3 | - | - | - | - | - | 1 | 1 | 3 | 2 |

**MANAV RACHNA INTERNATIONAL INSTITUTES OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of UGC Act 1956)

**CDC-PC-101: Professional Communication - I**

| | |
|---|---|
| Credits 1 | Max. Marks : 100 |
| L-T-P 0-0-2 | Continuous Evaluation : 50 |
| Examination Duration 2hrs | End Semester Exam : 50 |

**Pre-Requisite:** None
**Course Type:** HSMC

**Course Outcomes:** Students will be able to
**CDC-PC-101.1**: Develop all-round personality by mastering interpersonal skills to function effectively in different circumstances.
**CDC-PC-101.2**: Demonstrate effective communication through grammatically correct language.
**CDC-PC-101.3:** Apply effective listening and speaking skills in real life scenarios.

Unit 1: **Attitudinal Communication**
1.1 Attitude and its Impact on Communication
1.2 Courtesy & Politeness in Communication
1.3 Diversity & Inclusion – Bullying, Cultural Sensitivity, Stereotypes, Sexual Harassment, LGBTQ, Respect, Chivalry, Racial & Gender Discrimination, Disability Harassment, Inclusion.
1.4 Power Dressing

Unit 2**: Syntactical Communication - I**
2.1 Common errors in communication
2.2 Identification of word class
2.3 Errors & rectifications in
2.3.1 Article usage
2.3.2.Tenses usage - Present Perfect vs. Past Simple vs. Past Perfect
2.3.2 Subject Verb Agreement

Unit 3**: Phonetics**
3.1 Impact of First Language Influence
3.2 Tone
3.3 Intonation
3.4 Rate of Speech
3.5 Pronunciation: Vowels & Consonant sounds

Unit 4**: Developing Communication Skills -I (Listening & Speaking)**
4.1 Concept of LSRW: Importance of LSRW in communication.
4.2 Listening Skills : Real Life challenges, Barriers to Listening
4.3 Speaking : Self Introduction, Interview, GD, Resume

**Internal Marks Distribution:-**

| | |
|---|---|
| Sessional (Average of Sessional I & Sessional II) | 30 marks |
| Assignment | 10 marks |
| Class performance | 5 marks |
| Attendance | 5 marks |

**CourseArticulationMatrix**

| **CO Statement (CDC PC101)** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **O10** | **O11** | **O12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CDC-PC-101.**1 | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **CDC-PC-101.**2 | - | - | - | - | - | - | - | - | - | 2 | - | 1 | - | - |
| **CDC-PC-101.**3 | - | - | - | - | - | - | - | - | - | 2 | - | 1 | - | - |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BCH-MC-002: Environmental Science**

Credits AP | Max. Marks : 100
L-T-P 1-1-0 | Continuous Evaluation : 50
Examination Duration 2hrs | End Semester Exam : 50

**Pre-Requisite:** None
**Course Type:** HSMC

**Course Outcomes :**The students will be able to

BCH-MC-002.1: Comprehend various environmental issues through various activities.
BCH-MC-002.2: Understand that each and every action of ours reflects on the environment and collaborate in groups to suggest innovative ways to protect environment through project work/report writing.

**Activities:**
i) Small group meetings about conservation and management of natural resources, conservation of biodiversity, solid waste management and *environmental remediation*
ii) Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
iii) Expert talk
iv) Slogan writing /Poster making event
v) Cycle rally to create awareness on issues like pollution control, cleanliness, and waste management.
vi) Plantation activity
vii) Cleanliness drive
viii) Drive for segregation of waste
ix) Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
x) Environment protection related efforts

**The break-up for marks**
**Internal Marks**
Evaluation based on participation in activities: 50 marks
**External Marks**
Field work, Report writing & Viva: 20+20+10 = 50 marks

**Course Articulation Matrix**

| **CO Statement** ( BCH-MC-002**)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCH-MC-002.1 | 1 | 2 | 1 | - | - | 2 | 3 | 2 | 1 | - | - | 1 | - | - |
| BCH-MC-002.2 | 1 | 2 | 1 | - | - | 2 | 3 | 2 | 1 | - | - | 1 | - | - |

# SEMESTER-II

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BPH-106: PHYSICS FOR ENGINEERS**

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3+1-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3hrs | End Semester Exam : 100 |

**Pre-requisite: None**
**Course Type: Basic Sciences**

**Course Outcomes:** The students will be able to:
BPH-106.1 discuss and explain the key concepts and principles of quantum physics, lasers and optical fibres
BPH-106.2 apply the basic concepts of semiconductors and devices based on them
BPH-106.3 analyze the structure, characterization techniques and applications of advanced material.
BPH-106.4 recall the basic concept of electromagnetism and understand their applications to the theory of electromagnetic waves.

**Part A**

**Unit-1 Semiconductors (8 Lectures)**
1.1 Physical properties of semiconductors
1.2 Direct and indirect band gap semiconductors
1.3 Compound semiconductors, organic and inorganic semiconductors
1.4 Fermi level and Fermi energy
1.5 Occupation probability
1.6 Concentration of charge carriers
1.7 Generation and recombination, carrier transport: drift and diffusion
1.8 Energy band diagram of unbiased and biased p n junction
1.9 Light emitting diode
1.10 Photo detectors-p-n photodiode, pin
1.11 Photoconductivity, effect of impurity & traps
1.12 Photovoltaic effect and solar cell

**Unit-2 Quantum Physics (8 Lectures)**
2.1 Limitations of classical physics, Black-body radiations
2.2 Planck's hypothesis
2.3 Photo-electric effect
2.4 Compton effect
2.5 Uncertainty principle, Matter waves, Phase and group velocity
2.6 Schrodinger's equations (time dependent and independent)
2.7 Particle in a box (motion in one dimension)
2.8 Basics of quantum statistics

**Unit-3 Lasers and Optical Fibres (8 Lectures)**
3.1 Introduction to laser, Spontaneous and stimulated emissions of radiations
3.2 Einstein's coefficients and relation among them
3.3 Population inversion and laser pumping
3.4 Characteristics of lasers, Components of laser
3.5 He-Ne laser

3.6 Semiconductor laser, Applications of laser
3.7 Introduction to optical fibres, Acceptance angle and acceptance cone
3.8 Numerical aperture, Classification of fibres
3.9 Attenuation, Losses associated with optical fibres, Merits and applications of optical fibres

**Part B**

**UNIT 4: Advance Material and Synthesis (6 Lectures)**

4.1 Introduction to nanomaterials
4.2 Nano-science and nano-technology, two main approaches in nanotechnology
4.3 Bottom up technique, Top down technique, Quantum dot and graphene
4.4 Methods to produce nanomaterials, Chemical vapour deposition
4.5 Sol-gel process, Molecular beam epitaxy
4.6 Physical and chemical properties of nanomaterials
4.7 Carbon nanotubes: single and multi-walled nanotubes
4.8 Synthesis of Nanotubes: carbon arc method, Laser evaporation method
4.9 Sputtering, applications of advanced materials

**UNIT 5: Investigating Techniques (6 Lectures)**

5.1 Properties of X-Ray
5.2 Braggs' Law, Bragg's Spectrometer
5.3 Rutherford Back Scattering, Raman effect and Raman spectroscopy
5.4 Hall effect
5.5 Vander Pauw measurements for carrier density, resistivity, Hot-point probe measurement
5.6 AFM, SEM
5.7 Photoluminescence spectroscopy, band gap by UV-vis spectroscopy.

**Unit-6 Electrodynamics (8 Lectures)**

6.1 Divergence and curl of electrostatic field,
6.2 Laplace's and Poisson's equations for electrostatic potential,
6.3 Solutions of Laplace equation in one dimension
6.4 Dielectric Polarization and Dielectric constant, Piezoelectricity
6.5 Bio-Savart law and Ampere's circuital theorem, Continuity equation for current densities
6.6 Displacement current, Maxwell's equations
6.7 Electromagnetic energy–Flow of energy and Poynting vector
6.8 The wave equation; Plane electromagnetic waves in vacuum, their transverse nature
6.9 Energy carried by electromagnetic waves.

**Text Books/ Reference Books:**


1. P. Bhattacharya,2017, Semiconductor Optoelectronic Devices, Pearson education.
2. D.J Griffiths, 2015, Introduction to Electrodynamics, Pearson education.
3. Avadhanulu and Kshirsagar,2014, A textbook of Engineering Physics S. Chand.
4. S.P. Taneja,2018, Modern Physics for Engineers, R. Chand & Co.
5. Mark Ratner and Daniel Ratner, 2003,Nanotechnology, Pearson.
6. M.N.O. Sadiku, 2015, Elements of Electromagnetics, Asian Edition, Oxford Higher Education.


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B. Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Sessional-I | 30% |
| Sessional-II | 30% |
| Assignment/Tutorial | 20% |
| Class Work/ Quiz | 20% |

**Course articulation Matrix**

| CO Statement | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BPH-106.1 | 2 | 2 | 1 | 2 | 3 | - | - | - | - | - | 2 | 3 | 1 | 1 |
| BPH-106.2 | 3 | 1 | 3 | - | 2 | 1 | 1 | - | - | - | - | 3 | 1 | 1 |
| BPH-106.3 | 3 | 2 | 2 | - | 2 | 2 | 1 | - | - | - | - | 2 | 1 | 1 |
| BPH-106.4 | 3 | 3 | 3 | 1 | 1 | 3 | 1 | - | - | - | - | 3 | 1 | 1 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**

(Deemed to be University under section 3 of the UGC Act 1956)

**BMA-202: Mathematics-2**

**(Calculus, ordinary Differential Equations and Complex variables)**

| | |
|---|---|
| Credits 4 | Max. Marks : 200 |
| L-T-P 3-1-0 | Continuous Evaluation : 100 |
| Examination Duration 3hrs | End Semester Exam : 100 |

**Pre-requisites:** None
**Course Type:** Basic Sciences
**Course Coordinator:**

**Course Objectives:**
The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the outcomes are:

**BMA-202.1** Students will be able to solve linear differential equations.
**BMA-202.2** Students will be able to understand the calculus of complex variables and its transformation.
**BMA-202.3** Students will be able to apply the use of multivariate calculus in solving engineering problems.

**PART-A**

**Unit 1: Multivariable Calculus (Integration)**
1.1 Multiple Integration: Double integrals (Cartesian)
1.2 Change of order of integration in double integrals
1.3 Change of variables (Cartesian to polar)
1.4 Applications: areas and volumes, Center of mass and Gravity (constant and variable densities)
1.5 Triple integrals (Cartesian), orthogonal curvilinear coordinates
1.6 Simple applications involving cubes, sphere and rectangular parallelepipeds
1.7 Scalar line integrals, vector line integrals
1.8 Scalar surface integrals
1.9 Vector surface integrals
1.10 Theorems of Green, Gauss and Stokes.

**Unit 2: First Order Ordinary Differential Equations**
2.1 Exact, linear and Bernoulli's equations
2.2 Euler's equations
2.3 Equations not of first degree: equations solvable for p, equations solvable for y
2.4 Equations solvable for x and Clairaut's type.

**Unit 3: Ordinary Differential Equations of Higher Orders**
3.1 Second order linear differential equations with variable coefficients
3.2 Method of variation of parameters
3.3 Cauchy-Euler equation
3.4 Power series solutions: Legendre polynomials, Bessel functions of the first kind and their properties.

## PART-B

### Unit 4: Complex Variable – Differentiation

4.1 Differentiation, Cauchy-Riemann equations
4.2 Analytic functions, harmonic functions, finding harmonic conjugate
4.3 Elementary analytic functions (exponential, trigonometric, logarithm) and their properties
4.4 Conformal mappings, Mobius transformations and their properties.

### Unit 5: Complex Variable – Integration

5.1 Contour integrals, Cauchy-Goursat theorem (without proof)
5.2 Cauchy Integral formula (without proof)
5.3 Liouville's theorem and Maximum-Modulus theorem (without proof)
5.4 Taylor's series, zeros of analytic functions
5.5 Singularities, Laurent's series
5.6 Residues, Cauchy Residue theorem (without proof)
5.7 Evaluation of definite integral involving sine and cosine
5.8 Evaluation of certain improper integrals using the Bromwich contour.

**Suggested Text/Reference Books**


1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, $9^{th}$ Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, $9^{th}$ Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, $36^{th}$ Edition, 2010.


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering the entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each Unit). Students need to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment/Tutorial | 20% |
| Class Work/ Performance | 10% |
| Attendance | 10% |

**Course Articulation Matrix:**

| CO Statement ( BMA-202) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BMA-202.1 | 3 | 3 | 2 | 2 | 2 | -- | -- | -- | -- | -- | -- | 2 | -- | 2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BMA-202.2 | 3 | 3 | 2 | 2 | 2 | -- | -- | -- | -- | -- | -- | 1 | -- | 2 |
| BMA-202.3 | 3 | 3 | 2 | 2 | 3 | -- | -- | -- | -- | -- | -- | 2 | -- | 1 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

## BEE-103: BASICS of ELECTRICAL AND ELECTRONICS ENGINEERING

Credits 3 | Max. Marks : 200
L-T-P 3-0-0 | Continuous Evaluation : 100
Examination Duration 3hrs | End Semester Exam : 100

**Pre-requisites**
**Course Type: Engineering Science**

**Course Outcomes:** After completion of this course the students will be able to
BEE-103.1 understandthe basic electrical laws, theorems, components of electricalsystem, earthing and working of batteries.
BEE-103.2 apply thebasic theorems and laws for solving both dc and ac networks.
BEE-103.3 learn the construction and working of transformers and electrical machines
BEE-103.4 understand the working of semiconductor devices and digital circuits

**PART-A**

**Unit 1: DC CIRCUITS (8 hours)**
1.1 Electrical circuit elements (R, L and C), voltage and current sources,
1.2 Kirchoff's Voltage and Current Laws,
1.3 Analysis of simple circuits ( two loops) with dc excitation ,
1.4 Superposition Theorem,
1.5 Thevenin's Theorem,
1.6 Norton's Theorem,
1.7 Time domain analysis of first order system- RL circuit,
1.8 Time domain analysis of first order system- RC circuit.

**Unit 2: AC CIRCUITS (7 hours)**
2.1 Single Phase-AC Generation,
2.2 Sinusoidal Waveform- peak value average and rms values
2.3 Phasor representation, L, C, RL, RC circuit
2.4 RLC Series Circuits
2.5 Power factor, Real power, Reactive power and Apparent power
2.6 Resonance
2.7 Three Phase Emf Generation, Delta and Star Connections
2.8 Voltage and current relation in star and delta connections

**Unit 3: TRANSFORMERS AND ELECTRICAL MACHINES (7 hours)**
3.1Working Principle, Construction and Emf Equation of transformer
3.2 Ideal and Practical transformer,
3.3 Losses and Efficiency of transformer
3.4 Construction and working of DC motor and generator
3.5 Speed Control of Dc shunt motor
3.6 Construction and working of a three-phase induction motor
3.7 Single-phase induction motor working and types

**PART-B**

**Unit 4: SEMICONDUCTOR DEVICES (6 hours)**
4.1 Power semiconductor devices- power diodes, Bipolar transistor,
4.2 Field Effect transistor, MOSFET, IGBT
4.3 SCR-VI characteristics, and gate characteristics
4.4 Introduction to Power Converters -Diode rectifier, controlled rectifier
4.5 Inverter, DC to DC converters

**Unit 5: DIGITAL CIRCUITS (7 hours)**

5.1 Number systems
5.2 conversion of bases (Binary, Decimal, Hexa, Octal),
5.3,Basic logic gates, AND OR, NAND , NOR –truth tables
5.4 Boolean algebra,
5.5De Morgan's theorem
5.6Introduction to flip-flops SR,JK, D type,
5.7 Introduction to Counters and Shift registers

**Unit 6: ELECTRICAL INSTALLATIONS and BATTERIES (5 hours)**

6.1Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB,
6.2 Necessity and Standards of earthing, Methods of Earthing
6.3 Types of Batteries, capacity and efficiency (ampere hour and watt hour)
6.4Working of Lead Acid Battery, Charging and Discharging
6.5Working of Nickel Cadmium battery
6.6Working of Lithium Ion Battery

**Text Books/ Reference Books:**

1 J. Nagrath, D. P. Kothari ,2007, Basic Electrical Engineering, TMH.
2 S. NathChakrabarti, C. K. Chanda , 2009, Basic Electrical Engineering, TMH,2009.
3 B. L. Thereja , 2005, Electrical Technology Vol.1, S Chand.
4 S K Sahadev ,2015, Basic Electrical Engineering, Pearson India
5 V. N. Mittal, Aravind Mittal, 2007, Basic Electrical Engineering,TMH 2007.
6 SantiramKal, 2002, Basic Electronics- Devices, Circuits and it Fundamentals, Prentice Hall, India.
7 T. L. Floyd (2017), Digital Fundamentals, Pearson Education.
8 H. C. Rai, (2018) Power Electronics and Industrial Applications, CBS Publications
9 S.M. Sze, M.K. Lee, (2015), Semiconductor Devices,Physics and Technology, Wiley
10 V K Mehta, R Mehta 2014, Principles of Electronics, S Chand.

**Software required/Weblinks**

https://nptel.ac.in/courses/108105112
https://nptel.ac.in/courses/108108076/
https://nptel.ac.in/courses/108106181
https://nptel.ac.in/courses/108105113

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B. Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BEE- | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BEE- | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BEE- | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BEE- | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 2 | 1 |

**MANAVRACHNAINTERNATIONALINSTITUTEOFRESEARCH&STUDIES**

(DeemedtobeUniversityunder section3of theUGCAct1956)

**BME-101A:ENGINEERING GRAPHICS & DESIGN**

Credits 2 | Max. Marks : 200
L-T-P 0-0-4 | Continuous Evaluation : 100
Examination Duration 3hrs | End Semester Exam : 100

**Prerequisites:**
**CourseType:EngineeringScienceCourse**

**CourseOutcomes:**
**Aftercompletionofthiscoursethestudentswillbeableto**

BME-101A.1 understandtheroleandimportanceof EngineeringGraphics,design/draftingincognitivedevelopment.

BME-101A.2

conceptualize

BME-101A.3 visualize objects with the help of engineering principles, projection theories including theirapplicationstosolveproblemsrelatedtoengineeringandproduction.

BME-101A.4 developcapabilityofunderstandingengineeringdrawingproblemsandimplementationofrespectivesolution.

BME-101A.5 developcapabilityofselectionofsolutionsforagivendesign problem.

BME-101A.6 develop of capability of designing a product or assembly with its various components withasystematicdesignapproach

**Theory (Detailed Content)TraditionalEngineeringGraphics**:

Principleso f EngineeringGraphics;OrthographicProjection;DescriptiveGeometry;DrawingPrinciples;IsometricProjection;SurfaceDevelopment;Perspective;ReadingaDrawing; SectionalViews;Dimensioning&Tolerances;TrueLength,Angle;intersection, ShortestDistance.

(**Except the basic essential concepts, most of the teaching part can happen concurrently inthelaboratory**)

**Part-A**

**Unit1:IntroductiontoEngineeringDrawing,OrthographicProjections**
Principles of Engineering Graphics and their significance, usage of drawing instruments,lettering,ConicsectionsincludingtheRectangularHyperbola(Generalmethodonly);Cycloid,Epicycloid,HypocycloidandInvolute;Scales–Plain,DiagonalandVernierScales;PrinciplesofOrthographicProjections-Conventions - Projections of Points and lines inclined to both planes; Projections of planesinclinedPlanes-Auxiliary Planes;

**Unit 2: Projections of Regular Solids & Sections and Sectional Views of Right Angular Solids**Inclined tobothethePlanes-

AuxiliaryViews;Drawsimpleannotation,dimensioningandscale.Floorplansthatinclude: windows, doors,andfixturessuchas WC,bath,sink, shower,etc.
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids-Prism, Pyramid, Cylinder and Cone; draw the sectional orthographic views of geometrical solids, objectsfromindustry anddwellings(foundationtoslabonly).

**Unit3:IsometricProjections**
PrinciplesofIsometricprojection–IsometricScale,IsometricViews,Conventions;Isometric Viewsoflines,Planes,SimpleandcompoundSolids;ConversionofIsometric ViewstoOrthographicViewsandVice-versa,Conventions;

**Theory (Detailed Content)ComputerGraphics**

EngineeringGraphicsSoftware;-SpatialTransformations;OrthographicProjections;ModelViewing;Co-ordinateSystems;Multi-viewProjection;ExplodedAssembly;ModelViewing;Animation;SpatialManipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)(**Exceptthebasicessentialconcepts,mostoftheteachingpartcanhappenconcurrentlyinthelaboratory**)

**Part-B**

**Unit4:OverviewofComputerGraphics,Customization&CADDrawing**

Listing the computer technologies that impact on graphical communication, Demonstratingknowledge ofthe theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw,Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes andwindows,Shortcutmenus(ButtonBars),TheCommandLine(whereapplicable),TheStatusBar,Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes,Simple and compound Solids;consisting of set up of the drawing page and the printer, including scalesettings, Setting up of units and drawinglimits; ISO andANSIstandards for coordinate dimensioningandtolerancing; Orthographic constraints, Snap to objects manually and automatically;Producing drawings by using various coordinate input entry methods to draw straight lines,Applyingvariouswaysofdrawingcircles;

**Unit5:Annotations,layering,otherfunctions**
Applying dimensions to objects, applying annotations to drawings; Setting up and use ofLayers, layers tocreatedrawings,Create,editandusecustomized layers;Changinglinelengthsthrough modifyingexistinglines (extend/lengthen); Printing documents to paper using the print command; orthographicprojectiontechniques;Drawingsectionalviewsofcompositerightregulargeometricsolidsandprojectthe true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) softwaremodeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models.Part editing and two-dimensional documentation of models.Planar projection theory, including sketchingofperspective,isometric,multiview,auxiliary,andsectionviews.Spatialvisualizationexercises.Dimensioningguidelines,tolerancingtechniques;dimensioningandscalemultiviewsofdwelling;

**Unit6:Demonstrationofasimpleteamdesignproject**
Geometryandtopologyofengineeredcomponents:creationofengineeringmodelsan dtheirpresentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologiesfor engineering analysis and tool-path generation for component manufacture; geometric dimensioningand tolerancing; Use of solid-modeling software for creating associative models at the component andassembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower,etc. Applying color coding according to building drawing practice; Drawing sectional elevation showingfoundationto ceiling;IntroductiontoBuildingInformationModelling(BIM).

**TextBooks:**

1. BhattN.D.,PanchalV.M.&IngleP.R.,(2014),EngineeringDrawing,CharotarPublishingHouse
2. Shah,M.B.&RanaB.C. (2008),EngineeringDrawingandComputerGraphics,PearsonEducation
3. (Correspondingsetof)CADSoftwareTheoryandUserManuals

**Reference Books:**

1. AgrawalB. &AgrawalC. M. (2012),EngineeringGraphics, TMHPublication
2. Narayana,K.L.&PKannaiah(2008),TextbookonEngineeringDrawing, ScitechPublishers

**Weblinks:**

**https://nptel.ac.in/courses/112104172/**

**AssessmentTools:**

Surprise questions during lab/Class PerformanceTermend examination/viva

**CourseArticulationMatrix**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BME-101A.1** | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 3 | 3 | 3 |
| **BME-101A.2** | 2 | 2 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| **BME-101A.3** | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 3 | 2 | 2 | 2 | 3 | 3 |
| **BME-101A.4** | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 3 | 3 |
| **BME-101A.5** | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 3 | - |
| **BME-101A.6** | 2 | 1 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | - | - |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCS-100A: Artificial Intelligence for Engineers**

Credits 2 | Max. Marks : 200
L-T-P 2-0-0 | Continuous Evaluation : 100
Examination Duration 3hrs | End Semester Exam : 100

**Pre-Requisite: None**

**Course Type: Engineering Science Course**

**Course Outcomes:** The Students will be able-

BCS-100A.1 To understand evolution of Artificial Intelligence.

BCS-100A.2 To familiarize with artificial intelligence problems and their formulations.

BCS-100A.3 To Understand Intelligent system, Agents & its environment.

BCS-100A.4 To understand applications of artificial intelligence.

**Unit-1: AI Introduction, Background and History**

1.1 Introduction to AI
1.2 Foundations of AI
1.3 AI Evolution
1.4 Introduction to AI programming languages

**Unit-2: AI Problem Formulation**

2.1 AI problem formulation
2.2 Problem characteristics
2.3 Production System
2.4 Production System characteristics

**Unit 3: Intelligent System & Agents**

3.1 Introduction to intelligence system
3.2 Types of Intelligence
3.3 Difference between Human and Machine learning
3.4 Introduction to Agent & environment
3.5 Structure of Intelligent Agent
3.6 Nature and Properties of Environment.

**Unit-4: AI Applications**

4.1 Robotics
4.2 Natural Language Processing
4.3 Computer Vision
4.4 Health Care
4.5 Education
4.6 Expert System

**Text Books / Reference Books:**


1. Elain Rich and Kevin Knight (2009), Artificial Intelligence, 3rd edition, Tata McGraw Hill.
2. Stuart J.Russel and Peter Norvig (2009), Artificial Intelligence-A modern approach: 3rd edition, Pearson.

3. Patrick Henry Winston (1992), Artificial Intelligence , 3rdedition, , Pearson.
4. George F Luger, (2009), Artificial Intelligence : Structures and Strategies for Complex Problem Solving , University of New Mexico,6th edition, Pearson.
5. V S Janakiraman, Parerback (2005), Foundations of Artificial Intelligence And Expert Systems : 3rd edition, Macmillan India Limited

**Software required/Weblinks:**

http://artint.info/html/ArtInt_351.html

http://www.tutorialspoint.com/artificial_intelligence/

http://www.compinfo-center.com/tpai-t.htm

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**COURSE ARTICULATION MATRIX:**

| **CO Statement (BCS-100A)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCS-100A.1 | 2 | 2 | 1 | 2 | | | | | | | | | 2 | 2 |
| BCS-100A.2 | 2 | 3 | 2 | 3 | | | | | | | | | 2 | 2 |
| BCS-100A.3 | 3 | 2 | 2 | 2 | | | | | | | | | 3 | 3 |
| BCS-100A.4 | 3 | 3 | 2 | 3 | | | | | | | | | 2 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**

(Deemed to be University under section 3 of the UGC Act 1956)

**BPH-151A: PHYSICS LAB**

Credits 1 | Max. Marks : 100
L-T-P 0-0-2 | Continuous Evaluation : 50
Examination Duration 2hrs | End Semester Exam : 50

**Co-requisite: Physics for Engineers**
**Course Type: Basic Sciences Courses**

**Course Outcomes:** The students will be able to:

BPH-151A.1 calculate zero error, least count, maximum percentage error, percentage error and understand their importance
BPH-151A.2 understand the principle, concept and working of the experiments
BPH-151A.3 rearrange/assemble the different components of a device or a circuit
BPH-151A.4 describe the methodology of science and the relationship between observation and theory

**List of Experiments:**

1. To calculate the hysteresis loss and magnetic susceptibility by tracing B- H curve. (CO 2,3)
2. To determine the value of Planck's constant h by a photo cell. (CO 1,2,3,4)
3. To determine the grating element of a given grating by using LASER. (CO 1,2,4)
4. To study Hall Effect in a semiconductor and to find (i) Hall voltage and Hall coefficient (ii) number of charge carriers per unit volume (iii) mobility. (CO 2,3,4)
5. To draw the characteristics of a solar cell and to find the fill factor. (CO 1,2,3,4)
6. To find the band gap of an intrinsic semiconductor using four probe method. (CO 1,2,3,4)
7. To draw the V-I characteristics of a PIN diode. (CO 2,3,4)
8. To determine numerical aperture of an optical fibre. (CO 2,4)
9. To determine the volume magnetic susceptibility of manganese sulphate solution at different concentrations. (CO 1,2,3)
10. To find the charge to mass (e/m) ratio of an electron. (CO 1,2,3)
11. To study the resonance phenomena in LCR circuits. (CO 1,2,3)
12. To study the variation of magnetic field from Helmholtz coil. (CO 1,2,3)
13. To determine the moment of inertia of a flywheel. (CO 1,2,3)
14. To determine the Young's modulus of the material of a given beam supported on two knife-edges and loaded at the middle point. (CO 1,3)
15. To determine the Modulus of Rigidity of a wire by Maxwell's Needle. (CO 1,3)

**Text Books/References:**

1. S. L. Gupta & V. Kumar, Practical Physics, 2018, PragatiPrakashan.
2. S.L. Arora, B.SC, Practical Physics, 2010, S. Chand.
3. NPTEL video lectures for Experimental Physics.

**Instructions for Exam:** One experiment out of 10 given randomly needs to be performed in exams.

**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Viva-I | 30% |
| Viva-II | 30% |
| File/Records | 20% |
| Class Work/ Performance | 20% |

**Course articulation Matrix:**

| CO Statement | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BPH-151A.1 | 3 | 1 | | 1 | | | | 1 | 1 | 1 | | 3 | 1 | 1 |
| BPH-151A.2 | 2 | | 2 | | 2 | | | | 1 | 1 | | 2 | 1 | 2 |
| BPH-151A.3 | 2 | 3 | 2 | 3 | 3 | | | | 3 | | 1 | 3 | 2 | 2 |
| BPH-151A.4 | 3 | 1 | 2 | | 1 | | 1 | 1 | 1 | 1 | | 3 | 2 | 2 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

## BEE-151A: BASIC ELECTRICAL ENGINEERING LAB

| | |
|---|---|
| Credits 1 | Max. Marks : 100 |
| L-T-P 0-0-2 | Continuous Evaluation : 50 |
| Examination Duration 2hrs | End Semester Exam : 50 |

**Co-requisite: None**
**Course Type: ESC**
**Course Outcomes:** After completion of this course the students will be able to

BEE-151A.1 Familiarize with the measuring instruments, breadboard, CRO, components of LT installation

BEE-151A.2 Understand the transformers connection both single and three phase.

BEE-151A.3 Study the working principles of electric machines and power converters

BEE-151A.4 Design a simple PCB with software.

**LIST OF EXPERIMENTS:**

1. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors and verification of basic laws.
2. To measure the steady-state and transient time-response of R-L/R-L circuits to a step change in voltage (transient may be observed on a storage oscilloscope).
3. To examine sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage.
4. To find the resonance frequency inR-L-C circuits..
5. To observe the no-load current waveform of transformer on an oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
6. To perform Load test on a transformer: measurement of primary and secondary voltages and currents, and power.
7. To connect Three-phase transformers in Star and Delta and verify voltage and current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side and to measure three-phase power in balanced three-phase circuits.
8. Identification of various types of Printed Circuit Boards (PCB) and soldering techniques.
9. Introduction to PCB design software.
10. PCB Lab a) Artwork & printing of simple PCB b) Etching & drilling of PCB.

11. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine.
12. To draw Torque -Speed Characteristic of dc motor.
13. To find Synchronous speed of two and four-pole three-phase induction motors, check Direction reversal by change of phase-sequence of connections and to draw Torque-Slip Characteristic of an induction motor.
14. To Study components of LT, switchgear- MCB, ELCB, MCCB.
15. To Study DC-DC Converter.

**Text Books:**

Dr. N K Jain ,2010, A text book of Practicals in Electrical Engineering, Dhanpatrai Publishing Co.

**Instructions for Exam:** One experiment out of 10 given randomly needs to be performed in exams.

**Assessment Tools:**
File work/Class Performance 30 Marks
Rubrics/Viva 20 Marks
End Term Practical Examination 50 Marks

**COURSE ARTICULATION MATRIX**

| CO Statement (BEE-151A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BEE-151A.1 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BEE-151A.2 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BEE-151A.3 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BEE-151A.4 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 2 | 1 |

**MANAV RACHNA INTERNATIONAL INSTITUTES OF RESEARCH AND STUDIES**

(Deemed to be University under section 3 of UGC Act 1956)

**CDC-PC-102: Professional Communication - II**

Credits 2 | Max. Marks : 100

L-T-P 2-0-0 | Continuous Evaluation : 50

Examination Duration 2hrs | End Semester Exam : 50

**Pre-requisite: None**

**Course Type: HSMC**

**Course Outcomes:** By the end of this course the:

**CDC-PC-102.1**: Students will be able to exhibit effective reading and writing skills in a professionally stimulated environment.

**CDC-PC-102.2**: Students will be able to enhance skills to effectively deliver formal and informal presentations to a variety of audiences in multiple contexts.

**CDC-PC-102.3:** Students will be able to learn grammatically correct formal writing skills.

Unit 1: **Developing Communication Skills- II (Reading & Writing)**

1.1 Reading Comprehension

1.2 Writing Skills: Specific to AMCAT. Introduction to Writing: Organizing Principles of Paragraph, Precise Writing, Punctuations

1.3 Report Writing

1.4 Note Taking

Unit 2**: Syntactical English II**

2.1 Indianism& Localism

2.2 Conditionals

2.3 Preposition of Time & Place

Unit 3**: Effective Communication**

3.1 Concepts of Chronemics: Interpretation of time with business environment

3.2 Monochromic vs. Polychromic Cultures

3.3 Non- Verbal Communication: Kinesics & Proxemics

3.4 Acing virtual (video) interviews

Unit 4**: Presentation Skills**

4.1 Opening & closing of Presentations

4.2 Audience Analysis

4.3 Structuring the Presentation

4.4 Best Practice in Presentations

**Internal Marks Distribution:-**

| | |
|---|---|
| Sessional (Average of Sessional I & Sessional II) | 30 marks |
| Assignment | 10 marks |
| Class performance | 5 marks |

| | |
|---|---|
| Attendance | 5 marks |

**CourseArticulationMatrix**

| CO Statement (CDC-PC-102) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CDC-PC-102 .1 | - | - | - | - | - | - | - | - | - | 2 | - | 1 | - | - |
| CDC-PC-102 .2 | - | - | - | - | - | - | - | - | - | 3 | - | 1 | - | - |
| CDC-PC-102 .3 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BHM-MC-001: CONSTITUTION OF INDIA**

Credits AP
L-T-P 1-1-0
Examination Duration 2hrs

Max. Marks : 100
Continuous Evaluation : 50
End Semester Exam : 50

**Pre-requisite: None**
**Course Type:HSMC**

**Course Outcome**
**CO 1:** The students will be able to understand the principles and ideals of the Indian Constitution.
**CO 2:** The students will be introduced to constitutional design of state structures and institutions.
**CO 3:** The students will be able to understand the working of the state and its institutions.

.

**PART A**

Unit 1: The Constituent Assembly and the Constitution
- 1.1. Drafting of the Constitution
- 1.2. Philosophy and Features
- 1.3. Fundamental Rights and Directive Principles

Unit 2: The Legislature
- 2.1. Legislative Procedures in the Union Legislature
- 2.2. Comparative Analysis of the Powers of LokSabha and RajyaSabha
- 2.3. Influence of state legislatures on legislation

Unit 3: The Executive
- 3.1. Union Executive- Structure and Functions
- 3.2. Real Head and Formal Head of the state
- 3.3. Distribution of Executive Powers between the Union and the State

Unit 4: The Judiciary
- 4.1. Hierarchical Judicial Structure between Union and States
- 4.2. Functions and Powers
- 4.3. Independence of Judiciary
- 4.4. Judicial Activism, Judicial Review and Public Interest Litigation

**PART B**

Unit 5: Checks and Balances between the Organs of the Government
- 5.1. Passage of Money Bills
- 5.2. No-confidence Motion
- 5.3. Individual and Collective Responsibility of the Council of Ministers
- 5.4. Impeachment of President

Unit 6: Division of Powers between the Union and the State
- 6.1. Federalism
- 6.2. Inter-state Relations
- 6.3. Decentralization

**Text books/reference books:**


1. R. Bhargava, (2008) 'Introduction: Outline of a Political Theory of the Indian Constitution', in R. Bhargava (ed.) Politics and Ethics of the Indian Constitution, New Delhi: Oxford University Press, pp. 1-40.
2. G. Austin, (2000) 'The Social Revolution and the First Amendment', in Working a Democratic Constitution, New Delhi: Oxford University Press, pp. 69-98.
3. A. Sibal, (2010) 'From Niti to Nyaya,' Seminar, Issue 615, pp 28-34.
4. B. Shankar and V. Rodrigues, (2011) 'The Changing Conception of Representation: Issues, Concerns and Institutions', in The Indian Parliament: A Democracy at Work, New Delhi: Oxford University Press, pp. 105-173.
5. V. Hewitt and S. Rai, (2010) 'Parliament', in P. Mehta and N. Jayal (eds.) The Oxford Companion to Politics in India, New Delhi: Oxford University Press, pp. 28-42.
6. J. Manor, (2005) 'The Presidency', in D. Kapur and P. Mehta P. (eds.) Public Institutions in India, New Delhi: Oxford University Press, pp.105-127.
7. J. Manor, (1994) 'The Prime Minister and the President', in B. Dua and J. Manor (eds.) Nehru to the Nineties: The Changing Office of the Prime Minister in India, Vancouver: University of British Columbia Press, pp. 20-47.
8. U. Baxi, (2010) 'The Judiciary as a Resource for Indian Democracy', Seminar, Issue 615, pp. 61-67.
   R. Ramachandran, (2006) 'The Supreme Court and the Basic Structure Doctrine' in B. Kirpal et.al (eds.) Supreme but not Infallible: Essays in Honour of the Supreme Court of India, New Delhi: Oxford University Press, pp. 107-133.
9. M. Singh, and R. Saxena (eds.), (2011) 'Towards Greater Federalization,' in Indian Politics: Constitutional Foundations and Institutional Functioning, Delhi: PHI Learning Private Ltd., pp. 166-195.
10. V. Marwah, (1995) 'Use and Abuse of Emergency Powers: The Indian Experience', in B. Arora and D. Verney (eds.) Multiple Identities in a Single State: Indian Federalism in a Comparative Perspective, Delhi: Konark, pp. 136-159.

A. Sharma, (2010) 'The 1990s: Great Expectations'; 'The 2000s: Disillusionment Unfathomable', in Unbroken History of Broken Promises: Indian State and Tribal People, Delhi: Freedom Press and SahyogPustakKuteer, pp. 64-91.

11. P. deSouza, (2002) 'Decentralization and Local Government: The Second Wind of Democracy in India', in Z. Hasan, E. Sridharan and R. Sudarshan (eds.) India's Living Constitution: Ideas, Practices and Controversies, New Delhi: Permanent Black, pp. 370-404.
12. M. John, (2007) 'Women in Power? Gender, Caste and Politics of Local Urban Governance', in Economic and Political Weekly, Vol. 42(39), pp. 3986-3993.


**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment/Tutorial | 20% |
| Class Work/ Performance | 10% |
| Attendance | 10% |

# SEMESTER-III

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**PROJ-CE-300A: SUMMER INTERNSHIP-I**

Credits 1 | Max. Marks : 50
Practical/Week 2 | Continuous Evaluation : 50

**Prerequisites: None**
**Course Type: Project Work**

**Course Outcomes:** At the end of this course, the student will be able to:
PROJ-CE-300A.1. Identify various civil related software.
PROJ-CE-300A.2. Develop soft skills.
PROJ-CE-300A.3. Explore the various possibilities of a career in this field.
PROJ-CE-300A.4. Make use of basic Civil engineering Labs.
PROJ-CE-300A.5. Create reports on the undertaken lab work.

Every student will have to undergo 60 Hours Summer Internship over a period of 04 weeks in the Civil Engineering Department Labs. The training will comprise of session on the following areas:

- Soft skill development
- Innovation/ Entrepreneurship
- Civil Engineering Lab Work

The parameters for evaluation during the training shall be as under:

Presentation/Viva: 20 Marks
Report: 10 Marks
Class Performance: 10 marks
Attendance: 10 Marks
-------------
**50**

**ARTICULATION MATRIX**

| CO Statement (PROJ-CE-300A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROJ-CE-300A.1 | 1 | - | 3 | - | 1 | - | - | - | - | - | - | - | - | 2 |
| PROJ-CE-300A.2 | - | 1 | - | - | - | 1 | 1 | - | - | 2 | 2 | - | 2 | - |
| PROJ-CE-300A.3 | - | - | - | - | - | - | 1 | 1 | - | - | - | - | 1 | - |
| PROJ-CE-300A.4 | - | 2 | 2 | 2 | 1 | 2 | - | 2 | 2 | - | - | 1 | 1 | 2 |
| PROJ-CE-300A.5 | 2 | 2 | 2 | 2 | 1 | 1 | - | 2 | 1 | 3 | 2 | 2 | - | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-302A: ENGINEERING MECHANICS FOR CIVIL ENGINEERS

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 2-1-0 | Continuous Evaluation : 100 |
| Examination Duration 3hrs | End Semester Exam : 100 |

**Prerequisites: None**
**Course Type: Core**

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

| | |
|---|---|
| BCE-DS-302A.1 | Use scalar and vector analytical techniques for analysing forces in statically determinate structures |
| BCE-DS-302A.2 | Apply fundamental concepts of Engineering mechanics to the analysis of simple, practical problems |
| BCE-DS-302A.3 | Analyse basic beams and trusses using statics concepts |
| BCE-DS-302A.4 | Correlate basic dynamics concepts – force, momentum, work and energy |
| BCE-DS-302A.5 | Associate other basic dynamics concepts - the Work-Energy principle, Impulse-Momentum principle, the coefficient of restitution and simple harmonic motion. |
| BCE-DS-302A.6 | Createsystem problems in general plane motion based on concepts of mechanics(Euler's Equation and considering energy of a system in general plane motion, and the work of couples and moments of forces) |

**PART-A**

**Unit 1: Introduction to Engineering Mechanics**

1.1 Force Systems
1.2 Particle equilibrium in 2-D& 3-D; Rigid Body equilibrium
1.3 Resultant- Moment of Forces and its Application; Couples and Resultant of Force System
1.4 Equilibrium of System of Forces; FBDs; Equations of Equilibrium of Coplanar Systems and Spatial Systems
1.5 Static Indeterminacy
1.6 Friction, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction
1.7 Motion of Bodies, wedge friction, screw jack & differential screw jack

**Unit 2: Basic Structural Analysis**

2.1 Equilibrium in three dimensions; Simple Trusses
2.2 Method of Sections; Method of Joints
2.3 Beams & types of beams; Frames & Machines;
2.4 Centroid and Centre of Gravity, Centroid of simple figures from first principle
2.5 Centroid of composite sections;
2.6 Area moment of inertia- Definition, Moment of inertia of plane sections from first principles
2.7 Theorems of moment of inertia, Moment of inertia of standard sections and composite sections
2.8 Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

**Unit 3: Virtual Work and Energy Method**

3.1 Virtual displacements

3.2 Principle of virtual work for particle and ideal system of rigid bodies
3.3 Degrees of freedom
3.4 Active force diagram, systems with friction, mechanical efficiency
3.5 Conservative forces and potential energy (elastic and gravitational)
3.6 Energy equation for equilibrium
3.7 Applications of energy method for equilibrium; Stability of equilibrium.

**PART-B**

**Unit 4: Review of particle dynamics**

4.1 Rectilinear motion
4.2 Plane curvilinear motion (rectangular, path, and polar coordinates)
4.3 Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates)
4.4 Work-kinetic energy, power, potential energy
4.5 Impulse-momentum (linear, angular)
4.6 Impact (Direct and oblique)

**Unit 5: Introduction to Kinetics of Rigid Bodies**

5.1 Basic terms, general principles in dynamics
5.2 Types of motion, Instantaneous centre of rotation in plane motion and simple problems
5.3 D'Alembert's principle and its applications in plane motion and connected bodies
5.4 Work energy principle and its application in plane motion of connected bodies
5.5 Kinetics of rigid body rotation

**Unit 6: Mechanical Vibrations**

6.1 Basic terminology, free and forced vibrations
6.2 Resonance and its effects
6.3 Degree of freedom; single degree of freedom system
6.4 Derivation for frequency and amplitude of free vibrations without damping
6.5 Simple problems, types of pendulum, use of simple, compound and torsion pendulums.

**Text/Reference Books:**

1. I. H. Shames, 2006, Engineering Mechanics, 4th Edition, Prentice Hall.
2. F. P. Beer and E. R. Johnston, 2011, Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Edition, Tata McGraw Hill.
3. R. C. Hibbler, 2006, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. A.Ruina and Rudra Pratap, 2011, Introduction to Statics and Dynamics, Oxford University Press.
5. Shanes and Rao, 2006, Engineering Mechanics, Pearson Education.
6. Hibler and Gupta, 2010,Engineering Mechanics: Statics, Dynamics, Pearson Education.
7. Reddy Vijay Kumar K. and K. Suresh Kumar,2010, Singer's Engineering Mechanics.
8. R. K. Bansal, 2010, A Text Book of Engineering Mechanics, Laxmi Publications.
9. R.S. Khurmi, 2010, Engineering Mechanics, S. Chand & Co.
10. A.K. Tayal, 2010, Engineering Mechanics, Umesh Publications.

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

**Course Articulation Matrix**

| **CO Statement ( BCE-DS - 302A)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-302A.1 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | - | 3 | 3 | 2 |
| BCE-DS-302A.2 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | - | 3 | 2 | 3 |
| BCE-DS-302A.3 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | - | 3 | 2 | 3 |
| BCE-DS-302A.4 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | - | 3 | 2 | 3 |
| BCE-DS-302A.5 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | 1 | 1 | - | 3 | 3 | 3 |
| BCE-DS-302A.6 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-303: DISASTER PREPAREDNESS & PLANNING**

| | |
|---|---|
| Credits 2 | Max. Marks : 200 |
| L-T-P 2-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Prerequisites: None**
**Course Type: Core**

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

BCE-DS-303.1 Learn use of basic concepts of disaster management
BCE-DS-303.2 Interpret definitions and terminologies used in disaster management
BCE-DS-303.3 Relate to type and categories of disasters and their impacts
BCE-DS-303.4 Analyze relationship between development and disasters
BCE-DS-303.5 Correlate the challenges posed by various disasters
BCE-DS-303.6 Predict responsibility of stakeholders

**PART-A**

**Unit 1: Introduction**

1.1 Introduction - Concepts and definitions
1.2 disaster, hazard, vulnerability, risks severity
1.3 frequency and details, capacity, impact
1.4 prevention, mitigation.

**Unit 2: Disaster Classification**

2.1 Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.)
2.2 manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.)
2.3 hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

**Unit 3: Disaster Impacts**

3.1 Disaster impacts (environmental, physical, social, ecological, economic, political, etc.);
3.2 health, psycho-social issues; demographic aspects (gender, age, special needs);
3.3 hazard locations; global and national disaster trends;
3.4 climate change and urban disasters.

**PART-B**

**Unit 4: Disaster Risk Reduction (DRR)**

4.1 Disaster management cycle – its phases;
4.2 prevention, mitigation, preparedness,
4.3 relief and recovery; structural and non-structural measures;
4.4 risk analysis, vulnerability and capacity assessment;

4.5 early warning systems,
4.6 Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications)

**Unit 5: Stakeholder Responsibility**
5.1 Roles and responsibilities of government,
5.2 Community, local institutions, NGOs and other stakeholders;
5.3 Policies and legislation for disaster risk reduction,
5.4 DRRprogrammes in India and the activities of National Disaster Management Authority.

**Unit-6: Disaster Vulnerability**
6.1 Disasters, Environment and Development
6.2 Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.)
6.3 sustainable and environmental friendly recovery
6.4 reconstruction and development methods.

**Text Books/ Reference Books:**


1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. B.K. Singh, 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
3. G.K. Ghosh, 2006, Disaster Management, APH Publishing Corporation.
4. Disaster Medical Systems Guidelines, 2003, Emergency Medical Services Authority, State of California, EMSA no.214.
5. Inter Agency Standing Committee, 2007, IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings, Geneva.


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**COURSE ATRICULATION MATRIX**

| CO Statement (BCE-DS-303 ) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-303.1 | 2 | - | 1 | - | - | 2 | 3 | 2 | - | - | - | - | 3 | 2 |
| BCE-DS-303.2 | - | 1 | - | - | - | - | 2 | | - | - | - | - | 2 | 3 |
| BCE-DS-303.3 | - | - | - | - | 2 | - | - | - | - | 3 | 2 | - | 3 | 2 |
| BCE-DS-303.4 | - | - | - | 2 | | - | - | 3 | 2 | 3 | - | - | 3 | 3 |
| BCE-DS-303.5 | - | - | - | - | - | - | - | 3 | - | - | - | 2 | 3 | 2 |
| BCE-DS-303.6 | 2 | | 1 | - | - | 2 | 3 | 2 | - | - | - | - | 3 | 2 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-403 SURVEYING & GEOMATICS

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 2-1-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Core**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-403.1. Apply the basic Principles of surveying and leveling into related fields
BCE-DS-403.2. Use the concept of Triangulation and Trilateration to surveying
BCE-DS-403.3. Differentiate methods of analysis of various types of curves and its field applications
BCE-DS-403.4. Explain modern field survey systems with its basic principles
BCE-DS-403.5. Make use of Photogrammetry Surveying for photographic mapping
BCE-DS-403.6. Relate to the basic concepts and uses of Remote Sensing

### PART-A

**Unit 1: Introduction to Surveying**
1.1 Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines
1.2 Levelling: Plane table surveying, Principles of leveling, booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning
1.3 Digital and Auto Level, Errors in leveling
1.4 Contouring: Characteristics, methods, uses; areas and volumes

**Unit 2: Triangulation and Trilateration**
2.1 Theodolite survey: Instruments, Measurement of horizontal and vertical angle
2.2 Horizontal and vertical control, methods, triangulation, network Signals
2.3 Baseline, choices instruments and accessories, extension of base lines, corrections, Satellite station reduction to centre
2.4 Intervisibility of height and distances, Trigonometric leveling, Axis single corrections

**Unit 3: Curves**
3.1 Elements of simple and compound curves
3.2 Method of setting out, Elements of Reverse curve
3.3 Transition curve, length of curve, Elements of transition curve
3.4 Vertical curves

### PART-B

**Unit 4: Modern Field Survey Systems**
4.1 Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments
4.2 Distomat, Total Station, Parts of a Total Station, Accessories, Advantages and Applications
4.3 Field Procedure for total station survey, Errors in Total Station Survey
4.4 Global Positioning Systems- Segments, GPS measurements, errors and biases
4.5 Surveying with GPS, Co-ordinate transformation, accuracy considerations

**Unit 5: Photogrammetry Surveying**

5.1 Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements

5.2 Terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping

5.3 Aerial triangulation, radial triangulation, methods; photographic mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes

**Unit 6: Remote Sensing**

6.1 Introduction Electromagnetic Spectrum

6.2 Interaction of electromagnetic radiation with the atmosphere and earth surface

6.3 Remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing

**Text Books/ Reference Books:**

1. N. Madhu, RSathikumar, and S. Gobi, 2006, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson, India.
2. Manoj, K. Arora and Badjatia, 2011,Geomatics Engineering, Nem Chand & Bros.
3. S.S. Bhavikatti, 2010,Surveying and Levelling, Vol. I and II, I.K. International.
4. A.M. Chandra, 2002, Higher Surveying, Third Edition, New Age International (P) Limited.
5. Anji Reddy, 2001, Remote sensing and Geographical information system, B.S. Publications.
6. K.R. Arora, 2015, Surveying, Vol-I, II and III, Standard Book House.

**Software required/Weblinks:**

https://nptel.ac.in/courses/105107122/1
https://nptel.ac.in/courses/105104101/
https://nptel.ac.in/syllabus/105104100/
https://nptel.ac.in/courses/105104100/43

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS 403) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-403.1 | 3 | 3 | 3 | 1 | 2 | - | - | - | 2 | 3 | - | - | 3 | 2 |
| BCE-DS-403.2 | 3 | 3 | 3 | 3 | 2 | - | - | - | 3 | 3 | 2 | - | 3 | 3 |
| BCE-DS-403.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | 3 | 3 | - | - | 3 | 2 |
| BCE-DS-403.4 | 3 | 3 | 3 | 2 | 2 | - | - | - | 2 | 2 | 2 | 2 | 3 | 3 |
| BCE-DS-403.5 | 2 | 2 | 3 | 1 | 3 | **-** | **-** | **-** | 3 | 3 | 2 | - | 3 | 2 |
| BCE-DS-403.6 | 2 | 2 | 3 | 3 | 3 | - | - | - | 3 | 3 | 3 | 2 | 2 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-304: Smart Infrastructure Engineering**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Core**
**Course Outcomes:** At the end of this course, the student will be able to:

BCE-DS-304.1 Understand the concept of Smart Infrastructure
BCE-DS-304.2 Apply the concept of Smart Transportation System
BCE-DS-304.3 Understand Smart Waste Management System
BCE-DS-304.4 Understand Automation in Construction Industry
BCE-DS-304.5 Apply the knowledge of Smart Sustainable Construction Materials in Smart Infrastructure
BCE-DS-304.6 Understand challenges in developing Smart Cities

**PART A**

**Unit 1:Introduction to Smart Infrastructure**

1.1 Concept of Smart Infrastructure

1.2 Components of Smart Infrastructure

1.3 Correlation of Sensor Technology and IoT

1.4 Opportunities and Perspective of Urban Planning

**Unit 2:Smart Transportation System**

2.1 Introduction to Smart Transportation Systems

2.2 Self – Driving Transportation Services: Vehicles, Bus Services, Streets

2.3 Smart Mobility and Delivery Systems

2.4 Concept and Technologies for Smart Railway Systems

**Unit 3: Smart Waste Management System**

3.1 Concept and Components of Smart Waste Management Systems

3.2 IoT Enabled Smart Waste Management System

3.3 Correlation of SDGs with Smart Waste Management System

3.4 Concept, Application and Scope of E – Waste Management System.

**PART B**

**Unit 4: Smart Construction Industry**

4.1 Scope of Automation in Construction Industry

4.2 Concept and Applications of 3D Printing

4.3 Autonomous Machines on the Construction Site

4.4 Working Principle and Application of Drone Surveying on Construction Site

4.5 Virtual Reality During Project Planning and Training

**Unit 5:Smart Materials**

5.1 Introduction to Smart Materials and Structures

5.2 Types of Smart Materials used in Construction Industry

5.3 Smart Concrete

5.4 Polymers, Coatings, Shape Shifting Metals, Transparent Metals and Aerogels

**Unit 6:Challenges towards Smart Cities**

6.1 Challenges on Smart Buildings

6.2 Challenges on Services

6.3 Challenges for Policy Makers

6.4 Case Studies

**Text Books/ Reference Books:**

1. N. Mani, 2016, Smart Cities & Urban Development in India, John Willey & Sons.
2. Jeschke,R. Srivasan , 2017, Smart Cities: Foundations, Principles, and Applications, Oxford press.
3. Alan R. Shark , SylvianeToporkoff, Sebastien Levy, 2014, Smart Cities for Bright Sustainable Future: A Global Perspective, Wiley
4. ImrichChlamtac, Iyad Katib, Rashid Mehmood, Simon See, 2019, Smart Infrastructure and Applications: Foundations for Smarter Cities and Societies, Springer.

**Software required/Weblinks:**

1. https://onlinecourses.nptel.ac.in/noc19_ce31/preview
2. https://nptel.ac.in/courses/124105016

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix :**

| CO Statement (BCE-DS-304) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-304.1 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-304.2 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-304.3 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| BCE-DS-304.4 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 |
| BCE-DS-304.5 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 3 | 2 |
| BCE-DS-304.6 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-351A: Computer-aided Civil Engineering Drawing Lab**

| | | | |
|---|---|---|---|
| Credits | 2 | Max. Marks | : 200 |
| L-T-P | 0-0-4 | Continuous Evaluation | : 100 |
| Examination Duration | 2 hrs | End Semester Exam | : 100 |

**Pre-requisite: None**
**Course Type: Core**

**Course Outcomes:**At the end of this course, the student will be able to-
BCE-DS-351A. 1 Develop graphical skills for communicating concepts, ideas and designs of engineering products graphically/ visually.
BCE-DS-351A. 2 Interpret Parametric design and the conventions of formal engineering drawing
BCE-DS-351A. 3 Produce 2D & 3D drawings
BCE-DS-351A. 4 Examine a design critically and with understanding of CAD

**List of Drawing Experiments:**
1. Drafting a Plan of a typical residential building using Autocad
2. Taking standard drawings of a typical two storeyed building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 500 -700 words.
3. RCC framed structures
4. Reinforcement drawings for typical slabs, beams, columns and spread footings.
5. Industrial buildings - North light roof structures - Trusses
6. Perspective view of one and two storey buildings

**Text/Reference Books:**

1. Subhash C Sharma &Gurucharan Singh (2005), "Civil Engineering Drawing", Standard Publishers
2. Ajeet Singh (2002), "Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, New Delhi
3. Sham TickooSwapna D (2009), "AUTOCAD for Engineers and Designers", Pearson Education,
4. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt. Ltd.,
5. Balagopal and Prabhu (1987), "Building Drawing and Detailing", Spades publishing KDR building, Calicut,
6. (Corresponding set of) CAD Software Theory and User Manuals.
7. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd New Asian.
8. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria& Sons.


**Assessment Tools:**
Viva Voce
Lab Work
Lab Records

**Distribution of Continuous evaluation table**

| Parameter | Weightage |
|---|---|
| **Two Mid-Term Viva** | **60%** |
| **File/Record Keeping** | **20%** |
| **Class Performance** | **10%** |
| **Class Attendance** | **10%** |

**Course Articulation Matrix**

| CO Statement ( BCE-DS-351A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-351A.1 | 1 | 1 | 2 | 1 | - | 1 | 3 | 1 | - | - | - | 2 | 3 | 2 |
| BCE-DS-351A.2 | 1 | 2 | 2 | 1 | - | 3 | 3 | 1 | - | - | - | 1 | 2 | 3 |
| BCE-DS-351A.3 | 1 | 1 | 2 | 1 | 2 | 3 | 1 | 2 | 2 | 2 | - | - | 2 | 3 |
| BCE-DS-351A.4 | 1 | 1 | 2 | 1 | - | 3 | 3 | 2 | - | - | 1 | 1 | 1 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-453 SURVEYING & GEOMATICS LAB

| | |
|---|---|
| Credits 1 | Max. Marks : 100 |
| L-T-P 0-0-2 | Continuous Evaluation : 50 |
| Examination Duration 2 hrs | End Semester Exam : 50 |

**Co-requisite: Surveying & Geomatics (BCE-DS-403)**
**Course Type: Core**

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

BCE-DS-453.1. Use conventional surveying tools such as chain/tape, compass, plane table
BCE-DS-453.2. Demonstrate leveling to the field of civil engineering applications such as structural plotting, highway profiling and contouring
BCE-DS-453.3. Apply the procedures involved in field work and to work as a surveying team
BCE-DS-453.4. Take accurate linear and angular measurements
BCE-DS-453.5. Plot traverses to determine the location of points and coordinates present in the field.
BCE-DS-453.6. Make use of modern techniques and tools in the field of civil engineering applications such as plotting and measuring

**List of Experiments:**

1. Determination of area by chain & cross staff surveying.
2. Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angle.
3. Fixing bench mark with respect to temporary bench mark with dumpy level by fly leveling and check levelling.
4. Profile levelling and plotting of L-Section and cross section of road.
5. Contouring and plotting
6. Measurement of angles using theodolite.
7. Measurement of vertical angles by tangential and stadia methods.
8. Method of plane table surveying
9. Setting out of Horizontal curve
10. Traversing with Total Station
11. Measure the coordinates by using hand GPS
12. GIS and Autocad plotting

**Text Books/ Reference Books:**


1. N. Madhu N, Sathikumar, R and Satheesh Gobi, 2006, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson, India.
2. S.S. Bhavikatti, 2010, Surveying and Levelling, Vol. I and II, I.K. International.
3. Anji M. Reddy, 2001, Remote sensing and Geographical information system, B.S. Publications.
4. K.R. Arora, 2015, Surveying, Vol-I, II and III, Standard Book House.
5. B.C. Punmia, Surveying Vol-I & II, Laxmi Publications (P) ltd.
6. S.K.Duggal, Surveying Vol-I & II, Tata McGraw Hill Pvt. Ltd.
7. James Anderson and Edward Mikhail, Surveying Theory and Practice, Mc Graw Hill.

**Software required/Weblinks:**

https://nptel.ac.in/courses/105107122/1
https://nptel.ac.in/courses/105104101/
https://nptel.ac.in/syllabus/105104100/
https://nptel.ac.in/courses/105104100/43

**Distribution of Continuous evaluation table**

| Parameter | Weightage |
|---|---|
| **Two Mid-Term Viva** | **60%** |
| **File/Record Keeping** | **20%** |
| **Class Performance** | **10%** |
| **Class Attendance** | **10%** |

**Assessment Tools:**

Viva Voce
Lab Work
Lab Records

**Course Articulation Matrix**

| CO Statement (BCE-DS 453) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-453.1 | 3 | 3 | 3 | 1 | 2 | - | - | - | 2 | 3 | - | - | 3 | 2 |
| BCE-DS-453.2 | 3 | 3 | 3 | 3 | 2 | - | - | - | 3 | 3 | 2 | - | 3 | 3 |
| BCE-DS-453.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | 3 | 3 | - | - | 3 | 2 |
| BCE-DS-453.4 | 3 | 3 | 3 | 2 | 2 | - | - | - | 2 | 2 | 2 | 2 | 3 | 3 |
| BCE-DS-453.5 | 2 | 2 | 3 | 1 | 3 | - | - | - | 3 | 3 | 2 | - | 3 | 2 |
| BCE-DS-453.6 | 2 | 2 | 3 | 3 | 3 | - | - | - | 3 | 3 | 3 | 2 | 2 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

### DTI -300: Design, Thinking and Innovation-I

| | | | |
|---|---|---|---|
| Credits | 1 | Max. Marks | : 50 |
| L-T-P | 0-1-0 | Continuous Evaluation | : 50 |
| Examination Duration | 3 hrs | End Semester Exam | : 0 |

**Pre-requisites: Nil**
**Course Type: Research & Training**

**Course Outcomes**:
DTI 300.1. To explore different sources for generating ideas for Research.
DTI 300.2. To understand the problem classification based on domain specific resources.
DTI 300.3. To realize the design thinking stages.
DTI 300.4. To present critical analysis of literature survey.

**Activity 1: Motivation**
- 1.1 Divergent thinking and brain storming
- 1.2 Creative process

**Activity 2: Introduction to Design Thinking**
- 2.1 Empathize Mode
  - 2.1.1 Discussions and deliberations
- 2.2 Define Mode
- 2.3 Ideate Mode
  - 2.3.1 Contemporary Relevance.
  - 2.3.2 Tools and techniques for generating ideas
  - 2.3.3 Idea Challenges

**Activity 3: Problem Classification**
- 3.1 Domain Classification.
- 3.2 Identification of Mentors

**Activity 4: Problem identification**
- 4.1 Literature survey and option analysis.
- 4.2 Feasibility study.
- 4.3 Formulation of problem statement.
- 4.4 Expected Outcome / Model of the problem.
- 4.5 Planning Matrix

**Activity 5: Presenting the Ideation**
- 5.1 Structuring and preparation of PPT
- 5.2 Review on presentation skills and content delivered
- 5.3 Incorporating the review comments.

**Course Articulation Matrix:**

| CO Statement (DTI-300) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DTI 300.1 | 1 | 2 | - | - | 1 | - | 2 | 3 | 3 | 3 | 2 | 2 | - | 3 |
| DTI 300.2 | 2 | 3 | - | - | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | - |
| DTI 300.3 | 3 | 3 | 1 | 2 | 3 | 2 | 2 | 3 | 2 | - | - | 2 | 2 | 2 |
| DTI 300.4 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 3 | - | 2 | 2 | 3 | - |

**'3' (Tick) or 'More' Substantial/High Correlation, '2' Moderate/Medium Correlation, '1' Slightly/Low Correlation, 'Blank' No Correlation**

**Evaluation Criteria:** The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

| S. No: | Parameters | Description | Marks | |
|---|---|---|---|---|
| **1.** | **Attendance** | Percentage of classes attended by the students | **5** | **5** |
| **2.** | **Continuous Performance** | Group participation and response of the students to a given task: | | **15** |
| | | Judge individual student in the group | **5** | |
| | | Meeting timelines as per activity plan | **10** | |
| **3.** | **Literature Review** | Student interaction with faculty mentors | **5** | **15** |
| | | Relevance of the topic | **3** | |
| | | Usage of Scientific Literature Databases. e.g., Scopus/ Web of Science/ etc. | **2** | |
| | | Number of relevant papers / design referred for the given topic | **5** | |
| **4.** | **PPT & Report** | Report structure and Slide sequence | **5** | **15** |
| | | Contribution of individual group member towards the presentation and report | **5** | |
| | | Scientific/Technical writing | **5** | |
| | | **Max. Marks** | **50** | **50** |

**References:**


1. http://nptel.ac.in/courses/121106007/
2. http://public.wsu.edu/~taflinge/research.html

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BHM-MC-004: QUANTITATIVE APTITUDE

| | | | |
|---|---|---|---|
| Credits | AP | Max. Marks | : 100 |
| L-T-P | 0-0-2 | Continuous Evaluation | : 50 |
| Examination Duration | 2hrs | End Semester Exam | : 50 |

**Prerequisite: None**
**Course Type: HSMC**

**Course Outcomes:**At the end of this course, the student will be able to
BHM-MC-004.1. Recognize problems based on arithmetic & number system.
BHM-MC-004.2. Solve problems based on verbal reasoning & simplification.
BHM-MC-004.3. Calculate the correct answers to the problems within given time.
BHM-MC-004.4. Plan their career meticulously by setting their time oriented goals.
BHM-MC-004.5. Introspect and enhance their personality.
BHM-MC-004.6. Develop cultural sensitivity and communicate respectfully across cultures.

**PART-A**

**Unit 1: Number System 1**

1.1 Vedic Mathematics
- 1.1.1 Basic of mathematics
- 1.1.2 Addition and subtraction using Vedic Mathematics
- 1.1.3 Multiplication of two and three numbers.

1.2 Simplification
- 1.2.1 BODMAS rule
- 1.2.2 Fractions and recurring decimals
- 1.2.3 Surds and indices

1.3 Numbers
- 1.3.1 Types of numbers and number tree
- 1.3.2 Divisibility Rule
- 1.3.3 HCF & LCM

**Unit 2: Verbal Reasoning 1**

2.1 Direction Sense Test
2.2 Blood Relation Test

**Unit 3: Arithmetic 1**

3.1 Problem on Ages
3.2 Problem on Numbers
3.3 Averages

**PART- B**

**Unit 4: Career Planning**

4.1 **Career planningProcess** - Self Assessment, Research, Decision Making, Action and Employability
4.2 **Goal Setting:** Relevance, SMART goals, The Dos & Don'ts

**Unit 5: Personality Enhancement**

5.1 **Emotional Intelligence:** Emotional Self -Awareness, Self- Control, Emotional Management

5.2 **Stress Management:** What is Stress, Types of Stress, Stress Response Example, Vulnerability to Stress, Why do we Stress out, Stress Warning Symbols, Suggestions for Reducing Stress,

5.3 **Time Management:** Setting Priorities, Managing Time, Four Quadrants of Time Management

5.4. **Team Building:** Definition –Team, Characteristics of effective Teams, Competence, Clear and Compelling goal, Supportive Environment, Alignment, Designing the Team, Identifying Roles and Responsibilities, Determining Reward, Troubleshooting Guide, Good Team member

**Unit 6: Effective Communication**

6.1 **Courtesy in Communication:** Being Polite, Self -Discipline, Respecting Others and understanding other's perspective in communication

6.2 **Inter cultural Communication:** Breaking Stereotypes, Diversity Inclusion and Cultural Sensivity

**Text Books/Reference Books:**


1. R S Aggarwal, 2017, Quantitative Aptitude for Competitive Examinations, S Chand & Company Pvt Ltd.
2. R S Aggarwal, 2018, A Modern Approach to Verbal& Non Verbal Reasoning, S Chand & Company Pvt Ltd.
3. Mark A Griffin, College to Career: The Student Guide to Career and Life Navigation.
4. Anthony Gutierez, Effective Communication in the Workplace.


**Instructions for paper setting:** Fifty MCQ will be set in total. TwentyFiveMCQwillbe set from Part A and Twenty Five MCQ will be set from Part B. All questions will be compulsory. Each question will be of 1 mark. There will be no negative marking. Calculator will not be allowed.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Course Articulation Matrix**

| CO | PO 1 | PO 2 | PO3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PS 1 | PS 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BHM-MC-004.1** | 1 | - | - | 2 | - | - | - | - | - | - | - | - | - | 1 |
| **BHM-MC-004.2** | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | 1 |
| **BHM-MC-004.3** | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | - |
| **BHM-MC-004.4** | - | - | - | - | - | - | - | 1 | - | - | - | 1 | - | - |
| **BHM-MC-004.5** | - | - | - | - | - | - | - | 1 | 3 | 3 | - | 1 | - | 2 |
| **BHM-MC-004.6** | - | - | - | - | - | - | - | 1 | 2 | 3 | - | 1 | - | 1 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

**BHM-320: UNIVERSAL HUMAN VALUES**

| | | | |
|---|---|---|---|
| Credits | 2 | Max. Marks | : 100 |
| L-T-P | 1-1-0 | Continuous Evaluation | : 50 |
| Examination Duration | 2 hrs | End Semester Exam | : 50 |

**Pre-requisite: None**

**Course Type: Humanities & Social Science**

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

BHM-320.1. Develop a holistic perspective based on self-exploration aboutthemselves(humanbeing), family,societyandnature/existence.
BHM-320.2. Understand harmony in the human being,family,society and nature/existence

BHM-320.3. Strengthen the self-reflection, develop commitment and courage to act.

**Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation(5 Lectures)**

Purpose and motivation for the course,Self-Exploration–what is it? - Its content and process; 'Natural Acceptance'andExperiential Validation- astheprocessforself-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Rightunderstanding,RelationshipandPhysicalFacility- thebasic requirements for fulfillment of aspirations of every human being with their correctpriority, Understanding Happiness and Prosperity correctly- A critical appraisal of thecurrentscenario, Method to fulfill the above human aspirations: understanding and living inharmonyat variouslevels.

**Unit2:UnderstandingHarmonyintheHumanBeing-HarmonyinMyself!(5 Lectures)**

Understanding human being as a co-existence of the sentient 'I' and thematerial'Body' , Understanding the needs of Self ('I') and 'Body' - happiness and physicalfacility, Understanding the Body as an instrument of 'I' (I being the doer, seer andenjoyer),Understandingthecharacteristicsandactivitiesof 'I'andharmonyin'I', Understanding the harmony of I with the Body: Sanyam and Health; correctappraisalofPhysicalneeds,meaning ofProsperityindetail, ProgramstoensureSanyamandHealth.

**Unit 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship(7 Lectures)**

Understanding values in human-human relationship; meaning of Justice (nineuniversal values in relationships) and program for its fulfillment to ensure mutualhappiness;TrustandRespectasthefoundationalvaluesofrelationship, Understanding the meaning of Trust; Difference between intention andcompetence, Understanding the meaning of Respect, Difference between respect anddifferentiation;theother salient values inrelationship

Understanding the harmony in the society (society being an extension offamily): Resolution, Prosperity, fearlessness (trust) and co-existence ascomprehensive Human Goals,Visualizing a universal harmonious order in society- Undivided Society,Universal Order-from familyto worldfamily.

**Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence(6 Lectures)**

UnderstandingtheharmonyintheNature, Interconnectedness and mutual fulfillment among the four orders of nature-recyclabilityand self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all-pervasive space Holisticperceptionofharmonyatalllevelsofexistence.
Include practice sessions to discuss human being as cause of imbalance innature (film "Home" can be used), pollution, depletion of resources and role oftechnology etc.

**Unit 5: Implications of the above Holistic Understanding of Harmony onProfessionalEthics(5 Lectures)**

Naturalacceptanceofhumanvalues, DefinitivenessofethicalHumanConduct, Basis for Humanistic Education, Humanistic Constitution and HumanisticUniversal Order, Competence in professional ethics, Case studies of typical holistic technologies, management models andproductionsystems, Strategy for transition from the present state to Universal Human Order: a. Atthe level of individual: as socially and ecologically responsible engineers,technologists and managers b. At the level of society: as mutually enrichinginstitutionsand organizations,

**Text and ReferenceBooks**

1. R R Gaur, R Sangal, G P Bagaria, 2010, Human Values and Professional Ethics,Excel Books, New Delhi
2. A.N. Tripathi, 2019, Human Values, New age International Publishers.
3. E G Seebauer& Robert L.Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.

**Note:**

Lecture's hours are to be used for interactive discussion, placing the proposalsabout the topics at hand and motivating students to reflect, explore and verifythem.

Tutorialhoursaretobeusedforpracticesessions.

**Evaluation Tools:**
Assessment by faculty mentor: 10 marksSelf-assessment:10marks

Assessmentbypeers:10marks

Socially relevant project/Group Activities/Assignments: 20 marks

SemesterEndExamination: 50 marks

**Course articulation Matrix**

| CO Statement | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BHM-320.1 | - | - | 2 | - | - | 3 | 1 | 3 | 2 | - | - | 2 |
| BHM-320.2 | - | - | 2 | - | - | 3 | 1 | 3 | 2 | - | - | 2 |
| BHM-320.3 | - | - | 2 | - | - | 3 | 1 | 3 | 2 | - | - | 2 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-321: Building Services**

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**
**Course Outcomes:** At the end of this course, the student will be able to:

BCE-DS-321.1 Understand the concept of water supply systems
BCE-DS-321.2 Understand the working of sewerage systems
BCE-DS-321.3 Correlate Rain Water Disposal Systems to Smart Infrastructure
BCE-DS-321.4 Correlate the importance of HVAC systems to Smart Buildings
BCE-DS-321.5 Apply the concept of Vertical Transport System in Smart Infrastructure
BCE-DS-321.6 Understand and apply the concept of Ventilation

**PART A**

**Unit 1:Introduction to Water Supply System**

1.5 Introduction to Water Supply Systems

1.6 Types of Water Distribution Systems

1.7 Principles of Water Supply in Domestic Buildings

1.8 Roof Top Water Drainage

**Unit 2:Introduction to Sewerage System**

2.5 Introduction to Sewerage Systems

2.6 Principles, Norms and Standards of Sewerage Systems

2.7 Components of Sewer Conveyance Network

2.8 Determination of Gradient and Slope in Sewage Disposal

2.9 Various sanitary fixtures and its connections

**Unit 3:Rain Water Disposal System**

3.5 Techniques to divide Surface Area for Rain Water Disposal.

3.6 Details of Collection Point (Khurra).

3.7 Conveyance Network for Storm and Rain Water.

3.8 Apparatus for Conveyance of Water: Catch Basin, Gully Traps, etc.

**PART B**

**Unit 4:Introduction to HVAC Systems**

4.6 Concept of HVAC Systems

4.7 Principles, Laws and Terminologies related to HVAC

4.8 Cooling Systems of Air – Conditioning and Refrigerant Cycle

4.9 HVAC Installation Requirements and Demands in Building Layout

**Unit 5:Vertical Transport Systems in Smart Buildings**

5.5 Introduction to Vertical Transport Systems

5.6 Types and Provisions of Elevators; Recommendations from National Building Code

5.7 Safety Features, Passenger Handling Capacity, Space and Physical Requirements

5.8 Design of typical Lift Banks, Elevator; Machine Room spaces and their layouts

**Unit 6:Ventilation and Duct Systems**

6.5 Concept of Natural and Artificial Ventilation

6.6 Methods and Requirements of Ventilation

6.7 Supply Air and Return Air Ducting Systems

6.8 Layouts and Requirements of Duct Systems

**Text Books/ Reference Books:**

1. Dr. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, 2005, Water Supply and Sanitation, Laxmi Publications Pvt Limited.
2. Dr. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, 2005, Waste Water Engineering, Laxmi Publications Pvt Limited.
3. Stein, 2007, Electrical and Mechanical Services, John Wiley & Sons.
4. National Building Code 2016

**Software required/Weblinks:**

1. https://archive.nptel.ac.in/courses/105/105/105105201/
2. https://archive.nptel.ac.in/courses/112/105/112105129/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix :**

| CO Statement (BCE-DS-321) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-321.1 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-321.2 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-321.3 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| BCE-DS-321.4 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 |
| BCE-DS-321.5 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 3 | 2 |
| BCE-DS-321.6 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-322: SENSOR TECHNOLOGY**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course outcomes:** At the end of the course, students will be able to
BCE-DS-322.1. Summarize various performance characteristics of instruments and the quality of measurement.
BCE-DS-322.2. Interpret the type of transducer based on the transduction principles
BCE-DS-322.3. Identify the relevant transducer for measurement of physical quantities
BCE-DS-322.4. Discover the additional attributes in advanced sensors and their role in Civil Engineering
BCE-DS-322.5. Check the stability of Intelligent Sensor

**Unit 1 Sensors & Transducer**
1.1 : Definition, Classification & selection of sensors
1.2 Measurement of displacement using Potentiometer
1.3 LVDT & Optical Encoder
1.4 Measurement of force using strain gauge
1.5 Measurement of pressure using LVDT based diaphragm & piezoelectric sensor

**Unit 2 Measurement of temperature using Thermistor**
2.1 Thermocouple & RTD
2.2 Concept of thermal imaging, Measurement of position using Hall effect sensor
2.3 Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor
2.4 Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive

**Unit 3 Virtual Instrumentation**
3.1 Graphical programming techniques
3.2 Data types, Advantage of Virtual Instrumentation techniques
3.3 Concept of WHILE & FOR loops, Arrays
3.4 Clusters & graphs
3.5 Structures: Case, Sequence & Formula nodes,
3.6 Need of software based instruments for industrial automation

**PART-B**

**Unit 4 Data Acquisition Methods**
4.1 Basic block diagram, Analog and Digital IO
4.2 Counters, Timers, Types of ADC: successive approximation and sigma-delta
4.3 Types of DAC: Weighted Resistor and R-2R Ladder type, Use of Data Sockets for Networked Communication.

**Unit 5 Intelligent Sensor**
5.1 General Structure of smart sensors & its components
5.2 Characteristic of smart sensors: Self calibration, Self-testing & self-communicating
5.3 Application of smart sensors: Automatic robot control & automobile engine control.

**Unit 6 Case Studies and Emerging Trends**

6.1 Analysis of real-world sensor-based civil engineering projects
6.2 Emerging trends in sensor technology and their impact on civil engineering

**Text Books/ Reference Books:**


1. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
2. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
3. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.
4. Gary Johnson / Lab VIEW Graphical Programing II Edition / McGraw Hill 1997.
5. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
6. A.D. Helfrick and W.D. cooper, Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001
7. Hermann K.P. Neubert, "Instrument Transducers" 2nd Edition 2012, Oxford University Press.


**Software required/Web links:**
1. https://archive.nptel.ac.in/courses/105/108/105108077/
2. https://archive.nptel.ac.in/courses/108/108/108108147/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous Evaluation Table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-322) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE- DS-322.1 | 3 | 2 | 2 | 1 | - | - | 2 | 2 | 1 | 1 | - | - | 2 | 2 |
| BCE- DS-322.2 | 3 | 3 | 2 | 2 | 2 | - | - | 2 | 2 | 1 | 2 | - | 2 | 2 |
| BCE- DS-322.3 | 3 | 2 | 3 | 1 | 1 | - | - | 2 | 2 | 2 | 1 | - | 1 | 1 |
| BCE- DS-322.4 | 3 | 3 | 3 | 2 | 1 | 2 | - | - | 1 | 2 | 1 | 1 | 3 | 1 |
| BCE- DS-322.5 | 3 | 3 | 1 | 1 | 2 | - | 3 | 3 | 2 | 3 | 2 | - | - | 2 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-323: Biomimetics**

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type:** Domain Specific Elective

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-323.1 Understand the fundamental principles and concepts of biomimetics and its relevance to civil engineering.
BCE-DS-323.2 Apply biomimetic principles to the design and construction of structures, materials, and systems.
BCE-DS-323.3 Evaluate the environmental, social, and economic impacts of biomimetic designs.
BCE-DS-323.4 Collaborate effectively in interdisciplinary teams to solve complex engineering problems using biomimetic approaches.
BCE-DS-323.5 Demonstrate ethical considerations in the application of biomimetics

**PART-A**

**Unit 1: Introduction to Biomimetics**

1.1 Definition and history
1.2 Significance of biomimetics
1.3 Examples of biomimetic applications in civil engineering

**Unit 2: Biomimetic Materials**
2.1 Biomimetic materials: self-healing, self-cleaning, and adaptive properties
2.2 Structural materials inspired by biological systems
2.3 Case studies of biomimetic materials in civil engineering

**Unit 3: Geotechnical and Environmental Applications**
3.1 Biomimetics in soil stabilization and erosion control
3.2 Adaptation of biological systems for environmental remediation
3.3 Bio-inspired approaches to sustainable land development

**PART-A**

**Unit 4: Biomimetic Materials and Construction Techniques**
4.1 Biomimetic principles for material selection and design
4.2 Bio-inspired construction techniques and processes
4.3 Applications of biomimetic materials in civil engineering

**Unit 5: Sustainability and Ethics in Biomimetic Design**
5.1 Life cycle assessment of biomimetic designs
5.2 Ethical considerations in biomimetics
5.3 Integration of biomimetics with sustainable development goals

**Unit 6:Research and Innovation in Biomimetics**
6.1 Current trends and advancements in biomimetic research
6.2 Analysis of scientific literature and case studies
6.3 Practical applications and future prospects of biomimetics

**Text Books/ Reference Books:**

1. Biomimetics: Nature-Inspired Engineering" by Dr. K.M. Gupta, McGraw Hill Education
2. Biomimetics in Engineering: Building the Future with Nature by Dr. Pradeep K. Rohatgi and Dr. K. Prasad, CRC Press
3. Biomimetic Design Method for Innovation and Sustainability" by Yoji Akao, Norihiro Izumi, and Toshiharu Taura, Springer

**Software required/Weblinks:**
https://onlinecourses.nptel.ac.in/noc22_ge24

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-323) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-323.1 | 3 | 1 | 1 | 1 | | 2 | 3 | 3 | | | 2 | | 3 | 2 |
| BCE-DS-323.2 | 2 | 1 | 2 | | | 2 | 3 | 2 | | 2 | 2 | | 3 | 2 |
| BCE-DS-323.3 | 2 | 1 | 3 | | 2 | | | | | 3 | 2 | | 3 | 2 |
| BCE-DS-323.4 | 2 | | 3 | 2 | | | | 3 | 2 | 3 | 2 | | 3 | 3 |
| BCE-DS-323.5 | 2 | | 3 | | | | | 3 | | | 3 | 2 | 3 | 2 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-324: IoT Enabled Smart Infrastructure**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**
**Course Outcomes:** At the end of this course, the student will be able to:

BCE-DS-324.1 comprehend and analyze the ecosystem of Internet of Things (IOT).
BCE-DS-324.2 applications of IoT in M2M
BCE-DS-324.3 correlate Internet and communication
BCE-DS-324.4 interpret the elements of IoT development tools
BCE-DS-324.5 correlate IoT with Sustainable Smart Infrastructure

**PART-A**

**Unit 1: An Introduction to The Internet Of Things (IOT)**
1.1 Introduction and concepts of IOT
1.2 Classifications of IoT
1.3 Components of IoT
1.4 Layered architecture of IoT

**Unit 2: M2M to IOT**
2.1 Introduction to M2M
2.2 M2M Communication
2.3 M2M and IOT-Comparison

**Unit 3: Principles of IoT**
3.1 Internet Communications: Types and Applications in Smart Infrastructure
3.2 IP Addresses: Types and Applications in Smart Infrastructure
3.3 Application of IPv6
3.4 An Introduction to the concept of HTTP

**PART-B**

**Unit-4: IoT Application Development**
4.1 Overview of IoT Application based Hardware
4.2 Concept and Types of Arduinos IDE
4.3 Application of Arduino in Smart Infrastructure
4.4 Understanding and Framing of Arduino Syntax

**Unit 5: Secure IoT Communication**
5.1 Challenges in IoT Implementation in Smart Cities
5.2 Smart Infrastructure based IoT Security Threats
5.3 Security Requirements of IoT Communication

**Unit 6: Applications of IoT in Smart Infrastructure**
6.1 Smart Intelligent Home
6.2 Smart City
6.3 Intelligent Transportation System

6.5 Smart Construction Industry
6.6 Smart Manufacturing
**Text Books/ Reference Books:**

1. Internet of Things: Jeeva Jose, Khanna Publishing.
2. Designing the Internet of Things: Adrian McEwen and Hakim Cassimally, Wiley.
3. Internet of Things: A Hands-On Approach:ArsheepBahga, Vijay Madisetti,Universities Press.
4. Internet of Things: Principles and Paradigms: Rajkumar Buyya and Amir Vahid Dastjerdi, Elsevier.

**Software required/Web links:**

http://www.ti.com/ww/en/internet_of_things/iot-applications.html
https://www.tutorialspoint.com/internet_of_things/index.htm
NPTEL :: Computer Science and Engineering - NOC:Introduction to internet of things

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B. Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-324) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-324.1 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-324.2 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-324.3 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| BCE-DS-324.4 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 |
| BCE-DS-324.5 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 3 | 2 |

# SEMESTER-IV

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-401 INTRODUCTION TO FLUID MECHANICS

| | | | |
|---|---|---|---|
| Credits | 2 | Max. Marks | : 200 |
| L-T-P | 2-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Engineering Mechanics for Civil Engineers**
**Course Type: Core**

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

BCE-DS -401.1 Learn use of basic concepts of the properties of fluids and fluid statics
BCE-DS -401.2 Define terminologies used in equation of conservation of mass and its application.
BCE-DS -401.3 Relate to type and categories of kinematic problems such as finding particle paths and stream lines.
BCE-DS -401.4 Analyze relationship between continuity equation, Bernoulli's equation and turbulence, and apply the same to problems
BCE-DS -401.5 Interpret the laminar and turbulent flows
BCE-DS -401.6 Make use of Fluid Machinery and Open channel flow concepts to solve practical problems.

**PART-A**

**Unit 1: Introduction to properties of fluid**

1.1 Basic Concepts and Definitions – Distinction between a fluid and a solid, Density, Specific weight, Specific gravity.
1.2 Kinematic and dynamic viscosity, variation of viscosity with temperature.
1.3 Newton law of viscosity, vapour pressure, boiling point, cavitation.
1.4 Surface tension, capillarity, Bulk modulus of elasticity, compressibility.

**Unit 2: Fluid mechanics**

2.1 Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude.
2.2 Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers.
2.3 Pressure gauges, Hydrostatic pressure and force, horizontal, vertical and inclined surfaces.
2.4 Buoyancy and stability of floating bodies.

**Unit 3: Fluid Kinematics**

3.1 Classification of fluid flow,steady and unsteady flow, uniformand non-uniform flow, laminar and turbulent flow, rotational and irrigational flow, compressible and incompressible flow, ideal and real fluid flow,
3.2 One-, two- and three-dimensional flows
3.3 Stream line, path line, streak line and stream tube
3.4 Stream function, velocity potential function.
3.5 One-, two- and three -dimensional continuity equations in Cartesian coordinates

**PART-B**

**Unit 4: Fluid Dynamics**

4.1Fluid Dynamics- Surface and body forces;
4.2 Equations of motion - Euler's equation
4.3 Bernoulli's equation – derivation
4.4 Energy Principle
4.5 Practical applications of Bernoulli's equation

**Unit 5: Flow measurement**

5.1 venturimeter – principle, illustration, derivation of discharge
5.2 orifice meter - principle, illustration, derivation of discharge
5.3 pitot tube- principle, illustration, derivation of discharge
5.2 Momentum principle; Forces exerted by fluid flow on pipe bend
5.3 Vortex Flow – Free and Forced

**Unit 6 : Dimensional Analysis and Dynamic**

6.1 Similitude - Definitions of Reynolds Number
6.2 Froude Number- derivation and its application
6.3 Mach Number- derivation and its application
6.4 Weber Number and Euler Number- derivation and its application
6.5 Buckingham's π-Theorem. -statemen , proof and application

**Text/Reference Books:**

1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, 2010, Fluid Mechanics and Machinery,Oxford University Press,
2. P M Modi and S M Seth, Hydraulics and Fluid Mechanics, Standard Book House
3. K. Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill
4. R.L. Daugherty, J.B. Franzini and E.J. Finnemore, Fluid Mechanics with Engineering Applications, International Student Edition, Mc Graw Hill.

**Software required / Web links**

http://nptel.ac.in/courses/112105171/
http://nptel.ac.in/courses/112105183/
http://nptel.ac.in/courses/105101082/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-401) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-401.1 | 3 | 3 | 3 | 2 | 1 | - | - | - | 2 | 2 | 3 | 3 | 3 | 3 |
| BCE-DS-401.2 | 3 | 3 | 3 | 3 | 1 | - | - | - | 2 | 2 | 3 | 3 | 3 | 3 |
| BCE-DS-401.3 | 3 | 3 | 2 | 1 | 1 | - | - | - | 2 | 2 | 3 | 3 | 2 | 2 |
| BCE-DS-401.4 | 3 | 3 | 1 | 2 | 2 | - | - | - | 2 | 3 | 3 | 3 | 2 | 2 |
| BCE-DS-401.5 | 3 | 3 | 2 | 3 | 2 | - | - | - | 1 | 3 | 3 | 3 | 3 | 3 |
| BCE-DS-401.6 | 3 | 3 | 3 | 2 | 3 | - | - | - | 3 | 3 | 3 | 3 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-402: INTRODUCTION TO SOLID MECHANICS

| | | | |
|---|---|---|---|
| Credits | 2 | Max. Marks | : 200 |
| L-T-P | 2-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Engineering Mechanics for Civil Engineers**
**Course Type: Core**

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

BCE -DS-402.1 Explain the concept of Stresses and Strain on various sections
BCE -DS-402.2 Utilise the concept of Bending Moment and shear force for various types of loading and sections
BCE -DS-402.3 Analyze the concept of flexural stresses on various sections
BCE -DS-402.4 Deduce the concept of Shear Stresses in different sections
BCE -DS-402.5 Apply the concept of Torsions in various types of sections
BCE -DS-402.6 Measure hoop stresses and longitudinal stresses in Thin Cylinders

**PART-A**

**Unit 1: Stress and Strain**

1.1 Concept of stress and strain, St. Venant's principle, stress and strain diagram
1.2 Elasticity and plasticity – Types of stresses and strains, Hooke's law, stress – strain diagram for mild steel – Working stress – Factor of safety
1.3 Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses.
1.4 Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications. Compound Stresses and Strains- Two dimensional system, stress at a point on a plane,
1.5 Principal Stresses and Principal Planes, Mohr Circle Of Stress, Ellipse Of Stress And Their Applications.
1.6 Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between different elastic constants.

**Unit 2: Bending moment and Shear Force**

2.1 Bending moment and Shear Force Diagrams
2.2 BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs.
2.3 Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span
2.4 Combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

**Unit 3: Flexural Stresses**

3.1 Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation
3.2 Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and hollow),
3.3 I,T, Angle and Channel sections – Design of simple beam sections.

3.4 Slope and deflection- Relationship between moment, slope and deflection, Moment areamethod, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

**PART-B**

**Unit 4: Shear Stresses**

4.1 Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections
4.2 rectangular and circular sections
4.3 Triangular, I, T angle sections.

**Unit 5: Torsions**

5.1 Torsion- Derivation of torsion equation and its assumptions
5.2 Applications of the equation of the hollow and solid circular shafts, torsional rigidity
5.3 Combined torsion and bending of circular shafts
5.4 Principal stress and maximum shear stresses under combined loading of bending and torsion.
5.5 Analysis of close-coiled-helical springs.

**Unit 6: Thin Cylinders**

6.1 Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress
6.2 Longitudinal stress in a cylinder, and sphere subjected to internal pressures.

**Text Books/ Reference Books:**

1.S. Timoshenko and D.H. Young, Elements of Strength of Materials, DVNC, New York, USA.
2. S. M. A. Kazmi,Solid Mechanics, TMH, Delhi, India.
3. R. C. Hibbeler, 2004, Mechanics of Materials., 6th ed., Rutherford, NJ: Pearson Prentice Hall.
4. S. H. Crandall, N. C. Dahl, and T. J. Lardner., 1979, An Introduction to the Mechanics of Solids, 2nd ed, McGraw Hill, New York.
5. William Kendrick Hall, Laboratory Manual of Testing Materials.
6. P. Beer Ferdinand, E. Russel Jhonston Jr., John T. DEwolf, 2002,Mechanics of Materials, TMH.
7. R. Subramanian, Strength of Materials, Oxford University Press, New Delhi.

**Software required/Weblinks:**

https://archive.nptel.ac.in/courses/112/102/112102284/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials

Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BEC-DS-402) | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-402.1 | 1 | 2 | 3 | 2 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE -DS-402.2 | 2 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE -DS-402.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE -DS-402.4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE -DS-402.5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-402.6 | 2 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-404A: MATERIALS, TESTING & EVALUATION

| | |
|---|---|
| Credits 2 | Max. Marks : 200 |
| L-T-P 1-1-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Core**

BCE-DS-404A.1. Describe the properties and applications of different construction materials
BCE-DS-404A.2. Apply the knowledge of different materials to real life problems
BCE-DS-404A.3 Analyze the mechanical behavior of materials
BCE-DS-404A.4. Interpret the test result
BCE-DS-404A.5. Compare the applicability of civil engineering materials in varying situations
BCE-DS-404A.6. Recommend usage of appropriate construction materials with due consideration of sustainability

**PART-A**

**Unit 1: Introduction to Engineering Materials**

1.1 Introduction
1.2 Choosing Materials for Construction
1.3 Physical Properties, Mechanical Properties, Thermal Properties and Other Properties
1.4 Sustainable Materials

**Unit 2: Civil Engineering Materials**
2.1 Stones, Bricks
2.2 Cements
2.3 Ceramics, and Refractories
2.4 Bitumen and asphaltic materials
2.5 Structural Steel and other Metals

**Unit 3: Composite and Smart Materials**
3.1 Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete)
3.2 Carbon Fiber Reinforced concrete
3.3 Nanomaterials
3.4 Shape-Memory, 3D Printing of Materials

**PART-B**
**Unit 4: Deformation and Fracture of Materials**
4.1 Introduction
4.2 Types of Material Failures: Elastic and Plastic Deformation, Tension Tests, Bending Test, Torsion Test Quasi-brittle Fracture
4.3 Creep Deformation
4.4 Fatigue under Cyclic Loading
4.5 Background to Fracture Mechanics

**Unit 5: Testing and Evaluation of Materials**
5.1 Sampling and Testing of Cement

5.2 Field Tests on Cement
5.3 Chemical Tests on Cement
5.4 Tests for Aggregates
5.5 Tests for Mortars
5.6 Tests on Fresh and Hardened Concrete
5.7 Tests for Mortars

**Unit 6: Non Destructive Testing**
6.1 Rebound Hammer Test
6.2 Ultrasonic Pulse Velocity Test
6.3 Impact-echo Test
6.4 Permeability Test

**Text Books/ Reference Books:**
1. R. Chudley and Greeno, 2006,
Handbook, 6th ed., R. Butterworth-Heinemann.
2. S.K. Khanna, C.E.G Justo and A Veeraragavan, Highway Materials and Pavement Testing, 5th ed., Nem Chand& Bros.
3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications.
4. Kyriakos Komvopoulos, 2011, Mechanical Testing of Engineering Materials, Cognella.
5. E.N. Dowling 1993, Mechanical Behaviour of Materials, International Edition, Prentice Hall.
6. American Society for Testing and Materials (ASTM), 2000, *Annual Book of ASTM Standards*
7. Related papers published in international journals

**Software required/Weblinks:**

https://nptel.ac.in/
https://swayam.gov.in/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-404A) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-404A.1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | 1 | 1 | 2 | 3 | 2 |
| BCE-DS-404A.2 | 3 | 2 | - | 3 | 2 | - | - | 3 | - | - | 0 | 2 | 2 | 2 |
| BCE-DS-404A.3 | 3 | - | 1 | 2 | 2 | | - | 3 | - | - | | 2 | 3 | 2 |
| BCE-DS-404A.4 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | 2 | 2 | 1 |
| BCE-DS-404A.5 | 3 | 3 | 3 | 3 | 3 | - | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 |
| BCE-DS-404A.6 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-405: ENERGY SCIENCE & ENGINEERING

| | | | |
|---|---|---|---|
| Credits | 2 | Max. Marks | : 200 |
| L-T-P | 1-1-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: ESC**

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

BCE-DS-405.1. Describe concept of energy systems and renewable energy resources,
BCE-DS-405.2. Relate to the concept of sustainability
BCE-DS-405.3. Explore society's present needs and future energy demands,
BCE-DS-405.4. Evaluate carbon footprints due to contemporary techno processes
BCE-DS-405.5. Design various civil engineering systems/ projects dealing with energy generation paradigms in an efficient manner.
BCE-DS-405.6. Organize information on renewable energy technologies as a basis forfurther analysis and evaluation

**PART-A**

**Unit 1: Introduction to Energy Science:**

1.1 Scientific principles and historical interpretation to place energy use in the context of pressing societal
1.2 Environmental and climate issues; Introduction to energy systems and resources;
1.3 Introduction to Energy, sustainability & the environment

**Unit 2: Energy Sources:**

2.1 Overview of energy systems, sources, transformations, efficiency, and storage
2.2 Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen
2.3 Sustainability and environmental trade-offs of different energy systems
2.4 possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries)

**Unit 3: Energy & Environment**

3.1 Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development
3.2 Carbon footprint, energy consumption and sustainability
3.3 introduction to the economics of energy- production and consumption; linkages between economic and environmental outcomes
3.4 future energy impact on economic, environmental, trade, and research policy.

**PART-B**

**Unit 4: Civil Engineering Projects connected with the Energy Sources**

4.1 Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines
4.2 Solar chimney project, wave energy caissons

4.3 Coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams, tunnels, penstocks, etc.
4.4 Nuclear reactor containment buildings and associated buildings

**Unit 5: Design and Construction**
5.1. Constraints and testing procedures for reactor containment buildings
5.2. Spent Nuclear fuel storage and disposal systems
5.3. Energy Audit of Facilities and optimization of energy consumption

**Unit 6: Engineering for Energy conservation**
6.1 Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located
6.2 LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates

**Text Books/ Reference Books:**

1. G. Boyle, 2004, Renewable Energy, 2nd edition, Oxford University Press.
2. G. Boyle, Bob Everett, and Janet Ramage (Eds.), 2004, Energy Systems and Sustainability: Power for a Sustainable Future, Oxford University Press.
3. Schaeffer and John, 2007, Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam.
4. Jean-Philippe; Zaccour and Georges (Eds.), 2005, Energy and Environment Set: Mathematics of Decision Making, Loulou, Richard; Waaub, XVIII.
5. Ristinen, A. Robert Kraushaar, J. J. AKraushaar, J. P. Ristinen and Robert A., 2006, Energy and the Environment, 2nd Edition, John Wiley.
6. UNDP, 2000, Energy and the Challenge of Sustainability, World Energy assessment.
7. E H Thorndike, 1976, Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company.
8. Related papers published in international journals.


**Software required/Weblinks:**
https://nptel.ac.in/courses/103103206

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests

Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-405) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-405.1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-405.2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-405.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-405.4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-405.5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-405.6 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-407: BUILDING CONSTRUCTION

| | | | |
|---|---|---|---|
| Credits 2 | | Max. Marks | : 200 |
| L-T-P | 1-1-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Core**

**Course Outcomes:** On completion of the course, the students will be able

BCE-DS-407.1. Visualize different components of building construction.
BCE-DS-407.2. Describe the constructional detailing of different building components.
BCE-DS-407.3. Signify various building and general construction products
and their associated quality, durability, warrantees, and availability.
BCE-DS-407.4. Relate to classical development of Civil Engineering from past to present.
BCE-DS-407.5. Implement the sustainability parameters in building construction.

### PART- A

**Unit-I: Masonry Construction**

1.1 Types of buildings, components of a building, design loads
1.2 Introduction to various terms used
1.3 Stone masonry-Dressing of stones, Classifications of stone masonry, safe permissible loads
1.4 Brick masonry-bonds in brick work, laying brick work, structural brick work-cavity and hollow walls, reinforced brick work, Defects in brick masonry, composite stone and brick masonry
1.5 Composite masonry

**Unit-II: Load Bearing and Partition Walls**

2.1 Concept of framed structures
2.2 Classification of walls – load bearing, non-load bearing, dwarf wall, retaining, breast walls and partition walls
2.3 Classification of walls as per materials of construction: brick, stone, reinforced brick, reinforced concrete, precast, hollow and solid concrete block and composite masonry walls
2.4 Partition walls: Constructional details, suitability and uses of brick and wooden partition walls

**Unit-III: Foundation**

3.1 Introduction & Functions of Foundation
3.2 Types of shallow foundations, general feature of shallow foundation, design of masonry wall foundation
3.3 Sub-surface investigations, geophysical methods
3.4 Foundations in water logged areas
3.5 Introduction to deep foundations i.e. pile and pier foundations

### PART- B

**Unit-IV: Arches and Lintels**

4.1 Types of Arches and various terms used in arches and lintels
4.2 Stone arches and their construction
4.3 Brick arches and their construction

4.4 Purpose of lintel & materials used in Lintels
4.5 Cast-in-situ and pre-cast lintels
4.6 Lintel along with sun-shade or chhajja

**Unit V: Roofs and Floors**
5.1 Types of roofs
5.2 Various terms used
5.3 Roof trusses-king post truss, queen post truss etc.
5.4 Floor structures, ground, basement and upper floors, various types of floorings

**Unit-VI: Green Buildings**
6.1 Importance
6.2 components: Site, Rain water harvesting/water efficiency, energy efficiency, material efficiency
6.3 Indoor air quality design and innovation rating system
6.4 Sustainability in construction methods
6.5 Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings
6.6 Construction of insulating, fire-resistant buildings

**Text Books/ Reference Books:**


1. IS:1905-1987 "Code of Practice for Structural use of Unreinforced Masonry"
2. Sushil Kumar "Building Construction", Firewall Media
3. Rangawala,"Engineering Materials" Charotar Publications
4. A.W. Hendry, F.M.Khalaf**, "Masonry Wall Construction"**
5. A.W. Hendry, B.P.Sinha, S.R.Davies **, "Design of Masonry Structures",**
6. Francis D.K.Ching, " Building Construction Illustrated",John Wiley & Sons
7. Robin Barry, " Construction of Buildings",Wiley-Blackwell Publications
8. Roy Chudley, Building Construction Handbook,Routledge
9. M.M. Goyal, "Handbook of BUILDING CONSTRUCTION (Vol-1): The Essential Source of Standard Const. Practices", Hard Back


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Software required / Web links**

http://nptel.ac.in/courses/

http://nptel.ac.in/courses/

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement ( BCE-DS-407) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-407.1 | 3 | 3 | - | 1 | 2 | - | 2 | - | - | 3 | - | 2 | 3 | 1 |
| BCE-DS-407.2 | 3 | - | 2 | 1 | 2 | - | - | 3 | - | - | - | - | - | 1 |
| BCE-DS-407.3 | - | - | - | 1 | 2 | 2 | - | - | - | 2 | - | 3 | 3 | 1 |
| BCE-DS-407.4 | 3 | 3 | 2 | 1 | 2 | - | 3 | - | 2 | - | - | 3 | - | 1 |
| BCE-DS-407.5 | 1 | - | - | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | - | 2 | 1 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-406: TRANSPORTATION ENGINEERING**

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Core**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-406.1. Make use of surveys involved in planning and highway alignment.
BCE-DS-406.2.Discuss the geometric elements of highways and expressways.
BCE-DS-406.3. Classify various properties of pavement materials and their testing procedures.
BCE-DS-406.4. Design flexible and rigid pavement as per IRC guidelines.
BCE-DS-406.5. Survey the traffic studies in real life situations
BCE-DS-406.6. Implement traffic regulation and control measures and intersection design.

**PART-A**

**Unit 1: Highway development and planning**
1.1 Classification of roads
1.2 Road development in India
1.3 Current road projects in India
1.4 Highway alignment and project preparation

**Unit 2:Geometric design of highways**
2.1 Introduction
2.2 Highway cross section elements
2.3 Sight distance
2.4 Design of horizontal alignment
2.5 Design of vertical alignment
2.6 Design of intersections, problems

**Unit 3: Traffic engineering & control**
3.1 Traffic Characteristics
3.2 Traffic engineering studies
3.3 Traffic flow and capacity
3.4 Traffic regulation and control
3.5 Design of road intersections
3.6 Design of parking facilities
3.7 Highway lighting; problems

**PART-B**

**Unit 4: Pavement materials**
4.1 Soils, Stone aggregates
4.2 Bituminous binders, bituminous paving mixes
4.3 Portland cement: desirable properties, tests
4.4 Requirements for different types of pavements

4.5 Cement concrete: desirable properties, tests, Problems

**Unit 5: Design of flexible pavement**
5.1 Introduction
5.2 Flexible pavements
5.3 Factors affecting design and performance
5.4 Stresses in flexible pavements
5.5 Design of flexible pavements as per IRC, problems

**Unit 6: Design of rigid pavement**
6.1 Components and functions
6.2 Factors affecting design and performance of CC pavements
6.3 Stresses in rigid pavements
6.4 Design of concrete pavements as per IRC; problems

**Text Books/ Reference Books:**

1. S.K Khanna, C.E.G Justo and A Veeraragavan, 2017, Highway Engineering, revised 10th Edition, NemChand & Bros.
2. L.R Kadiyalai, Traffic Engineering and Transport Planning, Khanna Publishers.
3. ParthaChakraborty, Principles of Transportation Engineering, PHI Learning, AICTE Model Curriculum for Undergraduate degree in Civil Engineering (Engineering & Technology)
4. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, 4th Edition, John Wiley.
5. Srinivasa Kumar R, 2011, Textbook of Highway Engineering, Universities Press.
6. Paul H. Wright and Karen K. Dixon, 2009, Highway Engineering, 7th Edition, Wiley Student Edition.

**Software required/Weblinks:**
https://nptel.ac.in/downloads/105101087/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-406) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-406.1. | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 |
| BCE-DS-406.2. | 3 | 3 | 3 | 3 | 3 | - | 2 | 1 | - | 1 | 3 | 2 | 3 | 2 |
| BCE-DS-406.3. | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 |
| BCE-DS-406.4. | 1 | 2 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | 3 | 2 |
| BCE-DS-406.5. | 3 | 3 | 3 | 3 | 3 | - | 2 | - | 2 | - | - | 2 | 3 | 2 |
| BCE-DS-406.6. | 3 | 3 | 3 | 3 | 3 | - | 2 | - | 2 | - | - | 2 | 3 | 2 |

### BCE-DS-605A: DESIGN OF CONCRETE STRUCTURES

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 2-0-2 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Core**

**Course Outcomes** The student will be able to

BCE-DS -605A.1 Analyze the composite action of reinforced steel and concrete in reinforced concrete structural members
BCE-DS -605A.2 Design building components in accordance with IS-Codes
BCE-DS -605A.3 Utilize the relevant software to analyze and design of reinforced concrete members.
BCE-DS -605A.4 Draw reinforcement detailing of various structural components

**PART-A**

**Unit 1: Working Stress Method:**
1.1 Basic assumptions, permissible stresses in concrete and steel
1.2 Design of singly reinforced beams
1.3 Design of doubly reinforced beams
1.4 Design of T-beams

**Unit 2: Limit State Method:**
2.1 Basic assumptions
2.2 Design of singly reinforced beams
2.3 Design of doubly reinforced beams
2.4 Design of T-beams
2.5 Minimum and maximum reinforcement requirement
2.6 Design of a typical Beam section using Staad Pro/Etabs

**Unit 3: Analysis and Design of Sections in shear, bond and torsion:**
3.1 Diagonal tension, shear reinforcement,
3.2 Development length ,Anchorage and flexural bond
3.3 Torsional stiffness, equivalent shear, torsional reinforcement
3.4 Design a typical beam section on Staad pro
3.5 Draw a reinforcement detailing of shear reinforcement in Autocad

**PART-B**

**Unit 4: Design of One way and Two Ways Slabs:**
4.1 General considerations, Classification of Slabs
4.2 Design of one way slabs for distributed and concentrated loads
4.3 Design of two way slabs for distributed and concentrated loads
4.4 Design of a typical Slab section in Staad pro / ETabs
4.5 Draw a reinforcement detailing in Autocadd for a typical Slab section

**Unit 5: Design of Columns:**
5.1 General considerations, Classification of Columns
5.2 Effective length, Slenderness ratio, Minimum eccentricity
5.3 Design of Short columns under axial compression
5.4 Design of short column under uniaxial and biaxial bending

5.5 Design a typical Column section in Staad Pro
5.6 Draw a detailed drawing for reinforcements in Columns

**Unit 6: Design of RCC Foundations:**
6.1 Classification
6.2 Design of Isolated footings
6.3 Design of Rectangular Combined Footing
6.4 Concept of Raft foundation and Strap foundation
6.5 Sketch different types of Foundation in Auto Cadd
6.6 Design a typical RCC footing in ETabs/ Staad Foundatinon

**Text/Reference Books:**


1. P. Rajaratnam, “Design of Concrete Structures”, OXFORD &IBH-PUBS COMPANY-NEW DELHI.
2. A.K. Jain “Limit state design”, Nem Chand & Brothers.
3. Ramamrutham, “Design of Concrete Structures”, Dhanpat Rai Publishing Company.
4. I.C.Syal&A.K.Goel , “ Reinforced Concrete Structures”, S. Chand.
5. IS 456-2000, Indian Standard Code of Practice for Plain & Reinforced Concrete.


**Software required / Web links:**
http://nptel.ac.in/downloads/105105104/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-605A)** | **PO 1** | **PO 2** | **PO 3** | **PO4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-605A.1 | 3 | 2 | 2 | 2 | 1 | 1 | - | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| BCE-DS-605A.2 | 3 | 1 | 1 | 2 | - | 2 | 3 | 1 | 1 | - | 2 | 1 | 3 | 3 |
| BCE-DS-605A.3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 3 | 3 |
| BCE-DS-605A.4 | 1 | 3 | 3 | 3 | 2 | - | - | 1 | 1 | - | 2 | 2 | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-451-INTRODUCTION TO FLUID MECHANICS LAB

| | | | |
|---|---|---|---|
| Credits | 1 | Max. Marks | : 100 |
| L-T-P | 0-0-2 | Continuous Evaluation | : 50 |
| Examination Duration | 2 hrs | End Semester Exam | : 50 |

**Co-requisites: Introduction to Fluid Mechanics (BCE-DS-401)**
**Course Type: Core**

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

BCE-DS -451.1 Learn use of basic concepts for Measurement of viscosity and Pressure Measuring Devices
BCE-DS -451.2 Define terminologies used in derive expression of metacentric height, its measurement and hydrostatic pressure
BCE-DS -451.3 Evaluate head and discharge at different section
BCE-DS -451.4 Analyze concepts of jet and its applications
BCE-DS -451.5 Relate ideal flow to real flow
BCE-DS -451.6 Measure velocity in laminar flow

**PART-A**

**Lab Experiments**

1. Measurement of viscosity
2. Study of Pressure Measuring Devices
3. Stability of Floating Body
4. Hydrostatics Force on Flat Surfaces/Curved Surfaces
5. Verification of Bernoulli's Theorem
6. Venturimeter
7. Orifice meter
8. Impacts of jets
9. Flow Visualization -Ideal Flow
10. Length of establishment of flow
11. Velocity distribution in pipes
12. Laminar Flow

**Text/Reference Books:**

1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli,2010, Fluid Mechanics and Machinery, Oxford University Press.
2. P M Modi and S M Seth, Hydraulics and Fluid Mechanics, Standard Book House.
3. K. Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill.
4. R.L. Daugherty, J.B. Franzini and E.J. Finnemore, Fluid Mechanics with Engineering Applications, International Student Edition, Mc Graw Hill.

**Software required / Web links**

http://nptel.ac.in/courses/112105171/
http://nptel.ac.in/courses/112105183/

http://nptel.ac.in/courses/105101082/

**Distribution of Continuous evaluation table**

| Parameter | Weightage |
|---|---|
| Two Mid-Term Viva | 60% |
| File/Record Keeping | 20% |
| Class Performance | 10% |
| Class Attendance | 10% |

**Assessment Tools:**
Viva Voce
Lab Work
Lab Records

**Course Articulation Matrix**

| CO Statement | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BCE-DS -451.1** | 3 | 3 | 3 | 3 | 3 | - | - | - | 2 | 3 | 3 | 3 | 3 | 3 |
| **BCE-DS -451.2** | 3 | 3 | 3 | 3 | 3 | - | - | 1 | 2 | 2 | 2 | 1 | 2 | 2 |
| **BCE-DS -451.3** | 3 | 3 | 3 | 3 | 3 | - | - | 1 | 3 | 3 | 3 | 3 | 2 | 2 |
| **BCE-DS -451.4** | 3 | 3 | 3 | 3 | 3 | - | - | 1 | 3 | 3 | 3 | 3 | 2 | 2 |
| **BCE-DS -451.5** | 3 | 2 | 2 | 2 | 1 | -- | - | - | 3 | 2 | 2 | 3 | 2 | 2 |
| **BCE-DS -451.6** | 3 | 3 | 3 | 3 | 3 | - | - | - | 1 | 3 | 3 | 3 | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-452: SOLID MECHANICS LAB

| | | | |
|---|---|---|---|
| Credits | 1 | Max. Marks | : 100 |
| L-T-P | 0-0-2 | Continuous Evaluation | : 50 |
| Examination Duration | 2 hrs | End Semester Exam | : 50 |

**Co-requisites: Introduction to Solid Mechanics (BCE-DS-402)**
**Course Type: Core**

**Course Outcomes:** At the end of this course, the student will be able to:
**BCE-DS-452.1.** Distinguish material properties and material testing apparatus.
**BCE-DS-452.2.** Decide appropriate material in design
**BCE-DS-452.3**. Explain Bending Moment and Shear forces in beams
**BCE-DS-452.4**. Describe Strain in a bar
**BCE-DS-452.5** Apply the concept of deflection in beams

**List of Experiments:**

1 Tension test
2 Bending tests on simply supported beam and Cantilever beam
3 Compression test on concrete
4 Impact test
5 Shear test
6 Investigation of Hook's law that is the proportional relation between force and Stretching in elastic deformation,
7 Determination of torsion and deflection
8 Measurement of forces on supports in statically determinate beam
9 Determination of shear forces in beams
10 Determination of bending moments in beams
11 Measurement of deflections in statically determinate beam
12 Measurement of strain in a bar
13 Bend test steel bar
14 Yield/tensile strength of steel bar

**TextBooks:**

1. George Earl Troxell, Harmer Elmer Davis, An Introduction to the Making and Testing of Plain Concrete: A Text and Laboratory Manual, Stanford University Press.
2. C.B.Kukreja and V.V.Sastry, Experimental Methods in Structural Mechanics, Standard publishers.

**Distribution of Continuous evaluation table**

| Parameter | Weightage |
|---|---|
| **Two Mid-Term Viva** | **60%** |
| **File/Record Keeping** | **20%** |
| **Class Performance** | **10%** |
| **Class Attendance** | **10%** |

**Assessment Tools:**
Viva Voce
Lab Work
Lab Records

**Course Articulation Matrix**

| CO Statement ( BCE-DS-452) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BCE-DS-452.1** | 3 | 3 | 2 | 3 | 3 | 1 | 2 | - | 3 | 1 | 2 | 1 | 3 | 3 |
| **BCE-DS-452.2** | 3 | 3 | 2 | 3 | 3 | 1 | 2 | - | 3 | 1 | 2 | 1 | 3 | 3 |
| **BCE-DS-452.3** | 3 | 3 | 2 | 3 | 3 | 1 | 2 | - | 3 | 1 | - | 1 | 3 | 3 |
| **BCE-DS-452.4** | 3 | 3 | 2 | 3 | 3 | 1 | 2 | - | 3 | 1 | - | 1 | 3 | 3 |
| **BCE-DS-452.5** | 3 | 3 | 2 | 3 | 3 | 1 | 2 | - | 3 | 1 | 2 | 1 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-454A: Materials, Testing and Evaluation Lab

| | |
|---|---|
| Credits 1 | Max. Marks: 100 |
| L-T-P 0-0-2 | Continuous Evaluation : 50 |
| Examination Duration 2 hrs | End Semester Exam : 50 |

**Co-requisites: Materials, Testing & Evaluation (BCE-DS-404)**
**Course Type: Program Core**
**Course Outcomes:** The students will be able to

BCE-DS-454A.1 Demonstrate the experiments related to properties of cement.
BCE-DS-454A.2 Demonstrate knowledge on properties of fine and coraseaggregates.
BCE-DS-454A.3 Apply properties of concrete knowhow in fresh and hardened stage.
BCE-DS-454A.4 Conduct screening of concrete by Non – Destructive Testing.

### List of Experiments

1. Fineness of Cement
2. Specific Gravity of Cement
3. Consistency and Setting Time of Cement
4. Soundness of Cement
5. Compressive Strength of Cement
6. Fineness Modulus of Aggregates
7. Specific Gravity of Fine Aggregates and Coarse Aggregates
8. Water Absorption of Fine Aggregates and Coarse Aggregates
9. Bulking of Aggregates
10. Impact Value of Aggregates
11. Concrete Mix Design (as per IS 10262: 2019)
12. Workability of Concrete
13. Compressive Strength of Concrete
14. Flexural Strength of Concrete
15. Non – Destructive Testing: Rebound Hammer Test and UPV Test

**Text Books/ Reference Books:**

5. M. S. Shetty, 8th Edition, Concrete Technology: Theory and Practice, S. Chand Publications.
6. M. L. Gambhir, 5th Edition, Concrete Technology: Theory and Practice, McGraw Hill Publications.

**Software required/Weblinks:**

1. https://cs-iitd.vlabs.ac.in/

**Distribution of Continuous evaluation table**

| Parameter | Weightage |
|---|---|
| Two Mid-Term Viva | 60% |
| File/Record Keeping | 20% |
| Class Performance | 10% |
| Class Attendance | 10% |

**Assessment Tools:**
1. Assignments
2. Surprise questions during practical/Class Performance
3. End examination

**Course Articulation Matrix :**

| CO Statement (BCE-DS-454A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-454A.1 | 3 | 3 | 3 | 2 | - | 2 | 1 | - | 2 | 3 | - | 3 | 1 | 3 |
| BCE-DS-454A.2 | 3 | 3 | 3 | 3 | - | 2 | 3 | - | 3 | 3 | 2 | 3 | 2 | 3 |
| BCE-DS-454A.3 | 3 | 3 | 3 | 2 | - | 2 | 2 | - | 3 | 3 | - | 3 | 1 | 3 |
| BCE-DS-454A.4 | 3 | 3 | 3 | 2 | - | 2 | 2 | - | 2 | 2 | 2 | 2 | 2 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
**(Deemed to be University under section 3 of the UGC Act, 1956)**

## BCE-DS-455: TRANSPORTATION ENGINEERING LAB

| | | | |
|---|---|---|---|
| Credits | 1 | Max. Marks | : 100 |
| L-T-P | 0-0-2 | Continuous Evaluation | : 50 |
| Examination Duration | 2 hrs | End Semester Exam | : 50 |

**Co-requisites: Transportation Engineering**
**Course Type: Core**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-455.1. Relate to measurements of behavior of various materials used in road construction
BCE-DS-455.2. Demonstrate use of basics properties to complement concepts learnt
BCE-DS-455.3. Apply the experimental procedures to real life highway engineering problems
BCE-DS-455.4. Describe established material testing procedures
BCE-DS-455.5. Analyze application of appropriate materials in highway construction

**List of Experiments:**
1. Aggregate Impact test.
2. Los-Angeles Abrasion test of Aggregate.
3. Soundness test of Aggregate.
4. Crushing strength test of Aggregate.
5. Aggregate shape test.
6. Specific Gravity of Aggregate.
7. Softening point test of Bitumen.
8. Ductility test of Bitumen.
9. Penetration test of Bitumen.
10. Flash and Fire point test of Bitumen.

**Reference Books**
Khanna & Justo, Highway Engg, New Chand & Bros.

**Software required / Web links**
http://te.iitd.ac.in/
http://nptel.ac.in/courses/105105107/
http://nptel.ac.in/downloads/105101087/

**Distribution of Continuous evaluation table**

| Parameter | Weightage |
|---|---|
| Two Mid-Term Viva | 60% |
| File/Record Keeping | 20% |
| Class Performance | 10% |
| Class Attendance | 10% |

**Assessment Tools:**
Viva Voce
Lab Work

Lab Records

**Course Articulation Matrix**

| CO Statement (BCE-DS-455) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-455.1. | - | 1 | 1 | 1 | 1 | 2 | 1 | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-455.2. | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 3 | 3 | 2 | 2 | 3 | 2 |
| BCE-DS-455.3. | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 2 |
| BCE-DS-455.4. | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | - | 1 | 2 | 2 | 3 | 2 |
| BCE-DS-455.5. | - | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

### DTI - 400: Design, Thinking and Innovation -II

Periods/week Credits Max. Marks : 50
L:0 T:1 P:0 1 Continuous Assessment : 50

**Pre-requisites: Design, Thinking and Innovation -I**
**Course Type: Research & Training**

**Course Outcomes**:

DTI 400.1. To understand the research methodologies/approaches/techniques used in the literature
DTI 400.2. To formulate the experimental procedures / algorithms based on research methodology
DTI 400.3. To develop prototype by experiment / simulation.
DTI 400.4. To analyze the recorded data / output.

**Activity 1: Methodology Study & Matrix design.**
1.1. Analysis of different approach/methodology adopted by various researchers
1.2. Comparative analysis
1.3. Prospective Design.

**Activity 2: Design of experiments**
2.1 Finalization of experimental procedure / algorithm design.
2.2 Procurement of materials / Hardware and Software.
2.3. Develop experimental setup / design

**Activity 3: Execution of experiments/simulations**
3.1. Conduct experiments / build prototype.
3.2. Modification of the experimental set-up / algorithm.

**Activity 4**:
4.1 Tabulating and analyzing data / output.
4.2 Assessment of the output with earlier published work / product
4.3 Interpretation and presentation of the results / outcome.

**Course Articulation Matrix:**

| CO Statement (XX-400) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DTI -400.1 | 3 | - | - | 2 | 3 | 3 | - | 2 | 1 | - | - | - | 1 | - |
| DTI -400.2 | 3 | 3 | - | 3 | 3 | 2 | 1 | 3 | 2 | - | 3 | 1 | 3 | 2 |
| DTI -400.3 | 3 | - | 2 | 2 | 2 | - | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| DTI -400.4 | 3 | 3 | 2 | 1 | 2 | 2 | 2 | - | 2 | 2 | 2 | 2 | 3 | 2 |

**'3' (Tick) or 'More' Substantial/High Correlation, '2' Moderate/Medium Correlation, '1' Slightly/Low Correlation, 'Blank' No Correlation**

**Evaluation Criteria:** The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

| S. No. | Parameters | Description | |
|---|---|---|---|
| **1.** | **Attendance** | • Percentage of classes attended by the students | **5** |
| **2.** | **Continuous Performance** | Group participation and response of the students to a given task:<br>• Judge individual student in the group<br>• Meeting timelines as per lesson plan | **15** |
| **3.** | **Experimental Setup / Design** | • Assessment of experimental set up / design<br>• Evaluation of result / outcome.<br>• Validation of results.<br>• Novelty / Relevance of work. | **20** |
| **4.** | **Structuring and presentation** | • Structuring and presentation<br>• Group presentation with individual contribution | **10** |

**References:**


1. http://www.sciencedirect.com/
2. https://www.ncbi.nlm.nih.gov/pubmed
3. https://www.elsevier.com/books-and-journals
4. https://www.plos.org/
5. https://www.deepdyve.com/
6. http://ieeexplore.ieee.org/Xplore/home.jsp
7. https://www.researchgate.net/
8. https://www.science.gov/
9. https://scholar.google.co.in/
10. http://www.popsci.com/

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

### BHM-MC-006: Quantitative Aptitude and Personality Development-I

| | |
|---|---|
| Credits AP | Max. Marks : 100 |
| L-T-P 0-0-2 | Continuous Evaluation : 50 |
| Duration of Examination: 2 Hrs | End Sem Exam : 50 |

**Pre-Requisite: None**
**Course Type: HSMC**

**Course Outcomes:** Students will be able to-
BHM-MC-006.1. Recognize & solve problems based on non-verbal reasoning.
BHM-MC-006.2. Solve complex problems based on arithmetic reasoning.
BHM-MC-006.3. Apply short tricks on complex problems of verbal reasoning.
BHM-MC-006.4. Apply correct usage of grammar in communication.
BHM-MC-006.5. Enhance their vocabulary and use it in day to day life.
BHM-MC-006.6. Develop speed reading & writing skills.

**PART-A**

**Unit 1: Arithmetic II**
- 1.1 Percentages
- 1.2 Ratio & Proportion
  - 1.2.1. Proportionality
  - 1.2.2. Variations
  - 1.2.3. Partnership
- 1.3 Profit & Loss
  - 1.3.1. Basic terminology & Formulae
  - 1.3.2. Error in Weights
  - 1.3.3. Marked Price and Discounts
- 1.4Time & Work
  - 1.4.1. Time and Work, Chain Rule
  - 1.4.1. Work & Wages
  - 1.4.2. Pipes & Cisterns
- 1.5 Mixtures &Alligations

**Unit 2: Verbal Reasoning 2**
- 2.1 Syllogism
- 2.2 Ranking
- 2.3 Coding-Decoding
- 2.4 Inequalities and Mathematical Operations

**Unit 3: Non Verbal Reasoning**
- 3.1 Pictorial Series
- 3.2 Missing Values
- 3.3 Analogy and Images

**Part-B**

**Unit 4: Communication Accuracy**
- 4.1 Relevance of Verbal Ability and preparatory guidelines
- 4.2 Functional Grammar – Subject Verb Agreement
- 4.3 Tenses – Perfect, Simple, Continuous

4.4 Common Errors and rectification

**Unit 5: Word Power Building Skills**

5.1 Words: Antonyms, Synonyms, Verbal Analogies
5.2 Compound words: Homophones, Homonyms, Word Families
5.3 Root Word Technique for Prefixes & Suffixes
5.4: Word Power: 7 Tips for Learning New Words
5.5 Practice Vocabulary Exercises

**Unit 6: Reading & Writing Skills**

6.1 Objectives of Reading, Definition & Types of Reading & Importance of Reading
6.2 Reading Techniques: SW3R, Active Reading, Detailed, Speed
6.3 Practice Exercises: Short & Medium Passages3.1 Writing: Introduction of Writing Skills, Objectives of enhancing Writing Skills & Types of Writing
6.4 Sentences, Phrases, Types of Sentences, Parts of Sentences
6.5 Paragraph Writing: Construction, Linkage & Cohesion

**Text Books/Reference Books:**

1. R S Aggarwal, 2017, Quantitative Aptitude for Competitive Examinations, S Chand & Company PvtLtd.
2. R S Aggarwal, 2018, A Modern Approach to Verbal& Non Verbal Reasoning, S Chand & Company Pvt Ltd.
3. Verbal Ability and Reading Comprehension: MVN Enterprises
4. P.A. Anand, Verbal Ability and Reasoning for Competitive Examinations, Wiley

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix:**

| CO Statement (BHM-MC-006) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BHM-MC-006.1 | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - |
| BHM-MC-006.2 | 1 | - | - | 2 | - | - | - | - | - | - | - | - | - | - |
| BHM-MC-006.3 | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BHM-MC-006.4 | 1 | - | - | 1 | - | - | - | - | 1 | 3 | - | 2 | 1 | 1 |
| BHM-MC-006.5 | 1 | - | - | 1 | - | 1 | - | - | 1 | 3 | - | 2 | - | - |
| BHM-MC-006.6 | 1 | 2 | - | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 | 1 | 1 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

**BHM-MC-002: SPORTS AND YOGA**

| | | | |
|---|---|---|---|
| Credits | AP | Max. Marks | : 100 |
| L-T-P | 2-0-0 | Continuous Evaluation | : 100 |
| Duration of Examination: | 2 Hrs | End Sem Exam | : 0 |

**Pre-requisite: None**

**Course Type: Audit pass**

**Course Outcomes:**The course will enable the student to-

BHM-MC-002.1. Understand the importance of sound health and fitness principles as they relate to better health.

BHM-MC-002.2.Participate in variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.

**Unit 1: Introduction to Physical Education, Wellness & Lifestyle (6 Lectures)**

Meaning & definition of Physical Education, Aims & Objectives of Physical Education, changing trends in Physical Education, Meaning & Importance of Physical Fitness & Wellness, Components of Physical fitness, Health related fitness and wellness, Preventing Health Threats through Lifestyle Change, Concept of Positive Lifestyle.

**Unit 2: Fundamentals of Anatomy & Physiology in Physical Education, Sports &Yoga (8 Lectures)**

Define Anatomy, Physiology & Its Importance, Effect of exercise on the functioning of Various Body Systems (Circulatory System, Respiratory System, Neuro-Muscular System etc.), Meaning and Concept of Postures, Causes of Bad Posture, Advantages & disadvantages of weight training., Concept & advantages of Correct Posture, Common Postural Deformities –Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis, Corrective Measures for Postural Deformities.

**Unit 3: Yoga&Lifestyle(6 Lectures)**

ElementsofYoga,Introduction-Asanas,Pranayama,Meditation&YogicKriyas, Yogaforconcentration&relatedAsanas, RelaxationTechniquesforimprovingconcentration -Yog-nidra, Asanasaspreventivemeasures.

**Unit 4: Training, Planning & PsychologyinSports(8 Lectures)**

MeaningofTraining, warmingupandlimberingdown, Skill,Technique& Style, MeaningandObjectivesofPlanning, Tournament–Knock-Out,League/RoundRobin&Combination.

Definition&ImportanceofPsychologyinPhysicalEdu.&Sports, Define&DifferentiateBetweenGrowth&Development, AdolescentProblems&TheirManagement, Psychologicalbenefitsofexercise.

**TextBooks/References:**

1. Ajmer Singh and Rachhpal Singh Brar, 2019, Essentials ofPhysicalEducation, Kalyani Publishers.
2. B.K.S.Iyengar, 2015, Yoga for Sports, Westland publications.

**Evaluation Tools:**

**Class Quiz, Rubrics**

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-421: Smart Materials**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-421.1: Identify various smart materials on different patterns
BCE-DS-421.2: Classify various Sensors and sensing technologies
BCE-DS-421.3: Recommend actuator Techniques to be used
BCE-DS-421.4: Apply methods for data Acquisition

**PART-A**

**Unit 1: Introduction about Smart Materials**
1.1. Introduction to Smart Materials and Structures
1.2. Instrumented structures functions and response
1.3. Sensing systems
1.4. Self –diagnosis
1.5. Signal processing consideration
1.6. Actuation systems and effectors.

**Unit 2: Measuring techniques**
2.1. Strain Measuring Techniques using Electrical strain gauges
2.2. Types
2.3. Resistance
2.4. Capacitance
2.5. Inductance
2.6. Wheatstone bridges
2.7. Pressure transducers
2.8. Load cells
2.9. Temperature Compensation

**Unit 3: Sensing Technology**
3.1. Sensing Technology
3.2. Types of Sensors
3.3. Physical Measurement using Piezo Electric Strain measurement
3.4. Inductively Read Transducers
3.5. The LVDT
3.6. Fiber optic Techniques.

**PART-B**

**Unit 4: Structural Assessments**
4.1. Chemical sensing in structural Assessment

4.2. Bio-Chemical sensing in structural Assessment
4.2. Absorptive chemical sensors
4.3. Spectroscopes
4.4. Fibre Optic Chemical Sensing Systems and Distributed measurement.

**Unit 5: Actuator Techniques**
5.1. Actuator Techniques
5.2. Actuator and actuator materials
5.3. Piezoelectric and Electrostrictive Material
5.4. Magneto structure Material
5.5. Shape Memory Alloys
5.6. Electro rheological fluids
5.7. Electromagnetic actuation
5.8. Role of actuators and Actuator Materials.

**Unit 6: Data Acquisition and Processing**
6.1. Data Acquisition and Processing
6.2. Signal Processing and Control for Smart Structures
6.3. Sensors as Geometrical Processors
6.4. Signal Processing
6.5. Control System: Linear and Non-Linear.

**Text Books/ Reference Books:**


1. Srinivasan, A. V. and Michael McFarland, D., "Smart Structures: Analysis and Design", Cambridge University Press, 2009.
2. Michelle Addington and Daniel L. Schodek, "Smart Materials and Technologies: For the Architecture and Design Professions", Routledge 2004.
3. Brain Culshaw, "Smart Structure and Materials", Artech House – Borton. London,1996.
4. L. S. Srinath, "Experimental Stress Analysis", Tata McGraw-Hill, 1998.
5. J. W. Dally and W. F. Riley, "Experimental Stress Analysis", Tata McGraw-Hill, 1998.


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-421 ) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PS O 1 | PS O 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-421.1 | 2 | 3 | 3 | 3 | 2 | - | - | - | - | 1 | 1 | 2 | 3 | 2 |
| BCE-DS-421.2 | 3 | 2 | - | 3 | 2 | - | - | 3 | - | - | 0 | 2 | 2 | 2 |
| BCE-DS-421.3 | 3 | - | 1 | 3 | 3 | | - | 3 | - | - | | 2 | 3 | 2 |
| BCE-DS-421.4 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | 2 | 2 | 1 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

### BCE-DS-422: Introduction to Sustainable Development

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-422.1: have an increased awareness among students on issues in areas of sustainability.
BCE-DS-422.2: understand the role of engineering and technology within sustainable development.
BCE-DS-422.3: know the methods, tools, and incentives for sustainable product-service system development
BCE-DS-422.4: establish a clear understanding of the role and impact of various aspects of engineering and engineering decisions on environmental, societal, and economic problems

**Part A**

**Unit 1: Sustainability- need and concept**
Sustainability- need and concept, challenges, Environment acts and protocols,.

**Unit 2: Global, Regional and Local environmental issues**
Global, Regional and Local environmental issues, Natural resources and their pollution, Carbon credits,
**Unit 3: Zero waste concept**
Zero waste concept ISO 14000, Life Cycle Analysis, Environmental Impact Assessment studies,

**Part B**

**Unit 4: Sustainable habitat**
Sustainable habitat, Green buildings, green materials, Energy,

**Unit 5: Conventional and renewable sources**
Conventional and renewable sources, Technology and sustainable development,

**Unit 6: Sustainable urbanization, Industrial Ecology.**
Sustainable urbanization, Industrial Ecology.

**Reference:**

1. Edwards, Andres R.; Orr, David W., The sustainability revolution: portrait of a paradigm shift, Gabriola Island, B.C.: New Society, 2005

2. Blyton, Paul.; Franklin, Alex., Researching sustainability: a guide to social science methods, practice and engagement, London: Earthscan, 2011.

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-422 ) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PS O 1 | PS O 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-422.1 | 2 | 3 | 3 | 3 | 2 | - | - | - | - | 1 | 1 | 2 | 3 | 2 |
| BCE-DS-422.2 | 3 | 2 | - | 3 | 2 | - | - | 3 | - | - | 0 | 2 | 2 | 2 |
| BCE-DS-422.3 | 3 | - | 1 | 3 | 3 | | - | 3 | - | - | | 2 | 3 | 2 |
| BCE-DS-422.4 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | 2 | 2 | 1 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-423: Transformation to Green Buildings**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-423.1: Explain the principles of building planning, its bylaws and provide facilities for rainwater harvesting.
BCE-DS-423.2: Understand the concepts of green buildings
BCE-DS-423.3: Acquire knowledge on various aspects of green buildings
BCE-DS-423.4: Learn the principles of planning and orientation of buildings

**Part A**

**Unit 1: INTRODUCTION**

A historical perspective. General premises and strategies for sustainable and green design, objectives and basis.

**Unit 2: GREEN CONSTRUCTION AND ENVIRONMENTAL QUALITY**

Sustainable architecture and Green Building: Definition, Green building evaluation systems; Renewable Energy; Controlling the water cycle, Impact of materials on environment;

**Unit 3: PASSIVE DESIGN IN MATERIALS**

Passive Design and Material Choice – Traditional Building Materials – Importance of envelope material in internal temperature control – Specification for walls and roofs in different climate – Material and Humidity Control.,

**Part B**

**Unit 4: ECO HOUSE**

The form of the house, the building as an analogy. Building concepts: energy loss, insulation, passive solar gain, active solar gain, health benefits, sustainable materials.

**Unit 5: SUSTAINABLE AND GREEN BUILDING DESIGN STUDIO**

This studio will explore collaborative learning to explore, investigate and apply various parameters of sustainability for design development of projected building/ urban scenarios

**Unit 6: INDOOR ENVIRONMENTAL.**

Indoor Environmental Quality for Occupant Comfort and Wellbeing: Daylighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

**Reference:**


1. Mili Majumdar, "Energy-efficient buildings in India" Tata Energy Research Institute, 2002.
2. TERI "Sustainable Building Design Manual- Volume I & II" Tata Energy Research Institute, 2009.
3. Shahane, V. S, "Planning and Designing Building", Poona, Allies Book Stall, 2004.
4. Michael Bauer, Peter Mösle and Michael Schwarz "Green Building – Guidebook for Sustainable Architecture" Springer, 2010.
5. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison "Green Building Handbook" Volume I, Spon Press, 2001.
6. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
7. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
8. Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao
9. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
10. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
11. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
12. Charles J. Kibert, Sustainable Construction – Green Building Design and Delivery, John Wiley &Sons, New York, 2008.
13. Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.
14. Ken Yeang: Eco Design- A manual for Ecological design; Wiley Academy, 2006.
15. Sue Roaf et all: Ecohouse, A design guide; Elsevier Architectural Press, 2007.
16. Thomas E Glavinich: Green Building Construction; Wiley, 2008.
17. Brenda and Robert Vale: Green Architecture, Design for a Sustainable Future; Thames and Hudson, 1996.
18. Daniel Vallero and Chris Brasier: Sustainable Design - The science of sustainability and Green Engineering; Wiley, 2008


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-423 ) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PS O 1 | PS O 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-423.1 | 2 | 3 | 3 | 3 | 2 | - | - | - | - | 1 | 1 | 2 | 3 | 2 |
| BCE-DS-423.2 | 3 | 2 | - | 3 | 2 | - | - | 3 | - | - | 0 | 2 | 2 | 2 |
| BCE-DS-423.3 | 3 | - | 1 | 3 | 3 |  | - | 3 | - | - |  | 2 | 3 | 2 |
| BCE-DS-423.4 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | 2 | 2 | 1 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**

(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-424: Introduction to Smart Cities**

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

**BCE-DS-424.1** Describe the concept of Smart Cities with different approaches
**BCE-DS-424.2** Classify the utilities of energy in Urban cities
**BCE-DS-424.3** Deduce the Smart transportation system and other challenges in developing Smart cities
**BCE-DS-424.4** Explore IOT and its application in smart cities

**PART A**

**Unit 1: Smart Urban Infrastructures and Smart Cities**

1.1 Introduction about Smart Cities and urban planning
1.2 Smart Cities Applications and related Technologies
1.3 Perspective on Smart Cities
1.4 Smart Cities success factors and opportunities
**Unit 2: Smart Urban Energy System**
2.1 Energy Consumption and Utilities
2.2 Urban Energy System
2.3 Energy efficiency in buildings
2.4 Policies and Managerial requirements
2.5 Procedures for energy measurement
2.6 Energy monitoring Techniques
**Unit 3: Smart Urban Transport System**
3.1 Introduction to Intelligent Transportation
3.2 Smart Urban Transportation
3.3 Challenges in implementation and Expenditure

**PART B**

**Unit 4: Introduction to Internet of Things (IoT)**

4.1 Concept of Internet of Things
4.2 Big Data for IoT
4.3 Smart Sensors, process units and actuators
4.4 Artificial Intelligence
**Unit 5: Smart Cities Innovations and Challenges**
5.1 Challenges on Services
5.2 Challenges on Infrastructures
5.3 Challenges in Managers
5.4 Challenges for policy makers
**Unit 6: Smart City Case Study**
6.1 Baltimore, MD, USA

6.2 Shangai, China
6.3 Dunedin, New Zealand
6.4 Singapore
6.5 Toronto, Canada

**Text Books/Reference Books:**

1.N. Mani, 2016, Smart Cities & Urban Development in India, John Willey & Sons.
2.S. Jeschke,R. Srivasan , 2017, Smart Cities: Foundations, Principles, and Applications, Oxford press.
3. Alan R. Shark , Sylviane Toporkoff, Sebastien Levy, 2014, Smart Cities for a Bright Sustainable Future: A Global Perspective, 2014
4. Ejaz, Waleed, Anpalagan, Alagan, 2019, Internet of Things for Smart Cities: Technologies, Big Data and Security, Springer International Publishing

**Software required / Web links:**
https://www.youtube.com/watch?v=d7xgXsQmPZE
https://freevideolectures.com/course/4638/nptel-introduction-internet-things/48

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-424)** | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BCE-DS-424 .1** | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 |
| **BCE-DS-424.2** | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 |
| **BCE-DS-424.3** | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 |
| **BCE-DS-424.4** | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-425: INTELLIGENT BUILDINGS

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

BCE- DS-425.1 Understand the fundamental concepts and principles of intelligent buildings
BCE- DS-425.2 Identify and evaluate various technologies and systems used in intelligent buildings
BCE- DS-425.3 Analyze the benefits and challenges of implementing intelligent building systems
BCE- DS-425.4 Apply design strategies and techniques for integrating smart technologies in buildings
BCE- DS-425.5 Assess and optimize energy efficiency in intelligent buildings
BCE- DS-425.6 Evaluate the security and privacy considerations of intelligent building systems

### Part A

**Unit 1 Introduction to Intelligent Buildings**
1.1 Definition and characteristics of intelligent buildings
1.2 Evolution and importance of intelligent building systems
1.3 Key components and technologies in intelligent buildings

**Unit 2 Building Automation Systems**
2.1 Building management systems (BMS) and control strategies
2.2 Integration of HVAC, lighting, and security systems
2.3 Sensor networks and data acquisition in intelligent buildings

**Unit 3 Energy Efficiency in Intelligent Buildings**
3.1 Energy management and optimization strategies
3.2 Smart grid integration and demand response
3.3 Energy monitoring and analytics

### PART-B

**Unit 4 Security and Privacy in Intelligent Buildings**
4.1 Access control and surveillance systems
4.2 Cybersecurity and data protection
4.3 Privacy considerations and ethical implications

**Unit 5 Sustainability in Intelligent Buildings**
5.1 Green building certifications and rating systems
5.2 Renewable energy integration
5.3 Life cycle assessment and sustainable practices

**Unit 6 Case Studies and Emerging Trends**
6.1 Analysis of real-world intelligent building projects
6.2 Emerging technologies and future trends in intelligent buildings

**Text Books/ Reference Books:**

1. Intelligent Building System for Airport, ASHRAE Journal V-39 N 11, Nov. ’97 pp. 31-35
2. Maintenance System of Electrical Facilities Proceedings of the Annual Conference, 1997.

**Software required/Web links:**

1. https://archive.nptel.ac.in/courses/105/108/105108077/

2. https://archive.nptel.ac.in/courses/108/108/108108147/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous Evaluation Table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

| Course Articulation Matrix CO Statement (BCE- DS-425) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-425.1 | 3 | 2 | 2 | 1 | - | - | 2 | 2 | 1 | 1 | - | - | 2 | 2 |
| BCE-DS-425.2 | 3 | 3 | 2 | 2 | 2 | - | - | 2 | 2 | 1 | 2 | - | 2 | 2 |
| BCE-DS-425.3 | 3 | 2 | 3 | 1 | 1 | - | - | 2 | 2 | 2 | 1 | - | 1 | 1 |
| BCE-DS-425.4 | 3 | 3 | 3 | 2 | 1 | 2 | - | - | 1 | 2 | 1 | 1 | 3 | 1 |
| BCE-DS-425.5 | 3 | 3 | 1 | 1 | 2 | - | 3 | 3 | 2 | 3 | 2 | - | - | 2 |
| BCE-DS-425.6 | 3 | 3 | 1 | 1 | 2 | - | 3 | 3 | 2 | 3 | 2 | - | - | 2 |

# SEMESTER-V

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## PROJ-CE-500: SUMMER INTERNSHIP-II

| | |
|---|---|
| Credits 2 | Max. Marks : 100 |
| Practical/Week 4-6 weeks | Continuous Evaluation : 100 |

**Prerequisites: None**
**Course Type: Project**

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

PROJ-CE-500.1. Identify various civil related to relevant field
PROJ-CE-500.2. Explore the various possibilities of a career in this field.
PROJ-CE-500.3. Demonstrate competency in relevant engineering fields through problem identification, formulation
PROJ-CE-500.4. Generate a report-based project/ experience carried out
PROJ-CE-500.5. Develop the professional and ethical responsibilities of an engineer.

Every student will have to undergo 60 Hours Summer Internship over a period of 04 weeks in the field/ Civil Engineering Department Labs. Head of Department will approve the Industry/Organization for Onsite training. During this course of time, he/she will be regularly monitored and evaluated. On the completion of training duration, he/she will have to submit the training report, deliver presentation about the work/project undertaken during the training.

The parameters for evaluation during the training shall be as under:

| | |
|---|---|
| Presentation/Viva: | 40 Marks |
| Training Report: | 20 Marks |
| Performance: | 20 marks |
| Attendance: | 20 Marks |
| | ------------- |
| | **100** |

**ARTICULATION MATRIX**

| **CO Statement (PROJ-**CE-500) | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROJ-CE-500.1 | 1 | 2 | 3 | 3 | 1 | - | - | - | 2 | - | - | - | - | 2 |
| PROJ-CE-500.2 | 2 | 1 | - | - | - | 1 | 1 | - | 2 | 2 | 2 | - | 2 | 2 |
| PROJ-CE-500.3 | 2 | - | - | 3 | - | - | 1 | 1 | 1 | - | - | - | 1 | 2 |
| PROJ-CE-500.4 | 2 | 2 | 2 | 2 | 1 | 2 | - | 2 | 2 | - | - | 1 | 1 | 2 |
| PROJ-CE-500.5 | 2 | 2 | 2 | 2 | 1 | 1 | - | 2 | 1 | 3 | 2 | 2 | - | 2 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-502: GEOTECHNICAL ENGINEERING**

| | | | |
|---|---|---|---|
| Credits | 2 | Max. Marks | : 200 |
| L-T-P | 2-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Core**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-502.1. Classify soil according to their properties
BCE-DS-502.2. Summarize knowledge about seepage and stresses of soil
BCE-DS-502.3. Apply methods to find out the stresses, bearing pressure and contact pressure.
BCE-DS-502.4. Make use of compaction and field control of soil compaction with different method.
BCE-DS-502.5. Explain concept of consolidation and settlement
BCE-DS-502.6. Analyze shear strength parameters and inherent properties of soil

**PART-A**

**Unit 1: Introduction**

1.1 Types of soils, their formation and deposition, Scope of soil engineering. Comparison and difference between soil and rock.
1.2 Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio-moisture content, unit weight- percent air voids, saturation- moisture content, moisture content-specific gravity etc.,
1.3 Plasticity of soil, consistency limits, consistency indices, flow & toughness indices, definitions of activity and sensitivity
1.4 Classification of Soils-

**Unit 2: Permeability of Soil and effective stresses**

2.1 Darcy's law, validity of Darcy's law.
2.2 Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test.
2.3 Permeability aspects: permeability of stratified soils, factors affecting permeability of soil.
2.4 Stream and potential functions, characteristics of flow nets, graphical method to plot flow nets,
2.5 Effective stress principle, nature of effective stress, effect of water table. Fluctuations of effectivestress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

**Unit 3: Compaction and Soil Exploration**

3.1 Introduction, theory of compaction,
3.2 Laboratory determination of optimum moisture content and maximum dry density.
3.3 Compaction in field, compaction specifications and field control,

3.4 Methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, trail pits, borings, penetrometer tests, analysis of borehole logs, geophysical and advance soil exploration methods.

**PART-B**

**Unit 4: Stresses in Soil**

4.1 Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area.
4.2 Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart.
4.3 Contact pressure under rigid and flexible area,
4.4 Computation of displacements from elastic theory.

**Unit 5: Consolidation of Soil**

5.1 Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation,
5.2 Spring analogy for primary consolidation,
5.3 Interpretation of consolidation test results,
5.4 Terzaghi's theory of consolidation, final settlement of soil deposits,
5.5 Computation of consolidation settlement and secondary consolidation.

**Unit 6: Shear Strength**

6.1 Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses,
6.2 Mohr-Coulomb theory,
6.3 Types of shear tests: direct shear test, merits of direct shear test,
6.4 Triaxial compression tests, test behaviour of UU, CU and CD tests, pore-pressure measurement,
6.5 Computation of effective shear strength parameters. unconfined compression test, vane shear test

**Text Books/ Reference Books:**

1. Gopal Ranjan , Basic and Applied Soil Mechanics, New Age International
2. Alam Singh, Soil Mechanics, Asia Publishing House
3. K.R.Arora, Soil Mech& Foundation Engineering, Standard Publisher
4. B.C.Punmia, Soil Mech& Foundation Engineering,Fireball Media

**Software required/Weblinks:**

http://nptel.ac.in/courses/ 105103097 /

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-502) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-502.1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-502.2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-502.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-502.4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-502.5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-502.6 | 1 | 2 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE–DS–505A: Structural Analysis - I**

Credits 2 | Max. Marks : 200
L-T-P 1-0-2 | Continuous Evaluation : 100
Examination Duration 3 hrs | End Semester Exam : 100

**Pre-requisites: None**
**Course Type: Core**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS -505A.1Derive the shear and bending moment equations for idealized structures to draw the shearing force and bending moment diagrams.
BCE-DS -505A.2Calculate the internal forces in beams, frames, cable and arch type modelled real structures
BCE-DS -505A.3Deduce the influence lines for reactions, shears, and bending moments in beams and girders due to moving load.
BCE-DS -505A.4Apply the methods to calculate slope and deflection as well as force and moments in statically indeterminate structures for serviceability criteria Model structural systems (bridge and building) with the aid of Staad Pro software.

**Part A**

**Unit 1: Review of basic concepts**
1.1Equilibrium
1.2Stability and Static Determinacy of structures
1.3Shear force and bending moment diagram in beams and frames
1.4Verify BMD and SFD by Staad Pro.

**Unit 2: Analysis of statically determinate structures**
2.1Plane truss: method of joints and method of sections
2.2Three Hinged Arch
2.3Euler's theory of Columns
2.4Concept of Influence line diagram and moving loads
2.5Verify Axial force in truss by Staad Pro

**Unit 3: Analysis of statically determinate structures.**
3.1Strain Energy and Energy Theorems
3.2Deflection of truss: Method of virtual work
3.3Deflection of beams and frames-Moment area method, conjugate beam method and virtual work method
3.4Verify deflected profile with Staad Pro.

**PART-B**

**Unit 4: Analysis of statically indeterminate structures**
4.1Propped Cantilever
4.2Fixed beams
4.3Continuous beams
4.4Verify deflected profile with Staad Pro.

**Unit 5: Introduction to direct stiffness method**

5.1Kinematic Indeterminacy
5.2Beams and Frames: Moment distribution method
5.3Beams and Frames: Slope deflection method
5.4Verify slope value by Staad Pro.

**Unit 6**: **Suspension Bridges and Cable structures**
6.1Equilibrium of light cables
6.2Analysis of Cables
6.3Temperature stresses
6.4Three hinged stiffening girders
6.5Two Hinged stiffening girders
6.6Analysis for temperature in Staad Pro

**Text/Reference Books:**

1.Vazirani&Ratwani et al , "Analysis of Structures" Vol 1, Khanna Publishers
2.Bhavikatti, "Structural Analysis" Vol I Vikas Publishers
3.Hibbler , "Structural Analysis", Pearson Education.
4.Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill.
5.S.B.Junnarkar, Dr. H. J. Shah "MECHANICS OF STRUCTURES" VOL.I, Charotar Publishing House.
6.L.S Negi & R.S. Jangid, "Structural Analysis", Tata McGraw Hill
7.K U Muthu, "Basic structural Analysis" I K International Publishing House
8.Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill.
9.S. P. Timoshenko and D. Young, "Theory of Structures" Mc-Graw Hill Book Publishing Company Ltd
10.Devdas Menon, "Structural Analysis" Vol I, Narosa Publication
11.T.S. Thandavamoorthy, "Structural Analysis", Oxford University Press.

**Software required / Web links:**

Staad Pro Software
https://nptel.ac.in/courses/105/105/105105166/
https://nptel.ac.in/courses/105101085/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
**Course Articulation Matrix**

| CO Statement (BCE-DS - 505A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-505A.1 | 3 | 2 | 2 | 2 | 1 | 1 | - | 1 | 1 | 2 | 2 | 3 | 2 | 3 |
| BCE-DS-505A.2 | 3 | 1 | 1 | 2 | - | 2 | 3 | 1 | 1 | - | 2 | 1 | 2 | 3 |
| BCE-DS-505A.3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 2 | 3 |
| BCE-DS-505A.4 | 1 | 3 | 3 | 3 | 2 | - | - | 1 | 1 | - | 2 | 2 | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-506A: CONCRETE TECHNOLOGY

| | | | |
|---|---|---|---|
| Credits | 2 | Max. Marks | : 200 |
| L-T-P | 2-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Prerequisite:** None
**Course Type:** Core

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

BCE-DS-506A.1. Describe the role of cement, aggregates and water in concrete along with detailed study of cement.

BCE-DS-506A.2. Conduct different tests that can be performed on coarse and fine aggregates and grading curves.

BCE-DS-506A.3. Comprehend properties of fresh concrete and hardened concrete, affect of water cement ratio on strength of concrete.

BCE-DS-506A.4. Make use of admixtures both mineral and chemical in concrete

BCE-DS-506A.5. Develop special concretes.

BCE-DS-506A.6. Design concrete mix to suit different site requirements.

### PART-A

**Unit-1: Introduction**

1.1 Definition of concrete, brief introduction to properties of concrete, advantages of concrete, uses of concrete in comparison to other building materials
1.2 Ingredients of Concrete
1.3 Cement: physical properties of cement; different types of cement:

**Unit-2.: Fine Aggregate and Coarse Aggregate**

2.1 Classification of aggregates according to
  2.1.1 Particle size, shape and surface texture,
2.2 Specific gravity of aggregate; Bulk density, water absorption, surface moisture, bulking of sand, deleterious materials soundness
2.3 Grading of aggregates: coarse aggregate, fine aggregate; All-in aggregate; fineness modulus; interpretation of grading charts

**Unit-3: Properties of Concrete**

3.1 Properties in plastic state, Workability, Segregation, Bleeding and Harshness
3.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes;
3.3 Principle of water-cement ration law/Duff Abram's Water-cement ratio law: Limitations of water-cement law
3.4 Definition of strength of concrete, relation between water cement ratio and strength of concrete
3.5 Workability:
  3.5.1 Definition, phenomenon of workability, concept of internal friction, segregation and harshness; factors affecting workability

3.5.2 Measurement of workability: slump test, compacting factor and vee bee consistometer;recommended slumps for placement in various conditions as per IS: 456-2000

**PART-B**

**Unit-4: Admixtures**

4.1 Chemical admixtures (Plasticizers, Accelerators and Retarders, Water reducing admixtures, Air-entraining admixtures)
4.2 Mineral admixtures
4.3 Fly ash
4.4 Silica fumes
4.5 Rice husk ash
4.6 Meta Kaolin

**Unit-5: Special Concretes**

5.1 Concreting under special conditions
  5.1.1 Cold weather concreting
  5.1.2 Under water concreting
  5.1.3 Hot weather concreting
5.2 Fibre reinforced concrete
5.3 Ferro Cement
5.4 Light Weight Concrete
5.5 Polymer concrete
5.6 High Density Concrete
5.7 Self Compacting Concrete
5.8 High Performance Concrete

**Unit-6: Mix Design**

6.1 Objectives of mix design, introduction to various grades as per IS: 456-2000; proportioning for normal mix as prescribed by IS: 456-2000.
6.2 Adjustment on site for: Bulking of fine aggregate, water absorption of aggregate, workability
6.3 Difference between normal and controlled concrete
6.4 Principles of concrete mix design, basic considerations
6.5 Factors in the choice of mix design.
6.6 Outline of mix design procedure.

**Text Books/ Reference Books:**

1. M.S Shetty,Concrete Technology, S Chand Publications.
2. M.L Gambhir,Concrete Technology, Tata Mc Graw Hill Publications.
3. A.M Neville, Properties Of Concrete, Pearson Education, Fourth edition
4. IS 383:1970- Coarse and fine aggregates from natural source for concrete.
5. IS: 10262:2009- Concrete mix proportioning-Guidelines.
6. S.P.-23 Handbook on concrete mixes.

**Software required / Web links:**

http://nptel.ac.in/courses/105102012/
http://www.alphace.ac.in/downloads/notes/cv/10cv81.pdf

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-506A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-506A.1 | - | 3 | 1 | 2 | - | 1 | - | 1 | 1 | 1 | 2 | 3 | 2 | 2 |
| BCE-DS-506A.2 | - | 3 | 2 | - | - | - | - | 1 | 2 | 1 | 1 | 2 | 2 | - |
| BCE-DS-506A.3 | 1 | 3 | 1 | 2 | - | - | - | - | 1 | 1 | 1 | 2 | - | 1 |
| BCE-DS-506A.4 | 1 | - | 2 | 1 | - | - | - | 2 | 1 | 1 | 2 | 3 | 1 | - |
| BCE-DS-506A.5 | 1 | - | 1 | - | - | 1 | - | 1 | 2 | 1 | 3 | 3 | - | 2 |
| BCE-DS-506A.6 | 2 | 1 | 2 | 2 | - | 1 | - | - | 2 | 1 | 1 | 3 | 1 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

### BCE-DS-507: Environmental Engineering-I

| | |
|---|---|
| Credits 2 | Max. Marks : 200 |
| L-T-P 2-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Core**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-507.1 Relate to the concept of water demand
BCE-DS-507.2 Carry out water quality assessment studies
BCE-DS-507.3 Select the most appropriate technique for the treatment of water
BCE-DS-507.4 design various components of water treatment plant.

### PART-A

**Unit 1: Water Demand**
1.1 Types of demand, factors affecting per capita demand, variations in demand,
1.2 Population forecasting and its application in planning of water supply schemes
1.3 Sources of water supply and quality issues: estimation of water quantity, factors governing the selection of source;
1.4 Water conservation measures, water safety plans
1.5 Types of intakes, factors governing the location of intake

**Unit 2: Water Quality**
2.1 Physical chemical and microbiological water quality parameters, their significance
2.2 Water quality analysis methods
2.3 Water borne diseases and their control
2.4 Drinking water quality criteria and standards

**Unit 3: Water Treatment**
3.1 Objectives of water treatment
3.2 Treatment processes and their sequence in conventional treatment plant.
3.3 Sedimentation - plain and aided with coagulation. Types, features and design aspects
3.4 Mixing basins and Flocculation units.
3.5 Filtration - mechanism involved, types of filters, slow and rapid sand filtration units (features and design aspects)
3.6 Disinfection principles and aeration.

### PART-B

**Unit-4: Other Treatment Processes:**
4.1 Water softening, Chemical precipitation
4.2 Ion exchange, reverse osmosis;
4.3 Filtration: theory of filtration, types of filters and their classification, filter operations;
4.4 Disinfectioning: types of disinfectants, chlorination;

**Unit-5: Water Conveyance System:**
5.1 Conveyance of water
5.2 Rising and Gravity system, Dual systems
5.3 Pumping Systems and pumping stations

5.4 Valves and appurtenances, pipe materials and pipe fitting,

**Unit-6: Water Distribution System:**
6.1 Water distribution system, requirements of a good distribution system,
6.2 Methods of distribution,
6.3 Layout and design of water supply systems
6.4 Distribution Reservoir- functions and determination of storage capacity

**Text Books/ Reference Books:**


1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
2. Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
3. Peavy, H.S, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw -Hill International Editions, New York 1985.
4. Engineering Organization, Ministry of Urban Development, Government of India
5. Peavy Howard S, Rowe Donald R, Tchobanglous Geroge, Environmental Engineering, McGraw Hill Education (India) Pvt Ltd 2013
6. Water Supply & Sanitary Engineering, G.S.Birdie, J.S.Birdie, $10^{th}$ Edition, Dhanpat Rai Publishing Company (2015)
7. Water Supply Engineering, S.K.Garg, Khanna Publishers, 2010, Khanna Publishers


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examinationCourse Articulation Matrix

| CO Statement (BCE-DS-507) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-507.1 | 2 | | 1 | | | 2 | 3 | 2 | | | | | 3 | 2 |
| BCE-DS-507.2 | | 1 | | | | | 2 | | | | | | 2 | 3 |
| BCE-DS-507.3 | | | | | 2 | | | | | 3 | 2 | | 3 | 2 |
| BCE-DS-507.4 | | | | 2 | | | | 3 | 2 | 3 | | | 3 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-508: Smart Infrastructure: Design and Simulation**

| | |
|---|---|
| Credits 2 | Max. Marks : 200 |
| L-T-P 0-0-4 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**
**Course Outcomes:** At the end of this course, the student will be able to:

BCE-DS-508.1 plan and design a structure in AutoCAD 3D
BCE-DS-508.2 plan a structure in Revit Architecture
BCE-DS-508.3 plan a structure in Revit Structure
BCE-DS-508.4 understand the behaviour of structural elements in STAAD Pro
BCE-DS-508.5 understand Project Planning, Scheduling and Controlling by different analytical tools

**List of Experiments**

1. Introduction to AutoCAD 3D Modelling.
2. Planning of a Smart Building in AutoCAD 3D: Materials and Graphics.
3. Planning of a Smart Building in AutoCAD 3D: Lightening and Animation.
4. Designing of various Beams under various loading conditions in STAAD Pro.
5. Analysis of different types of Columns in STAAD Pro.
6. Designing of a Single – Storey Structure in STAAD Pro.
7. Analysis of a Four – Storey Structure in STAAD Pro.
8. Introduction to Revit Architecture.
9. Introduction to Revit Structure.
10. Introduction to OpenRoads.
11. Introduction to Microsoft Projects and Primavera.
12. Applicability of Microsoft Excel in Project Planning, Scheduling and Controlling.

**Text Books/ Reference Books:**

1. N. Mani, 2016, Smart Cities & Urban Development in India, John Willey & Sons.
2. Jeschke,R.  Srivasan , 2017, Smart Cities: Foundations, Principles, and Applications, Oxford press.
3. Alan R. Shark , SylvianeToporkoff, Sebastien Levy, 2014, Smart Cities for Bright Sustainable Future: A Global Perspective, Wiley
4. ImrichChlamtac, Iyad Katib, Rashid Mehmood, Simon See, 2019, Smart Infrastructure and Applications: Foundations for Smarter Cities and Societies, Springer.


**Software required/Weblinks:**
1. https://www.autodesk.com/education/home
2. https://www.bentley.com/support/learn/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Assessment Tools:**

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

**Course Articulation Matrix :**

| **CO Statement (BCE-DS-508)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-508.1 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-508.2 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-508.3 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| BCE-DS-508.4 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 |
| BCE-DS-508.5 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 3 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-552-: GEOTECHNICAL ENGINEERING LAB

| | | | |
|---|---|---|---|
| Credits 1 | | Max. Marks | : 100 |
| L-T-P | 0-0-2 | Continuous Evaluation | : 50 |
| Examination Duration | 2 hrs | End Semester Exam | : 50 |

**Co-requisite: Geotechnical Engineering**
**Course Type: Core**

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

BCE-DS-552.1. Recall soil types, its classification and index properties
BCE-DS-552.2. Demonstrate with Field density test methods
BCE-DS-552.3. Experiment with Proctor's compaction test for prediction of type of optimum moisture content and dry density.
BCE-DS-552.4. Examine permeability of the soil.
BCE-DS-552.5. AnalyseEngineering properties of soil for obtaining shear strength required for analysis and design the foundation.
BCE-DS-552.6. Make use of soil testing and correlate with the field problems.

**List of Experiments:**

1. Visual Soil Classification and water content determination.
2. Determination of specific gravity of soil solids.
3. Grain size analysis-sieve analysis.
4. Liquid limit and plastic limit determination.
5. Field density by:
   i) Sand replacement method
   ii) Core cutter method
6. Proctor's compaction test.
7. Coefficient of permeability of soils.
8. Unconfined compressive strength test.
9. Direct shear test on granular soil sample.
10. Unconsolidated undrained (UU) triaxial shear test of fine grained soil sample.
11. Vane Shear test
12. Relative Density

**Reference Books:**

1. M D Braja, Soil Mechanics. Laboratory Manual, Oxford University Press
2. Shamsher Prakash, Engineering Soil Testing,Nem Chand & Brothers
3. R.F. Craig, Soil Mechanics, Chapman & Hall
4. R.D. Holtz and W.D. Kovacs, An Introduction to Geotechnical Engineering, Prentice Hall, NJ 4.

**Software required / Web links**

home.iitk.ac.in/~madhav/geolab.html

**Distribution of Continuous evaluation table**

| Parameter | Weightage |
|---|---|
| **Two Mid-Term Viva** | **60%** |
| **File/Record Keeping** | **20%** |
| **Class Performance** | **10%** |
| **Class Attendance** | **10%** |

**Assessment Tools:**

Lab Practice

Mid-Term Viva

Surprise questions during practicals/Class Performance

File record

Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-552) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-552.1 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 3 |
| BCE-DS-552.2 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 3 |
| BCE-DS-552.3 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 3 |
| BCE-DS-552.4 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 3 |
| BCE-DS-552.5 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 3 | 3 |
| BCE-DS-552.6 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-553: STRUCTURAL ENGINEERING LAB

| | | | |
|---|---|---|---|
| Credits 1 | | Max. Marks | : 100 |
| L-T-P 0-0-2 | | Continuous Evaluation | : 50 |
| Examination Duration | 2 hrs | End Semester Exam | : 50 |

**Co-requisite: Structural Analysis-I**
**Course Type: Core**

**Course Outcomes:** On completion of the course, the students will be able -
BCE-DS-553.1 To visualize the deflections and behavior of structural components
BCE-DS-553.2 To apply the concepts of elastic properties of materials.
BCE-DS-553.3 To practically as well as theoretically analyze typical structures such as Three Hinged Arches, Two Hinged Arches and Determinate Trusses.
BCE-DS-553.4 To study and visualize Cable Suspension Bridges and Portal Frames.
BCE-DS-553.5 To understand the theory of Columns and their buckling behavior.

**Lists of experiments**

1. Verification of reciprocal theorem of deflection using a simply supported beam.
2. Verification of moment area theorem for slopes and deflections of the beam.
3. To determine elastic properties of a beam.
4. Experimental and analytical study of a Three Hinged Arch.
5. Experiment on two hinged arch.
6. Sway in portal frames.
7. Study of cable suspension bridge.
8. Experimental and analytical study of a 3 bar pin jointed truss
9. Uniaxial tension test for steel (plain & deformed bars) using UTM
10. Experimental and analytical study of struts with various end conditions.

**Reference Books:**


1. Hibbler, Structural Analysis, Pearson Education.
2. C. S. Reddy, Basic Structural Analysis, Tata McGraw Hill.
3. S.B. Junnarkar Dr. H. J. Shah,Mechanics of Structures, Vol.I, Charotar Publishing House.
4. L.S Negi & R.S. Jangid, Structural Analysis, Tata McGraw Hill
5. K. U. Muthu et al, Basic structural Analysis, I K International Publishing House
6. Wilbur and Norris, Elementary Structural Analysis, Tata McGraw Hill.
7. S. P. Timoshenko and D. Young, Theory of Structures, Mc-Graw Hill Book Publishing Company Ltd
8. Devdas Menon, Structural Analysis, Vol I & II, Narosa Publication


**Software required / Web links**
http://nptel.ac.in/courses/105101085/
http://nptel.ac.in/courses/105105109/

**Distribution of Continuous evaluation table**

| Parameter | Weightage |
|---|---|
| Two Mid-Term Viva | 60% |
| File/Record Keeping | 20% |
| Class Performance | 10% |
| Class Attendance | 10% |

**Assessment Tools:**
Lab Practice
Mid-Term Viva
Surprise questions during practicals/Class Performance
File record
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE- DS-553) | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE- DS-553.1 | 3 | 3 | 2 | 1 | 2 | - | - | - | | - | - | - | 2 | 3 | 1 |
| BCE- DS-553.2 | 3 | 3 | 2 | 1 | 2 | - | - | - | | - | - | - | 2 | 3 | 1 |
| BCE- DS-553.3 | 3 | 3 | 2 | 1 | 2 | - | - | - | | - | - | - | 2 | 3 | 1 |
| BCE- DS-553.4 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | | 2 | 2 | 1 | 2 | 1 | 1 |
| BCE- DS-553.5 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | - | | - | - | - | - | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956**)**

**BCE-DS-652: Environmental Engineering Lab**

| | | | |
|---|---|---|---|
| Credits 1 | | Max. Marks | : 100 |
| L-T-P | 0-0-2 | Continuous Evaluation | : 50 |
| Examination Duration | 2 hrs | End Semester Exam | : 50 |

**Co-requisites: Environmental Engineering-I**
**Course Type: Core**

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

BCE-DS-652.1 Make use of water quality characteristics
BCE-DS-652.2 Identify effect of the pollutants on the environment: atmosphere, water and soil.
BCE-DS-652.3 Plan strategies to control, reduce and monitor pollution
BCE-DS-652.4 Select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.
BCE-DS-652.5 Apply water quality testing protocols.

**Practical Work: List of Experiments**

1. Physical Characterization of water: Turbidity, Electrical Conductivity, pH
2. Analysis of solids content of water: Dissolved, Settleable, suspended, total, volatile, inorganic etc.
3. Alkalinity and acidity, Hardness: total hardness, calcium and magnesium hardness
4. Analysis of ions: copper, chloride and sulfate
5. Optimum coagulant dose
6. Chemical Oxygen Demand (COD)
7. Dissolved Oxygen (D.O) and Biochemical Oxygen Demand (BOD)
8. Break point Chlorination
9. Bacteriological quality measurement: MPN,
10. Ambient Air quality monitoring (TSP, RSPM, SOx, NOx)
11. Ambient noise measurement

**Text Books/ Reference Books:**


1 Gilbert Masters, Introduction to Environmental Engineering and Science, Prentice Hall, New Jersey.
2 P. AarneVesilind, Susan M. Morgan, Introduction to Environmental Engineering.
3 Peavy, H.S, Rowe, D.R, Tchobanoglous, 1985, G. Environmental Engineering, Mc-Graw -Hill International Editions
4 MetCalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.


**Distribution of Continuous evaluation table**

| Parameter | Weightage |
|---|---|
| Two Mid-Term Viva | 60% |
| File/Record Keeping | 20% |
| Class Performance | 10% |
| Class Attendance | 10% |

**Assessment Tools:**

Viva-voce
Lab Report
Surprise questions during laboratory sessions
Term end final evaluation

**Course Articulation Matrix**

| CO Statement (BCE-DS-652) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-652.1 | 2 | 2 | 3 | 3 | | | | | | | | | 3 | 2 |
| BCE-DS-652.2 | | | | | 3 | | 2 | 3 | | 2 | | | 2 | 3 |
| BCE-DS-652.3 | | | 2 | 2 | 3 | 2 | 3 | | | 2 | 1 | 2 | 3 | 2 |
| BCE-DS-652.4 | | | 2 | 2 | 3 | 2 | 3 | | | 2 | | | 3 | 2 |
| BCE-DS-652.5 | | | | | | | | 3 | 2 | 2 | 2 | 1 | 3 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956**)**

### DTI -500: Design, Thinking and Innovation -III

Credits 1 Max. Marks : 50
L-T-P 0-1-0 Continuous Evaluation : 50
Examination Duration 2 hrs

**Pre-requisites: Design, Thinking and Innovation -II**
**Course Type: Research & Training**

**Course outcomes**
At the end of this course, the student will be able to:**:**

DTI – 500.1 Understand the Plagiarism / Feasibility tools
DTI – 500.2 Document the outcome as Research Paper / Patent / Product / Start-up /copyright

**Activity 1:**
1.1 Compilation / Documentation of the outcome (Research Paper / Patent / Product / Start-up /copyright).
1.2 Plagiarism / Feasibility check.
1.3 Identification of the suitable Journal / Patenting Agencies / Angel Investors.
1.4 Submission to the identified Journal / Patenting Agencies / Angel Investors.

**Course Articulation Matrix:**

| CO Statement (DTI-500) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DTI-500.1 | - | 3 | - | - | - | - | - | 3 | - | - | - | 1 | - | - |
| DTI -500.2 | - | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |

**'3' (Tick) or 'More' Substantial/High Correlation, '2' Moderate/Medium Correlation, '1' Slightly/Low Correlation, 'Blank' No Correlation**

**Evaluation Criteria:** The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

| S. No. | Parameters | Description | (Marks) |
|---|---|---|---|
| **1.** | **Attendance** | • Percentage of classes attended by the students | **5** |
| **2.** | **Continuous Performance** | • Judge individual student's participation in the Activities<br>• Time bound completion of Activities | **15** |

| | | | |
|---|---|---|---|
| **3.** | **Accomplishment of the Outcome** | • Quality of the content and results<br>• Acceptance of the outcome (Research Paper/ Patent/ Product/ Copyright)<br>• Report submission / Presentation | **30** |

**References:**


1. www.originlab.com
2. http://www.cambridgesoft.com/software
3. http://www.synergy.com/
4. www.mathworks.com/products/matlab.html

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BHM-MC-008: QUANTITATIVE APTITUDE& PERSONALITY DEVELOPMENT II

| | |
|---|---|
| Credits AP | Max. Marks : 100 |
| L-T-P 0-0-2 | Continuous Evaluation : 50 |
| Examination Duration 2 hrs | End Semester Exam : 50 |

**Course Outcomes:** At the end of this course, the student will be able to:
BHM-MC-008.1. Analyze various forms of data.
BHM-MC-008.2. Solve complex problems based on arithmetic reasoning.
BHM-MC-008.3.Apply short tricks on complex problems of number system.
BHM-MC-008.4.Enhance and expand word knowledge by fostering word consciousness.
BHM-MC-008.5. Construct simple and complex sentences accurately.
BHM-MC-008.6.Develop reading skills & build verbal reasoning skills.

**PART-A**

**Unit 1: Number System II**

1.1 Factors and Multiples
1.2 Unit Digits &Cyclicity
1.3 Remainders
1.4 Factorials
1.5 Logarithm

**Unit 2: Arithmetic III**

2.1 Interest
- 2.1.1 Simple Interest
- 2.1.2 Compound Interest
- 2.1.3 Relation between SI & CI

2.2 Time, Speed & Distance
- 2.2.1 Basics Formulas & Proportionality
- 2.2.2 Average & Relative Speed
- 2.2.3 Trains and Boats & Streams
- 2.2.4 Circular Motion and Clocks

2.3Data Interpretation
- 2.3.1 Table and Bar graph
- 2.3.2 Line and Pie Charts
- 2.3.1 Mixed Charts and Caselets

**Unit 3: Verbal Reasoning III**
- 3.1 Calendar
- 3.2 Cubes and Dices
- 3.3 Data Sufficiency

**PART-B**

**Unit 4: Advanced Vocabulary**
- 4.1 Synonym & Antonym
- 4.2 One Word Substitution
- 4.3 Ordering of Words

4.4 Idioms and Phrases
4.5 Vocabulary, COW, Punctuation

**Unit 5: Sentence Construction & Syntax**

5.1 Sentence Improvement
5.2 Spotting Errors
5.3 Ordering of Sentences
5.4 Change of Voice/ Direct & Indirect speech
5.5 Completing Statements/Sentences

**Unit 6: Reading Comprehension & Reasoning**

6.1 Strategic Reading, Eliminating Poor Reading Habits
6.2 Techniques to increase speed reading, comprehension and recall
6.3 Solving Sample RC Passages
6.4 Closet Test
6.5 Para Jumbles

**Text Books/Reference Books:**

1. R S Aggarwal, 2017, Quantitative Aptitude for Competitive Examinations, S Chand & Company Pvt Ltd, Edition
2. R S Aggarwal, 2018, A Modern Approach to Verbal& Non Verbal Reasoning: S Chand & Company Pvt Ltd, Edition
3. R S Aggarwal, An Advanced Approach to Data interpretation, S Chand & Company PvtLtd, latest Edition
4. P.A. Anand, Verbal Ability and Reasoning for Competitive Examinations, Wiley

**Instructions for paper setting:** Fifty MCQ will be set in total. Twenty-five MCQ will be set from Part A and twenty five MCQ will be set from Part B. All questions will be compulsory. Each question will be of 1 mark. There will be no negative marking. Calculator will not be allowed.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Course Articulation Matrix**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PS1 | PS2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BHM-MC-008.1** | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | 1 |
| **BHM-MC-008.2** | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | 1 |
| **BHM-MC-008.3** | 1 | - | - | 2 | - | - | - | - | - | - | - | - | - | 1 |
| **BHM-MC-008.4** | 1 | - | 1 | - | - | - | - | - | 1 | 3 | 1 | 2 | 1 | 2 |
| **BHM-MC-008.5** | 1 | - | 1 | 1 | - | 1 | - | - | 1 | 3 | 1 | 2 | 1 | 2 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-501-HYDRAULIC ENGINEERING**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Introduction to Fluid Mechanics**
**Course Type: Domain Specific Elective**

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

BCE-DS -501.1 Learn use of basic concepts of flow of fluids and resistance to flow
BCE-DS -501.2 Use definitions and terminologies to identify boundary layer
BCE-DS -501.3 Relate to type and categories of design open channel flow , pipe flow and economical section of channel .
BCE-DS -501.4 Analyze relationship between uniform and non uniform flow
BCE-DS -501.5 Apply the concept of hydraulic jump , surge and Dynamic of fluid flow .
BCE-DS -501.6 Derive the equation of boundary layer to model fluid problems.

**PART-A**

**Unit 1**: **Laminar Flow**

1.1 Laminar flow through: circular pipes, annulus and parallel plates, Stoke's law, Measurement of viscosity.
1.2 Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow.
1.3 Definition of turbulence, scale and intensity, Causes of turbulence, instability,
1.4 Mechanism of turbulence and effect of turbulent flow in pipes.
1.5 Reynolds stresses, semi-empirical theories of turbulence,
1.6 Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram.

**Unit 2: Boundary Layer Analysis**

2.1 Assumption and concept of boundary layer theory, Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate
2.2 Laminar sub-layer, smooth and rough boundaries.
2.3 Local and average friction coefficients. Separation and Control.
2.4 Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity
2.5 Rayleigh method, Buckingham's Pi method and other methods.
2.6 Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.

**Unit 3**: **Introduction to Open Channel Flow**

3.1 Comparison between open channel flow and pipe flow, geometrical parameters of a channel, 3.2 classifications of open channels, classification of open channel flow, Velocity Distribution of channel section.
3.3 Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow,

3.4 Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient
3.5 Most economical section of channel-derivation and concept, Computation of Uniform flow, Normal depth.

**PART-B**

**Unit 4: Non-Uniform Flow**

4.1 Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth.
4.2 Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir.
4.3 Measurement of Velocity- Current meter, Floats, Hot-wire anemometer. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow,
4.4 Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile.
4.5 Computation of water surface profile by graphical, numerical and analytical approaches.
4.6 Direct Step method, Graphical Integration method and Direct integration method.

**Unit 5: Hydraulic Jump & Dynamics of Fluid Flow**

5.1 Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump.
5.2 Types, applications and location of hydraulic jump.
5.3 Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges.
5.4 Momentum principle, applications: Force on plates, pipe bends, moments of momentum Equation

**Unit 6: Flow through Pipes**

6.1 Loss of head through pipes, Darcy-Wiesbatchequation,minor losses, total energy equation, hydraulic gradient line
6.2 Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles.
6.3 Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.
6.4 Computational Fluid Dynamics: Basic equations of fluid dynamics, Grid generation, Introduction to in viscid incompressible flow,
6.5 Boundary layer flow as applicable to C.F.D. Hydro informatics: Concept of hydro informatics –scope of internet and web based modeling in water resources engineering. .

**Text/Reference Books:**


1. P.M. Modi and S.M. Seth Hydraulics and Fluid Mechanics, Standard Book House
2. K. Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill.
3. K. Subramanya, Open channel Flow, Tata McGraw Hill.
4. VenTe Chow, Open Channel Hydraulics, Tata McGraw Hill.
5. C.DBurnside, 1971, Electromagnetic Distance Measurement, Beekman Publishers


**Software required / Web links**

http://nptel.ac.in/courses/112105171/
http://nptel.ac.in/courses/112105183/
http://nptel.ac.in/courses/105101082/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-501) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-501.1 | 3 | 3 | 3 | 3 | 3 | - | - | 2 | - | 2 | 2 | 3 | 3 | 3 |
| BCE-DS-501.2 | 3 | 3 | 3 | 3 | 3 | - | - | 2 | - | 2 | 2 | 3 | 3 | 3 |
| BCE-DS-501.3 | 3 | 3 | 3 | 3 | 3 | - | - | 2 | - | 2 | 2 | 3 | 3 | 2 |
| BCE-DS-501.4 | 3 | 3 | 3 | 3 | 3 | - | - | 2 | - | 2 | 3 | 3 | 3 | 2 |
| BCE-DS-501.5 | 3 | 3 | 3 | 3 | 3 | - | | | | 1 | 3 | 3 | 3 | 3 |
| BCE-DS-501.6 | 3 | 3 | 3 | 3 | 3 | - | - | 2 | - | 3 | 3 | 3 | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-521: PAVEMENT MATERIALS

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Transportation Engineering**
**Course Type: Domain Specific Elective**

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

BCE-DS-521.1. Classify different types, characteristics of soil and their strength evaluation methods
BCE-DS-521.2. Categorize various properties of aggregate for pavement
BCE-DS-521.3. Summarize the concept of bitumen and its effects on construction of pavement
BCE-DS-521.4. Describe the various mechanical properties of bituminous mixes
BCE-DS-521.5. Design various bituminous mixes which fulfill the required properties of pavement material
BCE-DS-521.6. Apply IRC guidelines and material know-how to design of cement concrete pavement

### PART-A

**Unit 1: Soil**
1.1 Classification; Characteristics of soil
1.2Compactionof soil
1.3Evaluation of soil strength
1.4Stabilized pavement materials

**Unit 2: Aggregates**
2.1 Requirements
2.2 Properties and tests on road aggregates for flexible pavement
2.3 Properties and tests on road aggregates for rigid pavements

**Unit 3: Bitumen**
3.1 Origin &preparation
3.2Properties and tests
3.3 Constitution of bituminous road binders; requirements
3.4 Criterion for selection of different binders
3.5 Bituminous Emulsions and Cutbacks: Preparation, characteristics, uses and tests

### PART-B

**Unit 4: Bituminous Mixes**
4.1 Mechanical properties
4.2 Resilient modulus, dynamic modulus
4.3 Fatigue characteristics of bituminous mixes

**Unit 5: Bituminous Mix Design**
5.1 Bituminous mix design methods and specifications
5.2 Weathering and durability of bituminous materials and mixes
5.3 Performance based bitumen specifications

5.4 Super pave mix design method: design example problems

**Unit 6: Cement Concrete for Pavement Construction**

6.1 Requirements and design of mix for CC pavement
6.2 IRC and IS specifications and tests
6.3 Joint filler and sealer materials

**Text Books/ Reference Books**


1. A. T. Papagiannakis, E. A. Masad, 2007, Pavement Design and Materials, John Wiley&Sons,inc., 1st Edition
2. Shin-Che Huang, Di Benedetto, Hervé, 2015, Advances in Asphalt Materials: Road and Pavement Construction' , Wood head Publishing Series in Civil and Structural Engineering, 1st Edition
3. Geo; W. Tillson,2017' Street Pavements and Paving Materials: A Manual of City Pavements, the Methods and Materials of Their Construction, Forgotten Books
4. S.KKhanna., C.E.G Justo, and, A. Veeraragavan, 2017,Highway Engineering', Revised, NemChand & Bros, 10th Edition
5. A. Nikolaides, Bituminous Mixtures and Pavements VI, 1st Edition, e-book


**Software required/Weblinks:**
https://nptel.ac.in/courses/105101087/23

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-521) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-521.1. | 1 | 1 | 2 | 1 | - | 2 | 2 | 1 | - | - | - | 2 | 3 | 2 |
| BCE-DS-521.2. | 1 | 1 | 2 | 1 | - | 2 | 2 | 1 | - | - | - | 2 | 3 | 2 |
| BCE-DS-521.3. | 1 | 2 | 3 | 2 | 1 | 1 | 2 | - | 2 | 2 | 2 | 2 | 3 | 2 |
| BCE-DS-521.4. | 1 | 1 | 2 | 1 | - | 2 | 2 | 1 | - | - | - | 2 | 3 | 2 |
| BCE-DS-521.5. | 1 | 1 | 2 | 1 | - | 2 | 2 | 1 | - | - | - | 2 | 3 | 2 |
| BCE-DS-521.6. B | 1 | 2 | 3 | 2 | 1 | 1 | 2 | - | 2 | 2 | 2 | 2 | 3 | 2 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-522: DESIGN OF HYDRAULIC STRUCTURES

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Prerequisite: Introduction to Fluid Mechanics**

**Course Type: Domain Specific Elective**

**Course Outcomes:**At the end of this course, the student will be able to:
BCE-DS-522.1 Interpret irrigationand irrigation system
BCE-DS-522.2 Design lined and unlined channels.
BCE-DS-522.3 Identify the location and build of canal falls
BCE-DS-522.4 Demonstrate the various hydraulic structure components.
BCE-DS-522.5 Select the site for the construction of dam.
BCE-DS-522.6 Design Spillways.

**PART-A**

**Unit I: Basics of Irrigation**

1.1 Irrigation: Necessity and Methods of Irrigation.
1.2 Water requirement of crops: Duty, Delta, Base Period.
1.3 Consumptive use of water, Principal crops and crop season, crop rotation.
1.4 Canal irrigation system, Command area and Intensity of Irrigation.
1.5 Irrigation efficiencies.

**Unit II: Design of lined and unlined channels**

2.1 Design of lined canals using Chezy's and Manning's formulae, Most economical sections
2.2 Necessity/Advantages of canal Lining.
2.3 Design of unlined canals based on Lacey's theory.
2.4 Types of canal outlets.

**Unit III: Canal Falls**

3.1 Canal falls - Necessity and location, types of falls.
3.2 Roughening devices.
3.3 Diversion canal headworks: Various components and their functions, layout plan, selection of site for diversion headworks.
3.4 Silt control devices: Silt excluders and Silt ejectors.

**PART-B**

**Unit IV: Regulation Works**

4.1 Cross - regulator and distributory head regulators.
4.2 Canal escapes, types of escapes.
4.3 Bligh's creep theory and its application.
4.4 Mode of failure of hydraulic structures on permeable foundation.
4.5 Cross Drainage Structures: Classification and their selection.

**Unit V: Storage Headworks**

5.1 Necessity and types of dams.
5.2 Selection of site for the construction of dam.
5.3 Merits and demerits of different types of dams and their selection.
5.4 Earth dam, seepage through earth dams, determination of seepage line.
5.5 Control of seepage, design of filters.

**Unit VI: Spillways**

6.1 Essential requirements of spillway and spillway's capacity.
6.2 Types of spillways and their suitability.
6.3 Location of spillways.
6.4 Design of Ogee spillways.

**Text/Reference Books:**


1. S. K. Garg, 2014 Irrigation Engineering and Hydraulics Structures, Khanna Publishers,
2. Dr. B. C. Punmia, 2009, Irrigation and Water Power Engineering, Laxmi Publications,
3. P. N. Modi, 2014, Irrigation Water Resources & Water Power Engineering, Standard Book House
4. Bharat Singh,2005, Fundamentals of Irrigation Engineering, Nem Chand & Bros,
5. N. N. Basak, 2014 Irrigation Engineering, Tata McGraw Hill
6. G. L. Asawa, 2005 Irrigation and Water Resources Engineering, New Age International Publishers


**Software required/Web links**

http://nptel.ac.in/courses/126104001/
http://nptel.ac.in/courses/105105110/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-522) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-522.1 | 3 | 2 | 2 | - | 2 | 1 | - | 2 | 2 | 1 | 1 | 1 | 2 | 1 |
| BCE-DS-522.2 | 3 | 3 | 3 | 1 | 3 | 2 | - | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| BCE-DS-522.3 | 2 | 1 | 1 | - | 1 | 2 | - | 2 | 2 | 2 | 1 | 1 | 2 | 1 |
| BCE-DS-522.4 | 3 | 2 | 2 | 2 | 1 | 1 | - | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| BCE-DS-522.5 | 3 | 2 | 3 | 2 | 2 | 2 | - | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| BCE-DS-522.6 | 3 | 2 | 2 | 2 | 3 | 2 | - | 2 | 2 | 2 | 2 | 3 | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-523: ENGINEERING MATERIALS FOR SUSTAINABILITY

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:**At the end of this course, the student will be able to:
BCE-DS-523.1 Define Material Flow Analysis
BCE-DS-523.2 Estimate sustainability metrics for Material selection
BCE-DS-523.3 Quantify LEED and ASCE guideline
BCE-DS-523.4 Relate Life Cycle Assessment to material selection
BCE-DS-523.5 Apply sustainability concepts to design of structural components

### PART-A

**UNIT 1: Introduction**
1.1 Material properties
1.2 Material markets
1.3 Material Flow Analysis (MFA)
1.4 Embodied and process energies of materials
1.5 Impact on the Biosphere
1.6 Optimization of material use

**UNIT 2: Sustainability Concepts**
2.1 Definitions
2.2 Impacts of Civil Engineering on sustainability
2.3 Parameters used In the Calculation of Sustainability Metrics
2.4 Estimate sustainability metrics for select materials

**Unit 3: Sustainable Civil Engineering Design Practice**
3.1 ASCE Policy on the Role of the Engineer in Sustainability
3.2 Discussion on LEED and other guidelines
3.3 Estimate sustainability metrics for application-material combinations

### Part-B

**Unit 4: Life-Cycle Assessment (LCA)**
4.1Use of sustainability metrics in LCA
4.2Selection of materials using LCA

**Unit 5: Material Specifications**
5.1Components of a material specification
5.2Sustainability-based material specifications

**Unit 6: Design Project**

6.1Application of sustainability concepts in a real project
6.2Conduct sustainability-based material selection for a simple project
6.3Design a structural component by integrating sustainability concepts

**Text Books/ Reference Books:**

1. Michael F. Ashby, Materials and Sustainable Development

**Software required / Web links:**

http://aspire.surrey.ac.uk/modules/eng1078

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-523) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-523.1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-523.2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-523.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-523.4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-523.5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-523.6 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-524: Green and Renewable Energy**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Prerequisite: None**
**Course Type: Domain Specific Elective**
**Course outcomes:** At the end of the course, the student will be able to

BCE-DS-524.1 Relate to the concept of renewable energy and non-renewable energy.
BCE-DS-524.2 Apply fundamental principles of renewable energy sources.
BCE-DS-524.3 Develop capability to do basic energy assessment.
BCE-DS-524.4 Prioritize energy conversion methods

**PART -A**

**Unit 1: Introduction**

1.1 Energy, power, Forms of energy
1.2 Conservation of energy, second law of thermodynamics
1.3 Energy flow diagram to the earth
1.4 Origin and time scale of fossil fuels
1.5 Conventional energy sources
1.6 Role of energy in economic development and socialtransformation

**Unit 2:Energy Science**

2.1 Forms of Energy, importance of Energy consumption as measure of prosperity,
2.2 Per Capita Energy Consumption, roles and responsibility of Ministry of New and Renewable Energy
2.3 Sources, Needs of renewable energy, Classification of Energy Resources
2.4 Conventional Energy Resources , non-conventional energy resources,
2.5 World energy scenario, Indian Energy Scenario.

**Unit 3: Ocean Energy**

3.1 Principle of ocean thermal energy conversion
3.2 Tidal power generation
3.3 Tidal energy technologies
3.4 Energy from waves and its conversion techniques
3.5 Advantages, disadvantages and applications

**PART -B**

**Unit 4:Goethermal Energy**

4.1 Geothermal resource.
4.2 Nature of geothermal fields.
4.3 Advantages, disadvantages and applications.
4.4 Economics of geothermal energy utilization, site selection criteria.
4.5 Geothermal energy scenario of world and India.

**Unit 5: Wind Energy**

5.1 Basic principles of Wind Energy Conversion Systems (WECS), Types and Classification of WECS.
5.2 Principle of wind energy conversion.
5.3 Advantages, disadvantages and applications.
5.4 Economics of wind energy utilization, site selection criteria, wind farm, wind rose diagram.
5.5 Wind energy scenario of world and India.

**Unit 6:Bio energy**

6.1 Energy from bio-mass-sources of biomass-species.
6.2 Conversion of biomass into fuel, energy through fermentation.
6.3 Pyrolysis, gasification and combustion.
6.4 Properties and characteristics of biogas.

**Text Books/ Reference Books:**


1. G.D. Rai, Non-Conventional Energy Sources, Khanna Publications, New Delhi, 2011.
2. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 1996.
3. Khandelwal, K.C., Mahdi, S.S., Biogas Technology – A Practical Handbook, Tata McGraw-Hill, 1986.
4. Tiwari. G.N., Solar Energy – "Fundamentals Design, Modeling& Applications", Narosa Publishing House, New Delhi, 2002. 5.
5. Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK, 1990. 6.
6. Frank Krieth& John F Kreider ,Principles of Solar Energy, John Wiley, New York
7. Sukhatme. S.P., Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi,1997.
8. B. H. Khan, Non-Conventional Energy Resources, , The McGraw Hill
9. Twidell, J.W. & Weir, A. Renewable Energy Sources, EFN Spon Ltd., UK, 2006.
10. S. P. Sukhatme and J.K. Nayak, Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw-Hill, New Delhi.
11. Garg, Prakash, Solar Energy, Fundamentals and Applications, Tata McGraw Hill.


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous Evaluation Table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (**BCE-DS-524**)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O 1** | **PS O 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-524.1 | 2 | | 1 | | | 2 | 3 | 2 | | | | | 3 | 2 |
| BCE-DS-524.2 | | 1 | | | | | 2 | | | | | | 2 | 3 |
| BCE-DS-524.3 | | | | | 2 | | | | | 3 | 2 | | 3 | 2 |
| BCE-DS-524.4 | | | | 2 | | | 2 | 3 | 2 | 3 | | | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

## BCE-DS-525: Sustainable Architecture

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 2-0-2 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Program Elective**
**Course Outcomes:** At the end of this course, the student will be able to:

BCE-DS-525.1 develop a relation between sustainable principles at both regional and local scale
BCE-DS-525.2 practice the strategies and processes that shape sustainable architecture
BCE-DS-525.3 acquire a comprehensive knowledge about the Principles urban design
BCE-DS-525.4 explore the emerging concepts and role of GIS Applications concerning current and future development.

### PART A

**Unit 1:Introduction to Sustainable Architecture**

1.1 Concepts and Principles of Sustainable Architecture
1.2 Variables of Sustainability and their relation with real world
1.3 Vernacular Hill Architecture
1.4 Role of a Sustainable Architect

**Unit 2:Building Science and Sustainability**

2.1 Thermal Conductivity and Resistance
2.2 Building Energy: Calculations, Gains and Loss
2.3 Importance of Energy to Human Development
2.4 conventional and renewable energy sources

**Unit 3:Fundamentals of Ecology**

3.1 Basic Introduction
3.2 Impacts of Urbanization
3.3 Environmental Policies
3.4 Ecological Design Approach

### PART B

**Unit 4:Landscape Architecture**

4.1 Introduction
4.2 Elements of Landscape
4.3 Site Analysis and Site Planning
4.4 Case Studies
4.5 Making out Architecture Plan on AutoCAD 2D

**Unit 5:Urban Designing**

5.1 Concept of Urban Designing
5.2 Concept of Urban Transformation
5.3 City – Human Network
5.4 Concept of Smart Cities

**Unit 6:GIS Applications in Architecture**

6.1 Concept of Remote Sensing and Mapping
6.2 Raster and Vector Data Form
6.3 Aerial Photogrammetry
6.4 Role of GIS in Mapping and Resource Monitoring
6.5 Applications of GIS in Design, Analysis and Planning

**Text Books/ Reference Books:**

1. Landscape Architecture by Simonds, John Ormsbee, McGraw-Hill New York.
2. Fundamentals of Ecology by E. P. Odum, W.B. Saunders, Philadelphia, UAR.
3. Urban Design: Green Dimensions by J. C. Moughtin, Peter Shirley,Rouledge.
4. Climate responsive architecture: a design handbook for energy efficient buildings by Krishan, A., Tata McGraw-Hill Education

**Software required/Weblinks:**

https://nptel.ac.in/courses/124/107/124107011/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-525)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-525.1 | 2 | | 1 | | | 2 | 3 | 2 | | | | | 3 | 2 |
| BCE-DS-525.2 | | 1 | | | | | 2 | | | | | | 2 | 3 |
| BCE-DS-525.3 | | | | | 2 | | | | | 3 | 2 | | 3 | 2 |
| BCE-DS-525.4 | | | | 2 | | | | 3 | 2 | 3 | | | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

### BCE-DS-526: Planning and Design of Sustainable Transport Systems

Credits 3 | Max. Marks : 200
L-T-P 3-0-0 | Continuous Evaluation : 100
Examination Duration 3 hrs | End Semester Exam : 100

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

**BCE-DS-526.1** Understand the concept of sustainability, sustainable transportation, and related definitions
**BCE-DS-526.2** Comprehend the major sustainability issues in transportation system
**BCE-DS-526.3** Assess the impact of transportation system on environment
**BCE-DS-526.4** Make use of various design facilities to achieve sustainable mobility

**PART-A**

**Unit-1: Introduction**
1.1 Introduction to Transportation System
1.2 Concept of Sustainability
1.3 Current Scenario of Transportation in India
1.4 Climate Change
1.5 Impact of transportation Systems

**Unit-2: Land Use Planning and Zoning**
2.1 Introduction to Land Use
2.2 Land Use Planning and Zoning
2.3 Transit Oriented Development
2.4 TOD Implementation
2.5 TOD Case study

**Unit-3: Sustainable Transportation Planning**
3.1 Introduction to Sustainable Transportation Planning
3.2 Traditional Transportation Planning Process
3.3 Contemporary Transportation Planning Process
3.4 Management Strategies

**PART-B**

**Unit-4: Life Cycle Assessment**
4.1 Introduction
4.2 Material Flow Analysis
4.3 Concept of Circular Economy
4.4 Circular Economy in Transport sector

**Unit-5: Transportation Environment**
5.1 Modelling of Transport Emissions
5.2 Traffic Noise Emission Models
5.3 Initiatives and Policies for Environmental Sustainability
5.4 Decarbonizing the Transport sector
5.5 Alternate Fuels
5.6 Electric Vehicles and Sustainability

**Unit-6: Environment Impact Analysis**
6.1 Introduction to Environment Impact Analysis
6.2 EIA Processes
6.3 Methodologies of EIA
6.4 EIA Process in India
6.5 Global Practices in EIA Process
6.6 EIA Case-Study

**Text Books/ Reference Books:**


1. Black, W.R. (2010). Sustainable Transportation: Problems and Solutions. The Guilford Press, New York, NY.
2. Shiller, P.L., E. Bruun, and J.R. Kenworthy. (2010). An Introduction to Sustainable Transportation. Earthscan, London, Washington DC.
3. R. J. Salter and N. B. Hounsel, Highway Traffic Analysis and Design, Macmillan Press Ltd, 1996.


**Software required/Weblinks:**

https://archive.nptel.ac.in/courses/105/107/105107210/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
**Course Articulation Matrix**

**Course Articulation Matrix**

| CO Statement (BCE-DS-526) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-526.1 | 2 | 2 | 1 | 3 | 1 | 2 | - | - | 3 | - | 1 | 2 | 3 | 1 |
| BCE-DS-526.2 | 3 | 2 | 3 | 2 | 2 | - | 2 | 2 | - | - | 2 | - | 2 | 3 |
| BCE-DS-526.3 | 3 | 1 | 2 | 2 | 1 | - | 2 | 3 | 2 | 3 | 2 | - | 2 | 3 |
| BCE-DS-526.4 | 2 | 3 | 2 | - | 3 | - | 2 | - | - | 3 | - | 2 | 3 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-527: AI/ML in Infrastructure Engineering**

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**
**Course Outcomes:** At the end of this course, the student will be able to:

BCE-DS-527.1 understand the fundamentals of AI in Smart Infrastructure
BCE-DS-527.2 applications of ML in Smart Buildings
BCE-DS-527.3 understand Intelligent Infrastructure Systems
BCE-DS-527.4 apply Computational Techniques
BCE-DS-527.5 correlate Smart Infrastructure with Sustainable Smart Civil Engineering
BCE-DS-527.6 apply the concept of Building Information Modelling in Construction Projects

**PART A**

**Unit 1:Introduction to AI in Smart Infrastructure**

1.1 Introduction to AI

1.2 Neural Network Engineering; Supervised and Unsupervised Learning Network

1.3 Support Vector Machine and Support Vector Regression

1.4 Spatial and Temporal Data Analysis

**Unit 2:Fundamentals of ML in Civil and Infrastructure Engineering**

2.1 Concepts and Applications of Deep Learning

2.2 Probability and Bayesian Learning

2.3 Dimensionality Reduction and Clustering

2.4 Regression and Optimisation

**Unit 3:Smart Infrastructural Systems**

3.1 Introduction to Smart Cities

3.2 Intelligent Transportation Systems

3.3 Sensor Technology for Data Collection and Data Interpretation

3.4 IoT and Remote Sensing

**PART B**

**Unit 4:Applications of AI / ML towards Sustainable Infrastructure**

4.1 AI / ML in Smart Irrigation Systems

4.2 AI / ML in Environmental Life Cycle Assessment

4.3 AI / ML in Smart Waste Management

4.4 AI / ML in Pollution Control

**Unit 5:Computation in Mechanics and Materials**

5.1 Simulation Technologies for assessment of material's properties

5.2 Computation Techniques in Civil Infrastructure

5.3 Introduction to Finite Element Modelling (FEM) and Finite Element Analysis (FEA)

5.4 Introduction to Sensor Technologies in Structural Health Monitoring

**Unit 6:Building Information Modelling**

6.1 Introduction to Building Information Modelling

6.2 Phases of Building Information Modelling in Construction Industry

6.3 Applications of AI / ML in Construction Safety

6.4 Case Studies

**Text Books/ Reference Books:**


1. Limao Zhang, Yue Pan, Xianguo Wu, 2021, Artificial Intelligence in Construction Engineering and Management, Springer.
2. Paresh Chandra Deka, 2019, A Primer on Machine Learning Applications in Civil Engineering, Wiley.
3. ImrichChlamtac, Iyad Katib, Rashid Mehmood, Simon See, 2019, Smart Infrastructure and Applications: Foundations for Smarter Cities and Societies, Springer.
4. John R Vacca, 2020, Solving Urban Infrastructure Problems Using Smart City Technologies: Handbook on Planning, Design, Development, and Regulation, Elsevier.
5. B. H. V. Topping, 2000, Developments in Computational Techniques for Structural Engineering, Civil-Comp Press.
6. Karen Kensek, 2014, Building Information Modelling: BIM in Current and Future Practice, Wiley.


**Software required/Weblinks:**

1. https://nptel.ac.in/courses/106105077
2. https://archive.nptel.ac.in/courses/105/107/105107209/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous Evaluation Table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests

Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix :**

| CO Statement (BCE-DS-527) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-527.1 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-527.2 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-527.3 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| BCE-DS-527.4 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 |
| BCE-DS-527.5 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 3 | 2 |
| BCE-DS-527.6 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**

(Deemed to be University under section 3 of the UGC Act, 1956)

**HM-506 : French-1**

| | |
|---|---|
| Credits 2 | Max. Marks : 100 |
| L-T-P 2-0-0 | Continuous Evaluation : 50 |
| Examination Duration 2 hrs | End Semester Exam : 50 |

**Pre-Requisite:** None

**Course Type:** Generic Elective

**Course Outcomes:** Students will be able to-

HM-506.1. Exchange greetings and do introductions using formal and informal expressions. They can understand and use interrogative and answer simple questions.

HM-506.2. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greeting, weather and daily activities,) with repetition when needed.

HM-506.3.Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

HM-506.4. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.

HM-506.5. Express or/and justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.

HM-506.6. Describe various places, location, themselves using simple sentences and vocabulary.

**PART-A**

**Unit 1- Saluer et épeler l'alphabet**

1.1 Les Salutations & forms of politeness

1.2 Alphabets

**Unit 2- Usage de Vous et de Tu**

2.1 Taking leave expressions

2.2 Les pronoms sujets

2.3 Basic Questions

**Unit 3- Présentez-vous**

3.1 Les verbes ER

3.2 Self introduction

3.3 Décrivez votre ami(e)

**PART-B**

**Unit 4- Identifier un nombre, compter**

4.1 Les noms

4.2 Verbes Avoir, Etre, Aller & Faire

4.3 Les nombres

**Unit 5- Demander/ donner l'explications**
5.1 Les articles define et indefini
5.2 Les mois de l'annee
5.3 Les jours de la semaine

**Unit 6- Parler des saisons et demander l'heure**
6.1 Time
6.2 Weather
6.3 Unseen Passage

**Text Books/Reference Books/ Suggested Readings:**

1. Alter Ego Level One Textbook: Annie Berthet, Catherine Hugot, Veronique M Kizirian, 2006, Hachette Publications.
2. Apprenons Le Francais II & III: Mahitha Ranjit, 2014, Saraswati Publications.

**Weblinks:**
www.bonjourfrance.com
www.allabout.com

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**COURSE ARTICULATION MATRIX :**

| CO Statement (HM–506) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HM-506.1 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-506.2 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-506.3 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-506.4 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-506.5 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | 1 |
| HM-506.6 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | 1 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**HM-507 : German-1**

| | |
|---|---|
| Credits 2 | Max. Marks : 100 |
| L-T-P 2-0-0 | Continuous Evaluation : 50 |
| Examination Duration 2 hrs | End Semester Exam : 50 |

**Pre-Requisite:** None
**Course Type:** Generic Elective
**Course Outcomes:** Students will be able to-

HM-507.1. Exchange greetings and introductions using formal and informal expressions. They will be able to ask and answer simple questions.
HM-507.2. Discuss everyday life and daily routines, using simple sentences and familiar vocabulary.
HM-507.3. Identify key details in short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed.
HM-507.4. Discuss likes and dislikes, understand simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed
HM-507.5. Differentiate certain patterns of behavior in the cultures of the German- speaking world and the student's native culture.
HM-507.6. Describe various places, location, themselves using simple sentences and vocabulary.

**PART-A**

**Unit-1: Begrüßungen**
1.1 Salutations/Greetings
1.2 Introduction

**Unit-2: sich vorstellen und Zahlen**
2.1 Introduction
2.2 Alphabets
2.3 Numbers 1-20

**Unit-3: Berufe/ Pronomen**
3.1 Personal pronouns
3.2 Hobbies and professions

**PART-B**

**Unit-4:Café**
4.1 Café related vocabulary and dialogues
4.2 Revision personal pronouns

**Unit-5: Café dialog**
5.1 Café related vocabulary and dialogues
5.2 Common verbs and their conjugations

**Unit-6: Zeit und Monate**
6.1 Time
6.2 Days
6.3 Months

**Text Books/Reference Books:**

1. Studio D A1: Hermann Funk, 2011, Cornelson Publication.
2. Tangaram Aktuell A1: Kursbuch & Arbeitsbuch, 2011, Hueber.
3. Netzwerk: Stefanie Dengler, Paul Rusch, 2011, Klett.

**Weblinks:**

http://www.nthuleen.com/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**COURSE ARTICULATION MATRIX :**

| CO Statement (HM–507) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HM-507.1 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-507.2 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-507.3 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-507.4 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-507.5 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | 1 |
| HM-507.6 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | 1 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act, 1956)

**HM-508 : Spanish-1**

| | |
|---|---|
| Credits 2 | Max. Marks : 100 |
| L-T-P 2-0-0 | Continuous Evaluation : 50 |
| Examination Duration 2 hrs | End Semester Exam : 50 |

**Pre-Requisite:** None
**Course Type:** Generic Elective

**Course Outcomes:** Students will be able to-

HM-508.1. Exchange greetings and introductions using formal and informal expressions and students will be able to ask and answer simple questions.
HM-508.2. Discuss everyday life and daily routines, using simple sentences and familiar vocabulary and students will be able to discuss likes and dislikes understand simple conversations about familiar topics.
HM-508.3. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed and students will be able to offer basic descriptions of self, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.
HM-508.4. Provide basic information about familiar situations and topics of interest and students will be able to express or/and justify opinions using equivalents of different verbs.
HM-508.5. Differentiate certain patterns of behavior in the cultures of the Spanish-speaking world and student's native culture.
HM-508.6. Describe various places, location, themselves using simple sentences and vocabulary.

**PART-A**

**Unit 1: Introduction to Spanish and SER**
1.1 Presentation on Spanish language
1.2 Greetings and goodbyes
1.3 Spanish letters
1.4 Introduction of Verbo SER

**Unit 2: Verb Ser, Nationality, Profession and Counting**
2.1 Uses of Verbo SER
2.2 Adjectives related to Verbo SER.
2.3 Introduction of Nationality
2.4 Professions and vocabulary related to professions.
2.5 Counting till number 20.

**PART-B**

**Unit 3: Articles, Interrogative and Estar**
3.1 Introduction of Articles and Indefinite articles
3.2 Interrogatives
3.3 Introduction of Verbo Estar

**Unit 4:Estar, Preposition, Tener and Self Introduction**
4.1 Uses of Verbo ESTAR and adjectives related to it

4.2 Prepositions related to the positioning of an object
4.3 Tener & its uses
4.4 Self – introduction

**Unit 5 : Day, Month and Regular AR verb**
5.1 Days
5.2 Months
5.3 Introduction to regular –AR verbs

**Text Books/Reference Books:**
1. Spanish Grammar: Eric V Greenfield, 1971, Barnes and Noble.
2. Nuevo Espanol sin fronteras 1 + Workbook + CD: Jesus Sanchez Lobato and Isabel Santos Gargallo, 2006, Goyal, Ele & Sgel.

**Weblinks:**
http://studyspanish.com/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
**COURSE ARTICULATION MATRIX :**

| CO Statement (HM-508) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HM-508.1 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-508.2 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-508.3 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-508.4 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | - |
| HM-508.5 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | 1 |
| HM-508.6 | - | - | - | - | - | - | - | - | - | 1 | - | 1 | - | 1 |

# SEMESTER-VI

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## PROJ-CE-600A: PROJECT PHASE-I

| | | | |
|---|---|---|---|
| Credits | 1.0 | Max. Marks | : 100 |
| L-T-P | 0-0-2 | Continuous Evaluation | : 100 |
| Examination Duration | 2 hrs | End Semester Exam | : 00 |

**Prerequisite**: None
**Course Type**: Project

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

PROJ-CE-600A.1 Identifyengineering problems pertaining to their area of interest
PROJ-CE-600A.2 Conduct an extensive literature review on the identified problem area
PROJ-CE-600A.3 Design experiments in laboratory or field as maybe applicable
PROJ-CE-600A.4 Apply knowledge of mathematics, science, and engineering to real life Civil Engineering problems.
PROJ-CE-600A.5 Develop an understanding of professional and ethical responsibility and to communicate effectively.
PROJ-CE-600A.6 Function on multidisciplinary areas and in teams.

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental, design or combination of these in the area of Civil Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem.

**Assessment Tools:**
Title review
Mid-Term presentation
Guide’s continuous comprehensive assessment
Term end presentation

**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Presentation/Viva | 40% |
| Report | 20% |
| Class Work/ Performance | 20% |
| Attendance | 20% |

**Course Articulation Matrix**

| CO Statement PROJ-CE-600A | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROJ-CE-600A.1 | 3 | 1 | - | - | 2 | - | - | - | - | - | - | - | 3 | 3 |
| PROJ-CE-600A.2 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | 2 | 3 |
| PROJ-CE- | 3 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | 2 | - | 3 | 3 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 600A.3 | | | | | | | | | | | | | | |
| PROJ-CE-600A.4 | 2 | 3 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | 3 | 3 |
| PROJ-CE-600A.5 | 3 | 3 | 1 | 3 | 1 | - | - | - | - | - | - | - | 3 | 3 |
| PROJ-CE-600A.6 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | - | 1 | 2 | - | 1 | 2 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
**(Deemed to be University under section 3 of the UGC Act 1956)**

**BCE-DS-601A ESTIMATION, COSTING AND VALUATION**

| | |
|---|---|
| Credits 2 | Max. Marks : 200 |
| L-T-P 1-0-2 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites**: None
**Course Type**: Core

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS -601.1A Write general and detailed specifications of different Items of work in Civil Engineering works
BCE-DS -601.2A Analyze and calculate Rate analysis for different Items of work

BCE-DS -601.3A Apply the concept of various tenders including preparation, evaluation of tenders and Valuation of buildings
BCE-DS -601.4A Prepare estimates using software for various projects.

**PART-A**

**Unit-I: Estimate**
1.1 Principle of estimation, units, item work
1.2 Different kinds of estimates, different methods of estimation
1.3 Estimation of materials in single room building ,two room building with different sections of walls, foundation floors ,Plastering ,white washing, Distempering and painting ,doors and windows
1.4 Lump sum items
1.5 Estimates of canals, roads etc.

**Unit-II: Specification of Works**
2.1 Necessity of specification types of specification, general specification
2.2 Specification of bricks. Cement, sand, water, lime, reinforcement
2.3 Detailed specification for earthwork, cement, concrete, brickwork, flooring, D.P.C, R.C.C
2.4 Cement plastering, white and colour washing, distempering, and painting

**Unit-III: Rate analysis**
3.1 Purpose, importance and requirements of rate analysis, units of measurement
3.2 Preparation & procedure of rate analysis for items
3.3 Earth work .concrete works, R.C.C works
3.4 Plastering, painting, finishing (white washing ,distempering)

**PART-B**

**Unit-IV: Public Works Account and billing**
4.1 Tender – type, preparation,Process of issue and receipt, opening
4.2 Preparation of comparative statement and acceptance
4.3 Measurement book, administrative sanction, technical sanction
4.4 Preparation & Maintenance of muster roll,
4.5 Preparation of pay bill, measurement of work for payment of contractors

**Unit-V: Valuation & Arbitration**

5.1 Purpose & principles of valuation
5.2 Depreciation. sinking fund, salvage & scrap value
5.3 Valuation of a building-cost method rental returns method.
5.4 Indian contract Act
5.5 Arbitration Act and process of appealing.

**Unit-VI: Estimation problems**

6.1 Preliminary estimate using Plinth area method.
6.2 Detailed estimate of Load bearing structure using BIM/REVIT/ any estimation software
6.3. Calculation of steel with Bar bending Schedule using BIM/REVIT/ any estimation software
6.4. Detailed estimate of earthwork of road for Approximate 1km length using BIM/REVIT/ any estimation software

**Text/Reference Books:**

1. Patil, B.S., Civil Engineering Contracts, Vol. – I, Orient Longman Publication, 1998.
2. Rangwala, S.C., Elements of Estimating and Costing, Professional practice, Charotar Publishing House, Anand.
3. Aggarwal, A., Upadhyay, A.K., Civil Estimating, Costing & Valuation, S.K Kataria & Sons, New Delhi.
4. Chandola, S.P. and Vazirani, Estimating and Costing, Khanna Publication.

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-601A)** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-601A.1 | 3 | 3 | 2 | 1 | 3 | - | - | 1 | 1 | 1 | - | 2 | 3 | 3 |
| BCE-DS-601A.2 | 3 | 3 | 2 | 1 | 3 | - | - | 1 | 1 | 1 | - | 2 | 3 | 3 |
| BCE-DS-601A.3 | 3 | 3 | 2 | 1 | 3 | - | - | 1 | 1 | 1 | - | 2 | 3 | 3 |
| BCE-DS-601A.4 | 3 | 3 | 2 | 1 | 3 | - | - | 1 | 1 | 1 | - | 2 | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-603: HYDROLOGY & WATER RESOURCES ENGINEERING

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 2-1-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Prerequisite**: None
**Course Type**: Core

**Course Outcomes** At the end of this course, the student will be able to:
BCE-DS-603.1. Relate hydrological cycle and various phenomena affecting precipitation.
BCE-DS-603.2. Apply methods of measurement of evapo-transpiration.
BCE-DS-603.3. Solve the problems related to infiltration indices.
BCE-DS-603.4. Analyze the factors affecting runoff, measurement of velocity and stage in a river.
BCE-DS-603.5. Derive hydrographs for the various discharges.
BCE-DS-603.6. Estimate the various forms of ground-water availability.

**PART-A**

**Unit-1: Introduction:**
1.1 Hydrologic cycle, scope and application of hydrology to engineering problems
1.2 Drainage basin and its characteristics
1.3 Stream geometry, hypsometric curves
1.4 Forms and types of precipitation, characteristics of precipitation in India, measurement of precipitation
1.5 Recording and non-recording rain gauges, rain gauge station, rain gauge network
1.6 Estimation of missing data, presentation of rainfall data, mean participation
1.7 Area- duration relationship, frequency of point rainfall
1.8 Intensity –duration- frequency curves, probable max, precipitation

**Unit-2: Evaporation & Transpiration**:
2.1 Process, evaporimeters and empirical relationships
2.2 Analytical method, reservoir evaporation and methods of its control
2.3 Transpiration, evapo-transpiration and its measurement
2.4 Penman's equation and potential evapo-transpiration

**Unit-3: Infiltration:**
3.1 Infiltration process
3.2 Initial loss,
3.3 Infiltration capacity and measurement of infiltration
3.4 Infiltration indices.

**PART-B**

**Unit-4: Runoff:**
4.1 Factor affecting run-off, estimation of runoff, rainfall-run off relationships
4.2 Measurement of stage-staff gauge, wire gauge, automatic stage recorder and stage hydrograph
4.3 Measurement of velocity-current meters, floats ,area velocity method, moving boat and slope area method

4.4 Electromagnetic, ultra-sonic and dilution methods of stream flow measurement
4.5 Stage discharge relationship

**Unit-5 Hydrograph:**
5.1 Discharge hydrograph, components and factors affecting shape of hydrograph
5.2 Effective rainfall
5.3 Unit hydrograph and its derivation, unit hydrograph of different durations, use and limitations of UH
5.4 Triangular UH
5.5 Snyder’s synthetic UH, floods, rational methods, empirical formulae
5.6 UH method, flood frequency methods
5.7 Gumbel’s method, graphical method, design flood

**Unit-6: Ground Water:**
6.1 Occurrence, types of aquifers, compressibility of aquifers
6.2 Water table an, its effects on fluctuations
6.3 Wells and springs, movement of ground water
6.4 Darcy's law, permeability and its determination
6.5 Porosity, specific yield and specific retention, storage coefficient, transmissibility
6.6 Steady state flow to wells in unconfined and confined aquifers

**Text/Reference Books:**

1 K. Subramanya,2005, Engineering Hydrology, Tata McGraw-Hill Education
2 Santosh Kumar Garg,2006, Hydrology and Water Resources Engineering, Khanna Publishers
3 Dr. P. Jaya Rami Reddy, 2005, A Text Book of Hydrology,Firewall Media
4 H.M Raghunath, 2006, Hydrology: Principles, Analysis and Design, John Wiley & Sons


**Software required / Web links:**
http://nptel.ac.in/courses/105101002/
http://nptel.ac.in/courses/105103026/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement ( C-BCE-DS-603) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-603.1 | 3 | 2 | 1 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-603.2 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-603.3 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-603.4 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-603.5 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 3 | 2 | 2 | 1 | 2 | 1 | 1 |
| BCE-DS-603.6 | 1 | 1 | 2 | 3 | 2 | 2 | 2 | | | | | | 3 | 2 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-604A-CONSTRUCTION ENGINEERING & MANAGEMENT

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 2-0-2 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Core**

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

BCE-DS-604A.1 Describe the process of project planning & management
BCE-DS-604A.2 Draw various networks for planning a project
BCE-DS-604A.3 Enumerate the types of prevalent construction methods and construction equipment.
BCE-DS-604A.4 relate the concept of Quality in Construction and the importance of Contracts.

### PART A

**Unit 1: Basics of Construction**
1.1 Unique features of construction
1.2 Construction projects types and features
1.3 Phases of a project
1.4 Agencies involved and their methods of execution

**Unit 2: Construction project planning**
2.1 Stages of project planning
2.2 Process of development of plans and schedules, work break-down structure, activity lists
2.3 Assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data
2.4 Techniques of planning- Bar charts, Gantt Charts. Networks
2.5 Computation of float values, critical and semi critical paths, calendaring networks. PERT- assumptions underlying PERT analysis
2.6 Usage of MS Excel in making Progress Sheets and determining the Progress of the Project and its related activities with Bar Charts.

**Unit 3: Construction Methods**
3.1 Types of foundations and construction methods; Basics of Formwork and Staging
3.2 Common building construction methods
3.3 Modular construction methods for repetitive works and Precast concrete construction
3.4 Basics of Slip forming for tall structures, Steel Structures and Bridges

**Unit 4: Construction Equipments**
4.1 Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials.
4.2 Equipment Productivities
4.3 Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization
4.4 Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds

4.5 Cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts resource aggregation, allocation, smoothening and leveling
4.6 Practice and understanding the concept of Scheduling and Cost Analysis on MS Excel, Microsoft Projects.

**Unit 5: Project Monitoring & Control- Supervision**
5.1 Record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures
5.2 Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modeling (BIM) in project management
5.3 Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control
5.4 Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health
5.5 Using BIM software to correlate the construction activities and planned activities.

**Unit 6: Contracts Management and Importance of contracts**
6.1 Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters. Delays, penalties and liquidated damages
6.2 Force Majeure, Suspension and Termination. Changes & variations
6.3 Dispute Resolution methods
6.4 Construction Costs: Make-up of construction costs
6.5 Classification of costs, time cost trade-off in construction projects
6.6 Hands on Microsoft Project for analyzing the JCR and understating the concept of LOI.

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

| CO Statement (BCE-DS-604) | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-604A.1 | 2 | | 1 | | | 2 | 3 | 2 | | | | | 3 | 2 |
| BCE-DS-604A.2 | | 1 | | | | | 2 | | | | | | 2 | 3 |
| BCE-DS-604A.3 | | | | | 2 | | | | | 3 | 2 | | 3 | 2 |
| BCE-DS-604A.4 | | | | 2 | | 2 | | 3 | 2 | 3 | | | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-627A-DESIGN OF STEEL STRUCTURES

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 2-0-2 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Engineering Mechanics for Civil Engineers**
**Course Type: Core**
**Course Outcomes:** At the end of this course, the student will be able to:

**BCE-DS-627A.1.** Analyze material properties as used in steel structures
**BCE-DS-627A.2**. Evaluate the various types of joints to be used in steel design
**BCE-DS-627A.3.** Develop optimal design of steel columns, flexural members, Gantry Girder, Industrial buildings
**BCE-DS-627A.4.** Utilize the relevant software to analyze and design of Steel Member

### PART-A

**Unit 1: Properties of materials**
1.1 Properties of materials; loads and stresses
1.2 Design of semi-rigid,rigid and moment resistant connections
1.3 Demonstration of Design of Connections in Staad Pro

**Unit 2: Built-up sections**
2.1 Built-up sections Design of tension members subjected to axial tension and bending, splicing of tension member
2.2 Design of an I section Beam member using Staad Pro

**Unit 3: Design of compression members**
3.1 Design of compression members, Beam-column connections, Design of columns and their bases
3.2 Design of a Compression member in Staad Pro
3.3 Drawing a Beam Column connection in Autocad

### PART-B

**Unit 4: Design of flexural members**
4.1 Design of flexural members and Plate girder; loads, specification
4.2 Design a Typical section in Staad Pro/ ETabs

**Unit 5: Design Industrial buildings**
5.1 Design Industrial buildings; loads, design of purlins, trusses, bracings
5.2 Design of a typical Truss section using Staad Pro
5.3 Design of Purlins in Staad Pro / ETabs

**Unit 6: Gantry girders**
6.1 Gantry girders
6.2 Modelling of a Gantry Girder in Staad Pro
6.3 Design of a typical Gantry Girder in Staad Pro

**Text Books/ Reference Books:**

1. Segui, W. T., LRFD Steel Design, 2nd Ed., PWS Publishing, Boston.

2. Salmon, C.G. and Johnson, J.E., Steel Structures: Design and Behavior, 3rd Edition, Harper & Row, Publishers.

**Software required/Weblinks:**

https://nptel.ac.in/
https://swayam.gov.in/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-627A) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-627A.1 | 3 | 3 | 2 | 3 | 2 | - | 2 | 2 | - | - | 1 | 2 | 1 | 2 |
| BCE-DS-627A.2 | 3 | 2 | - | 3 | 2 | - | 3 | 1 | 3 | - | 1 | 2 | 3 | 2 |
| BCE-DS-627A.3 | 3 | - | - | 2 | 1 | 2 | 3 | 3 | 2 | 1 | - | 3 | 3 | 2 |
| BCE-DS-627A.4 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-606: Environmental Engineering-II**

| | | | |
|---|---|---|---|
| Credits | 2 | Max. Marks | : 200 |
| L-T-P | 2-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Core**

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

BCE-DS-606.1 Relate to the impact of humans on environment and vice-versa
BCE-DS-606.2 Apply basic environmental legislation.
BCE-DS-606.3 Select the most appropriate technique for the treatment of wastewater
BCE-DS-606.4 Recommend methodology for waste water treatment

**PART-A**

**Unit 1: Air Pollution**

1.1 Introduction and causes of air pollution,
1.2 Types of pollutants, their sources and impacts,
1.3 Air pollution meteorology, air pollution control,
1.4 Air quality standards and limits., plume behavior

**Unit 2: Solid Waste**

2.1 Sources of solid waste, types of solid waste
2.2 Waste composition and classification
2.3 Waste quantification
2.4 Landfilling of waste

**Unit 3: Wastewater Engineering**

3.1 An overview; constituents in wastewater, different sources of wastewater: domestic, industrial and storm water;
3.2 Types of sewerage and drainage system; Estimation of wastewater flow rates and its variations:
3.3 Estimation of peak, average and lean flow; drainage discharge; Hydraulics of sewers;
3.4 Design of wastewater collection systems; Design of storm water drains.

**PART-B**

**Unit-4: Wastewater Characteristics**

4.1 Physical, chemical and microbiological characteristics of wastewaters
4.2 typical characteristics of sewage: decay of sewage relative stability, population equivalent, effluent discharge standards;
4.3 Eutrophication; Response of streams to biodegradable organic waste: dissolved oxygen balance and its modelling, factor affecting steam flow rejuvenation

**Unit-5: Treatment Processes**

5.1 Primary, secondary and tertiary treatment;
5.2 Types of screens and its design, assessment of head loss through screen, grit chambers and its application, oil & grease removal
5.3 Design of primary and secondary clarifiers/ sedimentation tank;
5.4 Activated Sludge Process, Rotating Biological Contactors, Trickling Filters

**Unit-6: Government Authorities & Their Role**
6.1 Government authorities and their roles in water supply, sewerage disposal.
6.2 Solid waste management and monitoring/control of environmental pollution.

**Text Books/ Reference Books:**

1. MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.
2. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
3. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.
4. Sewage Disposal & Air Pollution Engineering, S.K.Garg, (2009)
5. Wastewater Engineering, Dr.B.C.Punmia, Er.Ashok Kumar Jain, Dr.Arun K.Jain, Laxmi Publications Private Limited

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-606) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-606.1 | 2 | | 1 | | | 2 | 3 | 2 | | | | | 3 | 2 |
| BCE-DS-606.2 | | 1 | | | | | 2 | | | | | | 2 | 3 |
| BCE-DS-606.3 | | | | | 2 | | | | | 3 | 2 | | 3 | 2 |
| BCE-DS-606.4 | | | | 2 | | | | 3 | 2 | 3 | | | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BHM-MC-009: QUANTITATIVE APTITUDE & PERSONALITY DEVELOPMENT III

| | | | |
|---|---|---|---|
| Credits | AP | Max. Marks | : 100 |
| L-T-P | 0-0-2 | Continuous Evaluation | : 50 |
| Examination Duration | 2 hrs | End Semester Exam | : 50 |

**Pre-requisite: None**

**Course Type: Humanities & Social Science**

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

**BHM-MC-009.1.** Recognize problem based on Modern Mathematics and Algebra
**BHM-MC-009.2.** Solve basic to moderate level problems based on Mensuration and Geometry.
**BHM-MC-009.3.** Calculate solution to logical reasoning.
**BHM-MC-009.4.** Get proficient with resume building and will be able to draft effective cover letters.
**BHM-MC-009.5.** Participate effectively and confidently in a Group Discussion
**BHM-MC-009.6.** Manage interviews effectively.

**PART-A**

**Unit 1: Modern Mathematics and Algebra**
**1.1 Permutation and Combination**
1.1.1 Principal of counting and Basic formulas
1.1.2 Arrangements, Selection and Selection + Arrangement.
1.1.3 Linear/Circular arrangements, Digits and Alphabetic Problems and Applications.
**1.2 Probability**
1.2.1 Events and Sample Space, Basic Formulas.
1.2.2 Problems on Coins, Cards and Dices.
1.2.3 Conditional Probability, Bayes' Theorem and their Applications.
**1.3 Algebra**
1.3.1 Linear & Quadratic equations
1.3.2 Mathematical inequalities
1.3.4 Maximum & Minimum Values
1.3.3 Integral Solutions

**Unit 2: Geometry and Mensuration**
**2.1 Geometry**
2.1.1 Basic geometry & Theorems, Lines & Angles
2.1.2 Polygons, Triangle and Quadrilaterals
2.1.3 Circles
**2.2 Mensuration I- Areas**
2.2.1 Different types of Triangles and their area and perimeter.
2.2.2Different types of Quadrilateral and their area and perimeter.
2.2.3Circumference and Area of Circle, Area of Sector and length of Sector.
2.2.4Mixed Figures and their Applications.
**2.3 Mensuration II- Surface Areas and Volumes**
2.3.1 Problems on Cubes & Cuboids, Cone, Cylinder and Sphere.
2.3.2 Prism and Pyramid.
2.3.3 Mixed Figures and their Applications.
**Unit 3: Logical Reasoning**

3.1 Linear Arrangement
3.2 Circular Arrangement
3.3 Puzzles

**Part-B**

**Unit 4: Professional Writing**

4.1. Profiling on Social Sites: LinkedIn, Facebook, Instagram
4.2. Cover Letter/Emails
4.3. Resume Writing

**Unit 5: Group Discussions**

5.1. Do's and Dont's of a Group Discussion
5.2. Roles played in a Group Discussion
5.3. Tips for Cracking a Group Discussion

**Unit 6: Managing Interviews**

6.1. Developing the employability mindset
6.2. Preparing for Self -Introduction
6.3. Researching the employer
6.4. Portfolio Management
6.5. Answering Questions in an Interview

**Text Books/Reference Books:**

1. Arun Sharma, 2017, Teach Your Self Quantitative Aptitude: 1st Edition, McGraw Hills Education
2. R S Aggarwal, 2017, A Modern Approach to Logical Reasoning, S Chand & Company Pvt Ltd
3. Yana Parker & Beth Brown, The Damn Good Resume Guide
4. Ceri Roderick & Stephan, Lucks Interview Answers

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| | PO 1 | PO 2 | PO3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PS 1 | PS 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BHM-MC-009.1 | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | 1 |
| BHM-MC-009.2 | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | 1 |
| BHM-MC-009.3 | 1 | - | - | 2 | - | - | - | - | - | - | - | - | - | 1 |
| BHM-MC-009.4 | - | - | - | - | - | - | - | 1 | - | 3 | - | 1 | - | 2 |
| BHM-MC-009.5 | - | - | - | - | - | - | - | 1 | - | 3 | - | - | - | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

### BHM-520: Entrepreneurship and Startups

| | | | |
|---|---|---|---|
| Credits 2 | | Max. Marks | : 200 |
| L-T-P | 2-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisite: None**

**Course Type: Humanities & Social Science**

**Course Outcomes:** The course will enable the student to-

BHM-520.1. Acquire Entrepreneurialspiritandresourcefulness.
BHM-520.2. Understand the concept and process of entre preneurship-its contribution and role in the growth and development of individual sandthenation.

BHM-520.3. Strengthen the skillsofcreationandmanagementofentrepreneurialventure.

**Unit1:IntroductiontoEntrepreneurshipandStart–Ups(6 Lectures)**

Definition and Traitsofanentrepreneur,Intrapreneurship,Motivation, typesofBusinessStructures,Similarities/differencesbetweenentrepreneursandmanagers.

**Unit2:BusinessIdeasandtheirimplementation(6 Lectures)**

Discoveringideasandvisualizingthebusiness, Activitymap, BusinessPlan

**Unit3:IdeatoStart-up and Management(7 Lectures)**

MarketAnalysis–Identifyingthetargetmarket, CompetitionevaluationandStrategydevelopment, Marketingandaccounting, Riskanalysis, Company'sOrganizationStructure, Recruitmentandmanagementoftalent, financialorganizationandmanagement

**Unit4:Financing,ProtectionofIdeas and Exit strategies(7 Lectures)**

Financingmethodsavailableforstart-upsinIndia, CommunicationofIdeastopotentialinvestors–InvestorPitch, PatentingandLicenses

**Text Books/ Reference books/Web references:**


1. SteveBlankandBobDorf, 2020, TheStartupOwner'sManual:TheStep-by-StepGuideforBuildingaGreat Company,wiley.
2. Eric Ries, 2011, The Lean Startup: How Today's Entrepreneurs use ContinuousInnovationtoCreateRadicallySuccessfulBusinesses by EricRies, Penguin UK.

3. https://www.fundable.com/learn/resources/guides/startup

4.https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate- structure/

5.https://www.finder.com/small-business-finance-tips

6.https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your- business

**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment/Tutorial | 20% |
| Class Work/ Quiz | 20% |

**Evaluation Tools:**

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

Assignments, Sessional and End Semester Examination paper will consist of various difficulty levels to accommodate the different capabilities of students. Assessment should cover all course outcomes and upper limit for lower order skills will be 40% (for knowledge-oriented questions). However, weightage for different cognitive levels in the question papers can vary.

**Instructions for paper setting:** The paper setter must ensure the coverage of entire syllabus while setting the question papers and mention the learning outcomes across each section to be measured by the examination. Weightage of the sections may vary as per the number of respective lecture hours mentioned in the syllabus.Action verbs should be used from Bloom's Taxonomy while designing question papers.

**Course articulation Matrix**

| CO Statement | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BHM520.1 | - | - | - | - | - | - | - | 1 | 2 | 2 | 2 | 2 |
| BHM-520.2 | - | - | - | - | - | - | - | 1 | 2 | 3 | 2 | 2 |
| BHM-520.3 | - | - | - | - | - | - | - | 1 | 2 | 3 | 2 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-621A: TRAFFIC ENGINEERING AND MANAGEMENT

| | | | |
|---|---|---|---|
| Credits 3 | | Max. Marks | : 200 |
| L-T-P 2-0-2 | | Continuous Evaluation | : 100 |
| Examination Duration 3 hrs | | End Semester Exam | : 100 |

**Pre-requisites: Transportation Engineering**
**Course Type: Domain Specific Elective**

**Course outcomes:** At the end of the course, the student will be able to
BCE-DS-621A.1. Comprehend the concept of different elements for traffic design.
BCE-DS-621A.2. Survey the various traffic related studies after having knowledge of these studies.
BCE-DS-621A.3. Make use of various traffic management techniques to control the traffic.
BCE-DS-621A.4 Implement PTV Vissim software to reduce traffic congestion.

**PART-A**

**Unit-1: Elements of Traffic Engineering**
1.1 Elements of Traffic Engineering road user, vehicle and road way
1.2 Vehicle characteristics, IRC standards, Design speed, volume
1.3 Highway capacity and levels of service
1.4 Capacity of urban and rural roads
1.5 PCU concept and its limitations
1.6 Road user facilities, Parking facilities, Cycle tracks and cycle way, Pedestrian facilities

**Unit-2:Traffic studies**

2.1 Traffic volume studies
2.2 Origin destination studies
2.3 Speed studies
2.4 Travel time and delay studies
2.5 Parking studies and delay studies

**Unit-3: Traffic Control**
3.1Traffic regulation and control
3.2 Signs and markings
3.3 Traffic signals
3.4 Pre-timed and traffic actuated
3.5 Rotary and intersections

**PART-B**

**Unit-4: Traffic Management**
4.1 Traffic management techniques
4.2 Local area management, Transportation system management
4.3 Low-cost measures, area traffic control
4.4 Various types of medium and long-term traffic management measures and their uses

**Unit-5: Road Safety**

5.1 Road safety issues and various measures for road safety
5.2 Engineering, education and enforcement measures for improving road safety
5.3 Short term and long-term measures, Road safety education and training
5.4 Traffic calming techniques and innovative ideas in road safety

**Unit-6:PTV Vissim**
6.1 Introduction to PTV Vissim software
6.2 Traffic Simulation Modelling
6.3 Use in Detect, Plan and Control traffic congestions
6.4 Next level Simulation

**Text Books/ Reference Books:**


1. ITE Hand Book, Highway Engineering Hand Book, McGraw,Hill.
2. BABKOV, V.F. ` Road conditions and Traffic Safety', MIR publications,1975.
3. R. J. Salter and N. B. Hounsel, Highway Traffic Analysis and Design, Macmillan Press Ltd, 1996.
4. K.W. Ogden, `Safer Roads – A Guide to Road Safety Engineering.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.


**Software required/Weblinks:**

https://nptel.ac.in/courses/105101008/50
PTV VISSIM Software
**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.
**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
**Course Articulation Matrix**

| CO Statement (BCE-DS-621A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-621A.1. | 2 | 3 | 3 | 3 | 1 | 2 | - | - | 3 | - | 1 | 1 | 1 | 1 |
| BCE-DS-621A.2. | 2 | 3 | 3 | 2 | 2 | - | 2 | 2 | - | - | - | - | 3 | 3 |
| BCE-DS-621A.3. | 3 | 3 | 3 | 2 | 1 | - | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 |
| BCE-DS-621A.4. | 3 | 3 | 3 | 1 | 3 | 1 | 2 | - | - | - | - | 2 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-622-GEOTECHNICAL DESIGN

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Geotechnical Engineering**
**Course Type: Domain Specific Elective**

**Course Outcomes** At the end of this course, the student will be able to:
BCE-DS-622.1. Relate to technology in the Geotechnical field
BCE-DS-622.2. Explain basic principles of limit state design required for design of foundations.
BCE-DS-622.3. Apply Geotechnical concepts to design foundations.
BCE-DS-622.4. Solve foundation Design problems.
BCE-DS-622.5. Analyze Bridge substructure problems.
BCE-DS-622.6. Design retaining walls for real life scenarios.

**PART-A**

**UNIT-I: Subsurface Site Evaluation**

1.1 Geographical Investigation, Characterization of ground, site investigations,
1.2 Method of drilling, sampling.
1.3 In-situ tests: SPT, CPT, plates load tests, methods for ultimate bearing capacity based on in situ tests.
1.4 Location of water Table

**Unit-II: Limit State Design-Basic Priciples**

2.1 Introduction
2.2 Partial Safety Factors
2.3 Limit State of Collapse
2.4 Limit state of Serviceability
2.5 Design for shear and Torsion

**UNIT-III Foundations**

3.1 Introduction
3.2 Location and Depth of Foundation
3.3 Bearing Capacity of Soil
3.4 Settlement of Footings
3.5 Uplift capacity of footings
3.6 Structural Design

**PART-B**

**UNIT-IV: FOUNDATION DESIGN-BASIC PRINCIPLES**

4.1 Types of foundations
4.2 Selection and type of foundations
4.3 Basic requirements of foundations
4.4 Computation of loads

4.5 Design steps

**UNIT-V: Bridge Substructures**
5.1 Depth of foundation
5.2 Determination of Scour Depth
5.3 Allowable bearing pressure
5.4 Loads to be considered
5.5 Lateral stability of well foundation
5.6 Design of Pier cap and Pier

**Unit-VI: Retaining Wall**
6.1 Common Proportioning of retaining walls
6.2 Stability of Retaining walls
6.3 Structural Design of Retaining walls

**Text/Reference Books:**

1. S. Parkash and Gopal Ranjan, Analysis and Design of Foundation and Retaining Structures, Sarita Prakashan
2. B. M. Das, Advanced Soil Mechanics, McGraw Hills
3. Swami Saran, Analysis and Design of Substructures: Limit State Design, CBS Publishers and Distributors Pvt Ltd


**Software required / Web links:**
https://nptel.ac.in/courses/105105104/pdf/m11l29.pdf
https://nptel.ac.in/courses/105101083/download/lec18.pdf

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-622) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-622.1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 2 | 2 | 1 | 1 | 2 | 2 |
| BCE-DS-622.2 | 3 | 3 | 3 | 1 | 1 | | 1 | 1 | 2 | 2 | 1 | 1 | 3 | 3 |
| BCE-DS-622.3 | 3 | 3 | 3 | 1 | 1 | | | 1 | 2 | 2 | 1 | 1 | 3 | 3 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-622.4 | 3 | 3 | 3 | 1 | 1 | 1 | | 1 | 2 | 2 | 1 | 1 | 3 | 3 |
| BCE-DS-622.5 | 3 | 3 | 3 | 1 | 2 | | | 1 | 2 | 2 | 1 | 1 | 3 | 3 |
| BCE-DS-622.6 | 3 | 3 | 3 | 1 | 2 | | 1 | 1 | 2 | 1 | 3 | 1 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-623A: Construction Project Planning & Systems**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 2-0-2 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Prerequisite: None**
**Course Type: Domain Specific Elective**

**Course Outcomes: At the end of the course, the student will be able to-**
BCE-DS-623A.1. Discuss project preparation, Appraisal and Risk analysis with its types, measures & tools for assessment using Primavera and MS Project.
BCE-DS-623A.2. Identify Value analysis including job plan, function analysis, creative thinking, cost.
BCE-DS-623A.3.Summarize Modelling, life cycle costing, value engineering and management.
BCE-DS-623A.4.Report Project planning and scheduling with reference to scheduling tools like bar Chart and Network techniques such as CPM and PERT.

**PART A**

**UNIT 1: Project Planning**
1.1. Stages of project planning: pre-tender planning, pre-construction planning,
1.2. Detailed construction planning, role of client and contractor, level of detail.
1.3. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data.
1.4. Application of MS-Project and PrimaVera for planning
**UNIT 2: Project Scheduling**
2.1. Bar charts, Networks: basic terminology, single and overlapping relationships 2.2. preparation of CPM networks: activity on link and activity on node representation,
2.3. Analysis of single relationship (finish to start) networks, computation of float values, critical and semicritical paths, calendaring the events.
**UNIT 3: Resource scheduling**
3.1. PERT: Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion
3.2. Resource Scheduling: Bar chart, line of balance technique,
3.3. Resource constraints and conflicts, resource aggregation, allocation, smoothening and levelling.

**PART-B**

**UNIT 4: Project budgeting**
4.1. Project Costing and Budgeting Classification of costs, time cost trade-off in construction projects,
4.2. Compression and decompression. Preparing budgets, master networks.
4.3 Introduction of Rivet software in estimation.
**UNIT 5: Project management**
5.1. Need and application of systems approach,
5.2. Emergence of management thought, Theory by Fredrick Taylor, Henry Fayol,
5.3. Emergence of behavioural sciences, and that of the modern management thought.
**UNIT 6: Application of IT in project management.**
6.1 Need and nature of construction sector,
6.2. Scope and functions of construction management.
6.3. Spatial data management
6.4. Communication and computer network in construction Planning and management
**Text Books / Reference Books:**

1. Saleh A. Mubarak (2012); "Construction project scheduling and control" John Wiley & Sons. ISBN 13: 9780470919958. 480p.

2. James Lewis (2005); "Project Planning, Scheduling & Control, 4E: A Hands-On Guide to Bringing Projects in on Time and on Budget" McGraw-Hill Companies, Incorporated. . ISBN 13: 9780071460378. 510p.
3. Eric S. Norman, Shelly A. Brotherton, Robert T. Fried (2010); "Work Breakdown Structures: The Foundation for Project Management Excellence" John Wiley & Sons. ISBN 13: 9781118000267. 304p.
4. Project Management Institute (2006); "Practice Standard for Work Breakdown Structures"' Project Management Institute, ISBN 13: 9781933890135. 111p.

**Software required/Weblinks:**
**https://nptel.ac.in/courses/105/103/105103093/**
**PRIMEVERA, MS Project, Rivet**

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
**Course Articulation Matrix**

| CO Statement (BCE-DS-623A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-623A.1 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-623A.2 | 2 | 2 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-623A.3 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 1 |
| BCE-DS-623A.4 | 3 | 2 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-624: ENVIRONMENTAL SYSTEMS

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-624.1 Make use of the concept of environmental system analysis
BCE-DS-624.2 Apply the concept of environmental system analysis to real life problems
BCE-DS-624.3 Use cost-benefit analysis
BCE-DS-624.4 Evaluate mathematical models in planning and design of engineering problems
BCE-DS-624.5 Develop data collection techniques

**PART-A**

**Unit 1: Introduction**
1.1 Introduction to the concepts of environmentalsystems analysis

**Unit 2: Applications**
2.1 Applications of environmental systems analysis

**Unit 3: Mathematical Modelling & Its Application**
3.1 Application of mathematical programming and modeling to the design, planning and management of engineered environmental systems, regional environmental systems, and environmental policy

**PART-B**

**Unit 4: Cost-Benefit Analysis**
4.1 Economic analysis, including benefit-cost analysis andmanagement strategies.

**Unit 5: Concept of Trade-offs**
5.1 Concepts of tradeoff, non- inferior sets, single and multi-objectiveoptimization.

**Unit 6: Practical Applications**
6.1 Practical application to case studies to convey an understanding of thecomplexity and data collection challenges of actual design practice.

**Text Books/ Reference Books:**

1. Stefano MarsiliLibelli, Environmental System Analysis with MATLAB, CRC Press, Taylor & Francis Inc
2. Whitten Bentley, System Analysis and Design Methods, McGraw Hill-Irwin (https://inspirit.net.in/books/academic/System%20Analysis%20&%20Design%20Methods%20-%20Whitten.pdf)

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-624)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-624.1 | 1 | - | 1 | - | 2 | | | | | | 2 | | 1 | 2 |
| BCE-DS-624.2 | 2 | | | | 2 | 2 | | | 2 | | | 2 | 1 | 3 |
| BCE-DS-624.3 | 2 | 3 | | 2 | | | 2 | | | | | | 1 | 3 |
| BCE-DS-624.4 | | | | | | | | 2 | | 3 | | | 2 | 2 |
| BCE-DS-624.5 | | | | | 2 | | | 2 | | | | | 2 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-625- OPEN CHANNEL FLOW

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Introduction to Fluid Mechanics**
**Course Type: Domain Specific Elective**

**Course Outcomes** At the end of this course, the student will be able to:
BCE-DS-625.1. Define different properties of fluid.
BCE-DS-625.2. Compare static forces of fluid
BCE-DS-625.3. Make relationships of Kinematics of Fluid Flow
BCE-DS-625.4. Evaluate dynamic forces of fluid flow
BCE-DS-625.5. Analyze basics of boundary layer theory and dimensional analysis
BCE-DS-625.6. Classify turbines, pumps, channels

**PART- A**

**Unit I: Introduction**
1.1 Fluid properties: mass density, specific weight, specific volume and specific gravity, compressibility
1.2 Surface tension, capillarity, pressure inside a droplet and bubble due to surface tension
1.3 Viscosity, Newtonian and Non-Newtonian fluids, real and ideal fluids

**Unit II: Fluid Statics**
2.1 Pressure-density-height relationship, gauge and absolute pressure
2.2 Simple differential and sensitive, manometers, two liquid manometers
2.3 Pressure on plane arid curved surfaces, center of pressure
2.4 Buoyancy, stability of immersed and floating bodies, determination of metacentric height
2.5 Fluids masses subjected to uniform acceleration, free and forced vortex.

**Unit III: Kinematics of Fluid Flow**
3.1 Steady & unsteady, uniform and non-uniform, laminar & turbulent flows, 1D, 2D &3D flows
3.2 Stream lines, streak lines and path lines
3.3 Continuity equation in differential form
3.4 Rotation and circulation, elementary explanation of stream function and velocity potential, rotational and irrotational flows
3.5 Graphical and experimental methods of drawing flow nets.

**PART-B**

**Unit IV: Dynamics of Fluid Flow**
4.1 Hydraulic and energy gradient lines
4.2 Head Losses in pipe lines
4.3 Concepts of equivalent lengths of pipes in parallel and series, branching of pipes and transmission of power through pipe lines.
4.4 Euler's equation motion along a streamline and its integration, limitation of Bernoulli's equation
4.5 Pitot tubes, Venturi-meter, Orfice-meter, flow through orifices & mouth pieces

4.6 Sharp crested weirs and notches, aeration of nappe.

**Unit V**: **Basics of Boundary layer theory and Dimensional Analysis**

5.1 Boundary layer thicknesses
5.2 Laminar boundary layer, turbulent boundary layer, laminar sub-layer, smooth and rough boundaries, local average friction coefficient, separation and its control.
5.3 Dimensional Analysis and Hydraulic Similitude Dimensional analysis
5.4 Buckingham theorem, important dimensionless numbers and their significance.

**Unit VI: Basics of Fluid Machinery and OCF**

6.1 Turbines: Classification and definitions, specific speed and unit quantities, working principles.
6.2 Classification, definitions, Centrifugal pumps: Various types and their important components, working principles, net positive suction head, specific speed; shut off head, cavitation.
6.3 Flow in open channels: classification of flows, Basic concepts, Resistance equations (Chezy's and Manning's formulae)
6.4 Efficient channel section
6.5 Specific energy concept critical flow and its computations.

**Text/Reference Books:**

1. R. K Bansal,2005, Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi publications
2. D.S.Kumar,2012, Fluid Mechanics, S. K. Kataria& Sons
3. P. N. Modi & Seth, 2009, Hydraulics & Fluid Mechanics, Standard Book House
4. S.Nagaratnam, 1995, Fluid Mechanics, Khanna Publishers
5. M. K. Natarajan,1994, Principles of Fluid Mechanics, Oxford &IBH Publishing Co
6. Jagdish Lal,2001, Hydraulics and Fluid Mechanics, Tata McGraw Hill
7. V. L. Streete, 1998, Fluid mechanics, Tata McGraw Hill
8. Frank M. White, Fluid Mechanics, Tata McGraw Hill.
9. YunusCengel, Fluid Mechanics: Fundamentals and Applications, Tata McGraw Hill.
10. Pijush K. Kundu, Ira M. Cohen et al, Fluid Mechanics, Academic Press.

**Software required / Web links**

http://nptel.ac.in/courses/112105171/
http://nptel.ac.in/courses/112105183/
http://nptel.ac.in/courses/105101082/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-625) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-625.1 | 3 | 2 | - | - | 3 | - | 1 | - | 1 | - | 2 | 2 | 2 | 1 |
| BCE-DS-625.2 | 3 | 3 | - | 1 | 3 | - | - | - | - | - | - | 1 | 3 | 2 |
| BCE-DS-625.3 | 3 | 3 | 1 | 1 | 2 | - | - | 1 | - | - | 2 | 1 | 3 | 2 |
| BCE-DS-625.4 | 3 | 3 | - | 2 | 3 | - | 1 | 1 | 1 | - | 1 | 2 | 3 | 3 |
| BCE-DS-625.5 | 3 | 2 | 1 | 2 | 3 | - | - | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| BCE-DS-625.6 | 3 | 3 | 1 | 2 | 3 | 1 | - | 2 | 2 | - | 2 | 3 | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-626A: RAILWAY ENGINEERING

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-626A.1 Describe different components of Railways
BCE-DS-626A.2 Illustrate different track layouts
BCE-DS-626A.3 Enumerate the types of Railway works.
BCE-DS-626A.4 Identify the requirements for track maintenance.
BCE-DS-626A.5 Analyze the concept of movement of trains on tracks.
BCE-DS-626A.6 Relate the concept of High-speed trains.

### PART-A

**Unit 1: Railway track**
1.1 Gauge, alignment of railway lines
1.2 Engineering surveys and construction of new lines
1.3 tracks and track stresses
1.4 rails
1.5 sleepers
1.6 ballast

**Unit 2: Subgrade and formation**
2.1 Rack fittings and fastenings
2.2 creep of rails

**Unit 3: Geometric design of track**
3.1 curves and super-elevation
3.2 points and crossings
3.3 track junctions and simple track layouts
3.4 rail joints and welding of rails

**Unit 4: Track maintenance**
4.1 track drainage
4.2 modern methods of track maintenance
4.3 rehabilitation and renewal of track

**Unit 5: Tractive resistance and power**
5.1 railway stations and yards
5.2 railway tunneling

**Unit 6: Signaling and interlocking**

6.1 maintenance of railways

6.2 high speed trains

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-626) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-626A.1 | | 1 | | 1 | | 2 | 3 | 3 | | | | | 3 | 2 |
| BCE-DS-626A.2 | 2 | | 1 | | | 2 | 3 | 2 | | | | | 3 | 2 |
| BCE-DS-626A.3 | | | | | 2 | | | | | 3 | 2 | | 3 | 2 |
| BCE-DS-626A.4 | | | | 2 | | | | 3 | 2 | 3 | | | 3 | 3 |
| BCE-DS-626A.5 | | | | | | | | 3 | | | | 2 | 3 | 2 |
| BCE-DS-626A.6 | | | | 2 | | | | 3 | 2 | 3 | | | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-629: Prefabricated Structures**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Design of Concrete Structures**
**Course Type: Domain Specific Elective**

**Course Outcomes:**

After the completion of course, students will be able:

BCE-DS-629.1 – To learn basic principles and standardization regarding Prefabricated Buildings.

BCE-DS-629.2 – To understand different components of Prefabricated Structures.

BCE-DS-629.3 – To undergo various Design Philosophies followed in the design of components of a Prefabricated Structure.

BCE-DS-629.4 – To design the connections for Prefabricated Structures.

BCE-DS-629.5 – To experience the effects of Lateral Loads on Prefabricated Structures using FEA software.

**PART-A**

**Unit 1: Basic Introduction**

1.1. Introduction to Prefabricated Structures
1.2. Principles of Prefabrication
1.3. Standardizations and Codal Provisions
1.4. Transportation and Erection
1.5. Case Studies

**Unit 2: Components of a Prefabricated Structure**

2.1. Types of Structural Components
2.2. Roof Panel Systems
2.3. Wall Panel Systems
2.4. Beams and Columns
2.5. Shear Walls

**Unit 3: Design Philosophies**

3.1. Design of cross section
3.2. Concept of Joint Flexibility
3.3. Allowance for joint deformation
3.4. Demountable precast concrete systems

**PART-B**

**Unit 4: Connections in Prefabricated Structures**

4.1. Types of Connections
4.2. Types of Joints
4.3. Design of Expansion Joints
4.4. Types of Sealants
4.5. Structural Detailing

**Unit 5: Lateral Loads on Prefabricated Structures**

5.1. IS Codal Provisions
5.2. Effect of Wind Forces on Prefabricated Structure
5.3. Effect of Seismic Forces on Prefabricated Structure
5.4. Design of Wind Loads on Prefabricated Tower Systems
5.5. Design of Seismic Loads on Prefabricated Engineered Building

**Unit 6: Sustainable Development Goals and FEM Analysis**

6.1. Correlation of Prefabricated Structure and SDGs 2030
6.2. FEM Analysis of a Prefabricated Engineered Building
6.3. FEM Analysis of a Prefabricated Tower Systems

**Text Books/ Reference Books:**


7. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
8. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2011.
9. Netherland Betor Verlag, Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, 2009.
10. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers,USA,1991


**Software required/Weblinks**

https://nptel.ac.in/courses/124105013

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**COURSE ARTICULATION MATRIX**

| CO Statement (BCE-DS-629) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-629.1 | 3 | 3 | 2 | 1 | 2 | 1 | - | 2 | 2 | - | 1 | 2 | 3 | 1 | 2 | 2 |
| BCE-DS-629.2 | 3 | 3 | 2 | 1 | 2 | - | 1 | - | 1 | 2 | 1 | 2 | 3 | 1 | 1 | 1 |
| BCE-DS-629.3 | 3 | 3 | 2 | 1 | 2 | - | 1 | 1 | 1 | - | 1 | 2 | 3 | 1 | 2 | 2 |
| BCE-DS-629.4 | 3 | 3 | 2 | 1 | 2 | - | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 1 | 2 | 2 |
| BCE-DS-629.5 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | - | 1 | - | 1 | 2 | 3 | 1 | 2 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

### BCE-DS-630: BUILDING INFORMATION MODELLING

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

**BCE-DS-630.1** Apply knowledge of mathematics, science, and engineering and familiar with current BIM technologies
**BCE-DS-630.2** Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
**BCE-DS-630.3** Understand new means of coordination and collaboration of design and construction
**BCE-DS-630.4** Use the techniques, skills, and modern engineering tools necessary for engineering practice

**PART-A**

**Unit-1: Introduction**
1.1 Introduction to Building Information Modelling (BIM)
1.2 Definition of BIM and Identification of BIM Objectives
1.3 Historical Background, Benefits of BIM.

**Unit-2: Impacts of BIM**
2.1 Roles and Impacts of BIM in Design
2.2 Impacts of BIM in Construction Engineering
2.3 Impacts of BIM in Facility Management
**Unit-3: Structural System**

3.1 Revit Architecture and Structure
3.2 MEP
3.3 Creating Sets, Building Elements,
3.4 Structural Systems, and MEP Systems

**PART-B**

**Unit-4: BIM Application in Capital Projects**
4.1 BIM and Construction Cost Estimating and Scheduling
4.2 Perform model-based cost estimating
4.3 Apply BIM to reduce error and change orders in capital projects

**Unit-5: BIM and Project Delivery**
5.1 BIM and Clash Detection
5.2 Perform 4D simulations
5.3 Integrated Project Delivery (IPD)

**Unit-6: Life Cycle Assessment**
6.1 Describe workflow in using BIM in the building lifecycle

6.2 Evaluate and communicate your ideas related to the use of BIM in the building life cycle
6.3 Future of Building Information Modelling

**Text Books/ Reference Books:**


1. Eastman, C., Teicholz, P., Sacks, R., & Liston, C., BIM handbook: A guide to building information modelling for owners, managers, designers, engineers and contractors, John Wiley & Sons, 2011.
2. Krygiel, E., & Nies, B., Green BIM: successful sustainable design with building information modelling. John Wiley & Sons, 2008.
3. Kymmell, W., Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations (McGraw-Hill Construction Series), McGraw Hill Professional, 2007.
4. Issa, R. R., & Olbina, S. (Eds.), Building Information Modeling: Applications and Practices. American Society of Civil Engineers 2015.
5. Duell, R., Hathorn, T, and Hathorn, T.R., Autodesk Revit Architecture 2016 Essentials, Wiley and Sons, Inc, 2015.
6. Eynon, J., Construction Manager's BIMHandbook. John Wiley & Sons, 2016.
7. Teicholz, P. (Ed.), BIM for facility managers. John Wiley & Sons, 2013.


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-630)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-630.1 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | - | 2 | - | 1 | - | 3 | 3 |
| BCE-DS-630.2 | 3 | 2 | 3 | | 2 | 1 | 3 | 1 | - | 2 | - | - | 3 | 3 |
| BCE-DS-630.3 | 3 | - | 3 | 2 | 2 | 3 | - | - | 1 | - | 3 | 3 | 3 | 3 |
| BCE-DS-630.4 | 3 | 2 | - | 3 | - | 3 | 3 | 1 | - | 1 | 3 | - | 3 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-631: Digital Twin & Asset Management**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

BCE-DS-631.1 understand the concept and applicability of Digital Twin.
BCE-DS-631.2 correlate Internet of Things (IoT) to Industrial Informatics and Digital Twin.
BCE-DS-631.3 apply methods for devising appropriate policies for Infrastructure Asset Management.
BCE-DS-631.4 understanding Asset Management and Strategic Planning.
BCE-DS-631.5 apply new approaches of responses with the usage of ICT Tools.
BCE-DS-631.6 correlate principles of Asset Management with Industry 4.0.

**PART A**

**Unit 1:Introduction to Digital Twin**

1.5 Concept and Fundamentals of Digital Twin

1.6 Applications and Opportunities

1.7 Current Challenges influencing Digital Twin

1.8 Digital Twin for Smart Infrastructure

**Unit 2:Application of Digital Twin in Production**

2.5 Impact of the Digital Twin and Cyber – Physical systems

2.6 Process Automation and Optimisation

2.7 Industry 4.0 and Digital Twin

2.8 IoT and Digital Twin in Manufacturing and Production

**Unit 3:Infrastructure Asset Management**

3.5 Introduction to Infrastructure Asset Management

3.6 Introduction to Industrial Informatics

3.7 Role of Value Chain in Infrastructure Asset Management

3.8 Digital Twin based Operation and Management

**PART B**

**Unit 4:Supply Chain Management**

4.5 Introduction to Digital Twin in Supply Chain Management

4.6 Simulation – based Smart Supply Chain Ecosystem

4.7 Quality Assurance and Quality Control

4.8 Role of Total Quality Management in Asset Management

**Unit 5:Applications in different sectors**

5.5 Healthcare

5.6 Construction Risk and Safety

5.7 Sustainable Smart Built Environment

5.8 Bio – Engineering

**Unit 6:Future Advancements and Ethical Considerations**

6.5 Ethics in Digital Twin

6.6 Ethics in Asset Management at different operational levels

6.7 Correlating Future possibilities with Digital Twin and Asset Management

6.8 Case Studies

**Text Books/ Reference Books:**


1. SurjyaKanta Pal, Debasish Mishra, Arpan Pal, Samik Dutta, Debashish Chakravarty, 2021, Digital Twin – Fundamental Concepts to Applications in Advanced Manufacturing, Springer.
2. Fei Tao, Meng Zhang, A.Y.C. Nee, 2019, Digital Twin Driven Smart Manufacturing, Elsevier.
3. Gopal Chaudhary, Manju Khari, Mohamed Elhoseny, 2021, Digital Twin Technology, CRC Press.
4. Duncan Hughes, 2005, Asset Management in Theory and Practice, New Age Publishers.
5. Al Naqvi, 2021, Artificial Intelligence for Asset Management and Investment, Wiley.
6. Nassim Khaled, BibinPattel, Affan Siddiqui, 2020, Digital Twin Development and Deployment on the Cloud, Elsevier.


**Software required/Weblinks:**

1. https://www.csccm.in/courses/introduction-to-digital-twins
2. https://nptel.ac.in/courses/106105195

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix :**

| CO Statement (BCE-DS-631) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-631.1 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-631.2 | 3 | 2 | 3 | 2 | 2 | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-631.3 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| BCE-DS-631.4 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 |
| BCE-DS-631.5 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 3 | 2 |
| BCE-DS-631.6 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-632: Pavement Maintenance Management System**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-632.1 Illustrate components Inventory of Pavement Management Systems.
BCE-DS-632.2 Describe the process of Pavement Performance like Roughness & Structural evaluation.
BCE-DS-632.3 Illustrate the Evaluation of Pavement Safety & Quality.
BCE-DS-632.4Explain the concepts of design alternatives, Rehabilitation and Maintenance.
BCE-DS-632.5Describe about Implementation of Pavement Management Systems.

**PART-A**

**Unit 1**: **INTRODUCTION**

1. Definition - Components of Pavement Management Systems
2. Pavement Management Levels and functions: Network and Project levels of PMS Influence Levels-PMS FunctionsFunction of Pavement evaluation
3. Requirements of PMS
4. Inventory Data: Purpose of Inventory Data - Types of Inventory Data - Selection and Referencing of Pavement Management Sections Collecting and Processing Section and Network Data - Traffic and Truck Load Data.

**Unit 2: PAVEMENT PERFORMANCE**

2.1 Serviceability-Performance Concept - Pavement Roughness - Equipment for Evaluating Roughness - IRI - Relating Roughness to Serviceability
2.2 Structural Condition – Non destructive Measurement and Analysis - Deflection Measurements - Ground Penetrating Radar - Destructive Structural Evaluation
2.3 Structural Capacity Index Concepts - Network versus Project Level Applications of Structural Capacity Evaluation
2.4 Pavement Surface Distress Condition Surveys: Purpose - Manual Methods of Survey - Automated Survey Methods - Types of Distress

**Unit 3**: **Structural requirements**

3.1 Design requirements, Structural condition evaluation techniques, factors affecting structural condition of flexible pavements
3.2 structural behavior and evaluation of structural condition of pavements. NDT procedures, rebound deflection, deflection bowl cantant measurement and analysis,3.4 Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient
3.3 IRC overlay design method, structural evaluation using falling weight deflectometer, back calculation of layer moduli, ground penetrating radar for pavement evaluation, evaluation of pavement safety: skid resistance and hydroplaning

**PART-B**

**Unit 4: EVALUATION OF PAVEMENT SAfetY**

4.1 Major Safety Components - Skid Resistance Evaluation
4.2 Basic Concepts of Skid Resistance and the importance of Pavement Texture
4.3 Methods of Measuring and Reporting Skid Resistance
4.4 Change of Skid Resistance with Time, Traffic and Climate;
4.5 Database Management: Introduction - Key Components - Advantages of Integrated Data Base Management - Success Factors for Effective Data Base Management
4.6 Pavement Deterioration Models: Clarification of Performance and deterioration Prediction- Parameters to be Predicted - Types.

**Unit 5: REHABILITATION OF PAVEMENT**

5.1 Identification of Alternatives - Pavement Preservation
5.2 Decision Process and Expert Systems Approach to identifying Feasible Alternative - Deterioration Modeling;
5.3 Priority Programming: Basic Approaches - Program Period - Functions - Methods - Budget Level Evaluation - Final Program Selection;
5.4 Framework for Pavement Design: Introduction - Focus on MEPDG - Structural Response Models - Characterization of Design Inputs - Variability, Reliability & Risk - Generating Alternative Design Strategies

**Unit 6: MEPDG PROCESS FOR PAVEMENT DESIGN**

6.1 Introduction MEPDG PROCESS FOR PAVEMENT DESIGN
6.2 Calibration Issues - MEPDG Software - Levels of Use in the MEPDG -
6.3 Life cycle pavement management - Principles - Design Inputs - Traffic Inputs - Climate Inputs - Pavement Performance;
6.4 MEPDG Rehabilitation of Existing Pavements: Introduction - Suggested Evaluation Data - Design with HMA - Design with PCC
6.5 Implementation of Pavement Management Systems: Key Components of Implementation - Role of Construction - Role of Maintenance - Research Management

**Text/Reference Books:**

1. Ralph Haas, Ronald Hudson Zanieswki. Modern Pavement Management, Kreiger Publications,2012.
2. Proceedings of North American Conference on Managing Pavement .
3. Proceedings of International Conference on Structural Design of Asphalt Pavements NCHRP, TRR and TRB Special Report

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-632) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-632.1 | 2 | 2 | 1 | 3 | 1 | 2 | - | - | 3 | - | 1 | 2 | 3 | 1 |
| BCE-DS-632.2 | 3 | 2 | 3 | 2 | 2 | - | 2 | 2 | - | - | 2 | - | 2 | 3 |
| BCE-DS-632.3 | 3 | 1 | 2 | 2 | 1 | - | 2 | 3 | 2 | 3 | 2 | - | 2 | 3 |
| BCE-DS-632.4 | 2 | 3 | 2 | - | 3 | - | 2 | - | - | 3 | - | 2 | 3 | 3 |
| BCE-DS-632.5 | - | - | - | - | - | - | - | - | 2 | 3 | 3 | 3 | 3 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**HM-606 : French-II**

| | |
|---|---|
| Credits 2 | Max. Marks : 100 |
| L-T-P 2-0-0 | Continuous Evaluation : 50 |
| Examination Duration 3 hrs | End Semester Exam : 50 |

**Pre-requisites: French-I**
**Course Type: Generic Elective-II**

**Course Outcomes:** Students will be able to-

HM-606.1. Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.

HM-606.2. Learn basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.

HM-606.3. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

HM-606.4. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.

HM-606.5. Express or/and justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.

HM-606.6. Describe various places, location, themselves using simple sentences and vocabulary.

**PART – A**

**Unit 1- Se présenter (1)**
1.1 Les pluriels
1.2 Adjectives to describe a person

**Unit 2- Se présenter (2)**
2.1 Professions
2.2 Short essay on family & friend
2.3 Comprehension

**Unit 3- Parler de ses habitudes quotidiennes**
3.1 Les verbes pronominaux
3.2 Décrivez votre journée

**PART – B**

**Unit 4- Nommez et localiser des lieux dans la ville**

4.1 Prepositions
4.2Asking & telling the way

**Unit 5- Informations simples sur le climat, la météo**
5.1 Les saisons
5.2 Les expressions de la saison
5.3 Comprehension

**Unit 6- Demander/ indiquer les horaires et les couleurs**
6.1 Timings
6.2 Colours

**Text Books/Reference Books/ Suggested Readings:**

1. Annie Berthet, Catherine Hugot, Veronique M Kizirian,2006, Alter Ego Level One Textbook, Hachette Publications.
2. Mahitha Ranjit, 2016, Apprenons Le Francais II & III, Saraswati Publications.

**Weblinks:**
www.bonjourfrance.com
www.allabout.com

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
**COURSE ARTICULATION MATRIX :**

| CO Statement (HM–606) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HM-606.1 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | 1 | - | - |
| HM-606.2 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | - |
| HM-606.3 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | - |
| HM-606.4 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | - |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HM-606.5 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | 1 | - | 1 |
| HM-606.6 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | 1 |

## HM-607 : GERMAN – II

| | | | |
|---|---|---|---|
| Credits 2 | | Max. Marks | : 100 |
| L-T-P | 2-0-0 | Continuous Evaluation | : 50 |
| Examination Duration | 3 hrs | End Semester Exam | : 50 |

**Pre-requisites: German-I**
**Course Type: Generic Elective-II**

**Course Outcomes:** Students will be able to-

HM-607.1. Discuss about various directions, countries and languages they speak.
HM-607.2. Write short essays on family and friends. They will have knowledge of tenses.
HM-607.3. Identify classroom vocabulary in the German language.
HM-607.4. Speak ordinal and cardinal numbers and they will also learn months, days in German.
HM-607.5. Express or/and justify opinions using equivalents of different verbs.
HM-607.6. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

### PART – A

**Unit 1: Ordinal und Kardinal Zahlen,**
1.1 Ordinal & Cardinal numbers
1.2 Months, days, Feiertage and dates

**Unit 2: sein und haben**
2.1 Verbs: to be and to have
2.2 helping verbs practice worksheets
2.3 Vocabulary (Family) short essay on family, friends etc.

### PART – B

**Unit 3: Gegenstände im Kursraum**
3.1 Vocabulary (classroom)
3.2 Definite and indefinite articles

**Unit 4: Länder, Sprachen**
4.1 Countries, languages, directions
4.2 Past of the verb 'to be'

**Text Books/Reference Books:**

1. Rita Maria Niemann,Cornelsen, 2005, Studio d A1: Deutsch alsFremdsprache, Volume 6.
2. Dallapiazza, Rosa-Maria and Jan, Eduard von. Tangram aktuell 1. Deutsch alsFremdsprache Tangram aktuell 1 - Lektion 1-4: Deutsch als. (HueberVerlag, 2005).
3. Dallapiazza, Rosa-Maria and Jan, Eduard von. Tangram aktuell 1. Deutsch alsFremdsprache Tangram aktuell 1 - Lektion 5-8: Deutsch als. (HueberVerlag, 2005).

4. Paul Rusch, 2015: Langenscheidt and Klett.

**Weblinks:**
http://www.nthuleen.com/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Student needs to attempt four questions from the remaining six questions. Five questions need to be attempted in total. Each question will be of 10 marks.

**Evaluation Tools:**
Sessional tests
End Semester Examination scores
Participation in class activities
Home assignments
Class attendance

**COURSE ARTICULATION MATRIX :**

| CO Statement (HM–607) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HM-607.1 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | 1 | - | - |
| HM-607.2 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | - |
| HM-607.3 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | - |
| HM-607.4 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | - |
| HM-607.5 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | 1 | - | 1 |
| HM-607.6 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | 1 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
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## HM-608 : SPANISH – II

| | |
|---|---|
| Credits 2 | Max. Marks : 100 |
| L-T-P 2-0-0 | Continuous Evaluation : 50 |
| Examination Duration 3 hrs | End Semester Exam : 50 |

**Pre-requisites: Spanish-I**
**Course Type: Generic Elective-II**

**Course Outcomes:** Students will be able to-
HM-608.1. Know about various color names in Spanish along with various vocabularies related to cloths and wardrobe.
HM-608.2. Differentiate between Ser and Estar verbs along with uses.
HM-608.3. Understand adjectives along with telling time.
HM-608.4. Learn Count till 1000
HM-608.5. Acquire knowledge of regular –ER and –IR verbs along with its various uses.
HM-608.6. Assess knowledge of vocabulary related to family and marital status.

### PART – A

**Unit 1 : Color and Clothing**
1.1 Introduction of colors
1.2 Vocabulary related to clothes and wardrobe

**Unit 2 : Ser, Estar and Haber**
2.1 Difference between the use of Verbo SER and ESTAR and their use with the similar adjective.
2.2 Introduction of Verbo HABER

### PART – B

**Unit 3 : Adjective, Counting and Time**
3.1 Demonstrative adjectives
3.2 Counting till 1000
3.3 Time

**Unit 4 : Verb ER and IR and Family**
4.1 Introduction and Usage of –ER Verbs
4.2 Introduction and Usage of –IR Verbs
4.3 Vocabulary related to the family and marital status

**Text Books/Reference Books:**
1. Eric V Greenfield, 1971, Barnes and Noble.
2. Nuevo Espanol sin fronteras, Jesus Sanchez Lobato and Isabel Santos Gargallo, 2005, Goyal Saab, ELE & SGEL.

**Weblinks:**

http://studyspanish.com/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
**COURSE ARTICULATION MATRIX :**

| CO Statement (HM-608) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HM-608.1 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | 1 | - | - |
| HM-608.2 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | - |
| HM-608.3 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | - |
| HM-608.4 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | - |
| HM-608.5 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | 1 | - | 1 |
| HM-608.6 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | 1 |

# SEMESTER-VII

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## PROJ-CE-710: Summer Internship-III

| Periods/week | Credits | Max. Marks | : 100 |
|---|---|---|---|
| 4 weeks Minimum | 2.0 | Continuous Evaluation | : 100 |

Duration of Exam: 2 Hrs

**Course Type: Project**

**Course Outcomes:** After completion of this course At the end of this course, the student will be able to:

Proj-CE-710.1. actually face challenges of real field work.
Proj-CE-710.2. apply their learning skills to solve real life problem.
Proj-CE-710.3. Show the research capability.
Proj-CE-710.4. enhance their Innovative skills.
Proj-CE-710.5. develop solutions.
Proj-CE-710.6. build technology for new areas.

Every student will have to undergo Industrial Training for 6 weeks in the relevant field of Engineering in which he/she is enrolled for B.Techprogramme after 6$^{th}$ semester. Respective Head of Department will approve the Industry/Organization for training. During this course of time he/she will be regularly monitored and evaluated. After successful completion of the training, the student will have to submit the training report, deliver a seminar about the work/project undertaken during the training and will have to appear for viva. The evaluation of the industrial training shall be made as per following:

**Continuous Evaluation during training:**

| | | |
|---|---|---|
| 1. Evaluation by the Supervisor in the Industry | : | 50 marks |
| 2. Evaluation by Faculty Mentor during training visit | : | 20 marks |
| 3. Internal/Continuous Evaluation: seminar/ Presentation | : | 30 marks |
| Total Marks | : | **100** |

**End Semester Exam : Evaluation after training:**

| | | |
|---|---|---|
| 1. Project Report | : | 30 marks |
| 2. Seminar/Presentation | : | 40 marks |
| 3. Viva | : | 30 marks |
| | ------------------ | |
| Total marks | | **100** |

**Total Credits : 2**

**COURSE ARTICULATION MATRIX :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Proj-CE-710.1 | 1 | 2 | 3 | - | - | - | 2 | 2 | 3 | 3 | 2 | 3 | 1 | 2 |
| Proj-CE-710.2 | 1 | 3 | 3 | - | - | - | 2 | 3 | 3 | 2 | 2 | 3 | 1 | 2 |
| Proj-CE-710.3 | 2 | - | - | - | - | - | 2 | 1 | 2 | 3 | 2 | 3 | 1 | 2 |
| Proj-CE-710.4 | 1 | - | - | - | - | - | 2 | 1 | 3 | 3 | 2 | 3 | 1 | 2 |
| Proj-CE-710.5 | 2 | - | - | - | - | - | 2 | 2 | 3 | 2 | 2 | 3 | 2 | - |
| Proj-CE-710.6 | 1 | - | - | - | - | - | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### PROJ-CE-700A: PROJECT PHASE- II

| | | | |
|---|---|---|---|
| Credits | 5 | Max. Marks | : 300 |
| L-T-P | 0-0-10 | Continuous Evaluation | : 200 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Project Phase-I**
**Course Type: Project**

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

PROJ-CE-700A.1. Develop study and research literature
PROJ-CE-700A.2. Conduct Laboratory / Field Studies
PROJ-CE-700A.3. Solve complex Civil Engineering problems by applying appropriate techniques and tools.
PROJ-CE-700A.4. Exhibit good communication skill to the engineering community and society.
PROJ-CE-700A.5. Master the art of working in group and learning professional ethics
PROJ-CE-700A.6. Develop understanding of technical dissertation presentation and writing.

**Syllabus Contents:**

Project Phase-II will be extension of the work on the topic identified in Project Phase– I.

Continuous Evaluation should be done of the work done by adopting the methodology involving conduct of experiments, collection and analysis of data, etc. There will be pre submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along with guide.

**Assessment Tools:**

Mid-Term presentation
Guide's continuous comprehensive assessment
Term end presentation

**Distribution of Continuous Evaluation:**

| | |
|---|---|
| Presentation/Viva | 40% |
| Report | 20% |
| Class Work/ Performance | 20% |
| Attendance | 20% |

**Course Articulation Matrix**

| CO Statement (PROJ-CE-700A) | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROJ-CE-700A. | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 3 |
| PROJ-CE-700A. | 2 | - | - | - | - | 1 | 3 | - | - | - | - | - | 2 | 2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROJ-CE-700A. | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 |
| PROJ-CE-700A. | - | 3 | 3 | 3 | 1 | - | - | 3 | 3 | 1 | 3 | 1 | 2 | 2 |
| PROJ-CE-700A. | - | 3 | 3 | 3 | 2 | - | 1 | 3 | 3 | 2 | 3 | 2 | 1 | 1 |
| PROJ-CE-700A. | - | 1 | 3 | 3 | 3 | - | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 1 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**GP-CE-700: General Proficiency**

## Grades to be Awarded based on Student's Achievements
## Audit Pass Course.

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-702A: Structural Analysis II**

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 2-0-2 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Core**

**Course Outcomes:**
BCE-DS-702A.1 Correlate the behavior of real-life frame structures
BCE-DS-702A.2 Analyze the structural behaviour of elements subjected to moving loads
BCE-DS-702A.3 Illustrate behaviour in influence line diagram in structural Analysis of truss and archs.
BCE-DS-702A.4 To make the student familiar with latest computational techniques and software used for structural analysis.

**PART A**

**Unit 1: Analysis of Frames**

1.1 Analysis of building frames
1.2 Kani's moment distribution and other methods
1.3 Approximate methods;
1.4 Verify BMD and SFD by Staad Pro.

**Unit 2: Stiffness Matrix Method**

2.1 Stiffness matrix method
2.2 Application to simple problems of beams
2.3 Application to simple problems of frames
2.4 Verify BMD and SFD by Staad Pro

**Unit 3: Flexibility Method**
3.1 Flexibility matrix method
3.2 Application to simple problems of beams
3.3 Application to simple problems of frames
3.4. Verify BMD and SFD by Staad Pro

**PART B**

**Unit 4: Moving Loads**
4.1 Moving loads for determinate beams
4.2 Different load cases
4.3 Moving loading in Staad Pro.

**Unit 5: Influence Line Method**
5.1 Influence lines for forces for determinate beams
5.2 Influence lines for pin-jointed trusses
5.3 Influence lines for indeterminate beams using Muller Breslau principle.
5.4. ILD by Staad Pro.

**Unit 6: Arches**
6.1 Influence lines for Arches
6.2 stiffening girders
6.3. ILD by Staad Pro.

**Text/ Reference Books**:


1. Vazirani&Ratwani et al ," Analysis of Structures " Vol 1&2, Khanna Publishers
2. L.S Negi & R.S. Jangid, "Structural Analysis", Tata McGraw Hill
3. S.B. Junnarkar Dr. H. J. Shah "MECHANICS OF STRUCTURES" VOL. II, Charotar Publishing House.
4. Hibbler,"Structural Analysis", Pearson Education.
5. Reddy, C.S, "Basic Structural Analysis", Tata McGraw Hill.
6. C. K. Wang, "Indeterminate Structural Analysis"
7. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill.
8. P. Dayaratnam, "Analysis of Statically Indeterminate Structures" East West Press
9. S. P. Timoshenko and D. Young, "Theory of Structures" Mc-Graw Hill Book Publishing Company Ltd.


**Software required / Web links:**
Staad Pro V8i
http://nptel.ac.in/courses/105101085/
http://nptel.ac.in/courses/105105109/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-702A.1 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-702A.2 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-702A.3 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-702A.4 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-703A: FOUNDATION ENGINEERING

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 2-0-2 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Core**

**Course Outcomes** The student will be able to

BCE-DS-703A.1. Relate to various foundations and their purpose
BCE-DS-703A.2. Apply knowledge about bearing capacity, settlement and design of various foundations
BCE-DS-703A.3. Evaluate slope stability of finite and infinite slopes
BCE-DS-703A.4. Perform analysis using software for various research works and projects.

**PART-A**

**UNIT-I: Foundations**
1.1 Concept of shallow and deep foundation
1.2 Types of shallow foundations and their suitability
1.3 Factors affecting the depth of shallow foundations
1.4 Dewatering of foundations

**Unit-II: Bearing Capacity and Settlement of Foundations**
2.1 Bearing capacity & various factors affecting bearing capacity
2.2 General, local and shear failures
2.3 Settlement of footings
2.4 Plate load test (no procedure details) and interpretation of its results, limitations of plate load test
2.5 SPT Test, Procedure, correction applied & Application of SPT
2.6 IS method of finding bearing capacity of soil
2.7 Basic design problems of shallow and deep foundations using PLAXIS / GEO5.

**UNIT-III Pile Foundation**
3.1 Type of piles and their suitability;
3.2 constructional features of pile foundations,
3.3 Pile classification on the basis of material, method of load transmission, method of installation. selection of foundation type
3.4 Pile Load Tests
3.5 Under- reamed pile foundations
3.6 Design and analysis of pile foundations using PLAXIS/ GEO5

**PART-B**

**UNIT-IV: Sheet plies**:
4.1 Different types of sheet pile walls: free and fixed earth support
4.2 Anchored bulk heads, design of anchored bulk heads
4.3 Arching in tunnels, open cut strutting and sheeting
4.4 Design and analysis of Sheet piles using PLAXIS/ GEO5

**Unit-V: Retaining Wall**
5.1 Rigid Retaining structures
5.2 Flexible Retaining structures
5.3 Braced Cuts
5.4 Analysis of retaining structures using using PLAXIS/ GEO5

**Unit VI: Slopes and underground structures**
6.1 Stability of finite and infinite slopes
6.2 Types of failures & different factors of safety
6.3 Determination of factor of safety by method of slices, Swedish circle, friction circle, Bishop's method, Morgenstern Price method, Taylor's stability number, location of critical circle
6.4 Stability analysis of earth dam slopes for different conditions
6.5 Underground Structures
6.6 Analysis of retaining structures and slope stability problems using PLAXIS/GEO5

**Text/Reference Books:**

1. S. Parkash and Gopal Ranjan, Analysis and Design of Foundation and Retaining Structures, Sarita Prakashan
2. B. M. Das, Advanced Soil Mechanics, McGraw Hills
3. Swami Saran, Soil Dynamics, I. K. International Publishing Pvt Ltd.
4. Alam Singh, Soil Mechanics, Asia Publishing House
5. K.R.Arora , Soil Mech & Foundation Engineering, Standard Publisher
6 .Dr. B.C.Punmia, Soil Mech & Foundation Engineering, Fireball Media

**Software required / Web links:**
http://nptel.ac.in/courses/105107120/
http://nptel.ac.in/courses/105101083/
GEO5
PLAXIS

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-703A)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-703A.1 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-703A.2 | 2 | 2 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-703A.3 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 1 |
| BCE-DS-703A.4 | 3 | 2 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-721: MASONRY STRUCTURES

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: Materials, Testing & Evaluation**
**Course Type: Domain Specific Elective**

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

BCE-DS-322.6. Correlate the masonry design approaches.
BCE-DS-322.7. Analyse Reinforced Masonry Members.
BCE-DS-322.8. Relate to interactions between members.
BCE-DS-322.9. Determine shear strength and ductility of Reinforced Masonry members.
BCE-DS-322.10. Check the stability of walls
BCE-DS-322.11. Perform Elastic and Inelastic analysis of masonry walls.

**Unit 1 Introduction**

1.6 Introduction, Historical Perspective
1.7 Masonry Materials
1.8 Masonry Design Approaches,
1.9 Overview of Load Conditions
1.10 Compression Behaviour of Masonry, Masonry Wall Configurations
1.11 Distribution of Lateral Forces

**Unit 2 Flexural Analysis**

2.5 Flexural Strength of Reinforced Masonry Members
2.6 In plane loading
2.7 Out-of-plane Loading

**Unit 3 Masonry Structures**

3.7 Interactions
3.8 Structural Wall
3.9 Columns and Pilasters
3.10 Retaining Wall
3.11 Pier and Foundation

**PART-B**

**Unit 4 Shear Analysis**

4.4 Shear Strength of Reinforced Masonry Members
4.5 Ductility of Reinforced Masonry Members.

**Unit 5 Pre-stressed Masonry**

5.4 Prestressed Masonry
5.5 Stability of Walls

5.6 Coupling of Masonry Walls
5.7 Openings
5.8 Columns
5.9 Beams.

**Unit 6 Inelastic Analysis**
6.1 Elastic and Inelastic Analysis
6.2 Modelling Techniques
6.3 Static Push Over Analysis
6.4 Use of Capacity Design Spectra

**Text Books/ Reference Books:**

1. NarendraTaly, Design of Reinforced Masonry Structures, 2nd Edition, ICC
2. Hamid Ahmad A and Drysdale Robert G, 1994, Masonry Structures: Behavior & Design
3. Maurizio Angelillo, 2014, Mechanics of Masonry Structures
4. Toma_evi_Miha, 1999, Earthquake-resistant Design of Masonry Buildings, Imperial College Press


**Software required/Weblinks:**
3. https://swayam.gov.in/nd1_noc19_ce21
4. https://nptel.ac.in/courses/105102088

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous Evaluation Table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-721) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-721.1. | 3 | 1 | - | - | - | 2 | - | - | - | - | - | 2 | 1 | 1 |
| BCE-DS-721.2. | 3 | - | 2 | 2 | - | 2 | - | - | - | - | - | 2 | 2 | 2 |
| BCE-DS-721.3. | 3 | - | - | - | - | 1 | - | - | - | - | - | 2 | 3 | 3 |
| BCE-DS-721.4. | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 2 | 2 |
| BCE-DS-721.5. | 2 | 1 | 2 | 2 | 2 | - | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 1 |
| BCE-DS-721.6. | 3 | - | - | - | - | - | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

### BCE-DS-722A: HIGHWAY CONSTRUCTION AND MANAGEMENT

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: Transportation Engineering**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, At the end of this course, the student will be able to:
BCE-DS-722A.1 Conduct surveys involved in highway planning and alignment
BCE-DS-722A.2 Characterize pavement materials
BCE-DS-722A.3 Comprehend various types of highway construction and their suitability under Indian conditions
BCE-DS-722A.4 Describe different aspects of highway maintenance
BCE-DS-722A.5 Apply fundamentals of planning and managementfor field highways.

**PART A**

**Unit 1: Highway Development**
1.1 Highway development and planning
1.2 Highway alignment and project preparation
1.3 Materials used in Highway Construction- Soils, Stone aggregates
1.4 Desirable properties, tests, requirements for different types of pavements

**Unit 2: Highway Construction of flexible pavement**
2.1 General features of highway construction
2.2 Embankment and subgrade
2.3 Construction of flexible pavement
2.4 Low volume roads

**Unit 3: Highway Construction of rigid pavement**
3.1 Necessity of providing a base course under cement concrete road
3.2 Selection of materials, construction methods,
3.3 Classification of various types of joints
3.4 Necessity of providing each type, method of construction of joints
3.5 Load transfer devices, dowel bars, tie bars

**PART B**

**Unit 4: Geosynthetics in Pavements**
4.1 Overview, introduction, types including natural geotextiles
4.2 Manufacturing methods, Functions of Geotextiles
4.3 Filtration, separation, protection, Sediment Control, Reinforcement

4.4 Application of various geotextile materials in Pavement

**Unit 5: Highway Maintenance**
5.1 Importance of highway maintenance works
5.2 Deterioration and damages in road infrastructure
5.3 Maintenance requirement in different road components
5.4 Distresses in flexible pavements and maintenance measures
5.5 Structural evaluation of flexible pavements

**Unit 6: Highway Planning and Management**
6.1 Need and nature of construction sector
6.2 Planning process, objectives, strategies and policies, making planning effective
6.3 Scope and functions of construction management
6.4 Use of project management software packages like Primavera, MS Project
6.5 Public–Private Partnerships and Private Sector Finance

**Text/Reference Books:**
1. S.K.Khanna, and Justo, 2017, Highway Engineering, 10th Edition, Nem Chand & Bros.
2. Partha Chakraborty, Principles of Transportation Engineering, PHI Learning
3. Sparkes, F.N. and Smith A.F. "Concrete Roads" Edwards Amola& Co., London.
4. R. Srinivasa Kumar, 2011, Textbook of Highway Engineering, Universities Press.
5. Paul H Wright and Karen K Dixon, 2009, Highway Engineering, 7th Edition, Wiley Student Edition.
6. Peurifoy R. L.,Construction, Planning, Equipment and Method, McGraw Hill Book Co.

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-722A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-722A.1 | 2 | 2 | | 3 | 1 | 2 | 2 | 3 | | 2 | 1 | 3 | 3 | 2 |
| BCE-DS-722A.2 | 1 | | 1 | | | 2 | 3 | 3 | | | | | 3 | 2 |
| BCE-DS-722A.3 | 1 | 2 | | 3 | 2 | | 3 | | 2 | 3 | 2 | 2 | 3 | 2 |
| BCE-DS-722A.4 | 2 | 1 | 2 | | 3 | | 2 | 3 | | 3 | | 2 | 3 | 2 |
| BCE-DS-722A.5 | 1 | 2 | 2 | | 2 | 3 | 2 | | 3 | | 1 | 2 | 3 | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-723: URBAN TRANSPORTATION PLANNING**

Credits 3
L-T-P 3-0-0
Examination Duration 3 hrs

Max. Marks : 200
Continuous Evaluation : 100
End Semester Exam : 100

**Pre-requisites: Transportation Engineering**
**Course Type: Domain Specific Elective**

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

BCE-DS-723.1. Describe various aspects of urban morphology
BCE-DS-723.2. Explain the transport planning process and its features.
BCE-DS-723.3. Design the trip production and attraction models to find out the road users for a particular trip.
BCE-DS-723.4. Analyze the distribution of traffic flow of a particular trip and its routes
BCE-DS-723.5. Implement the various route assignment techniques for networking oftraffic.
BCE-DS-723.6. Develop action plan for urban transport problem and their evaluation process.

**PART-A**

**Unit 1: Urban Morphology**

1.1 Urbanization and travel demand
1.2 Urban activity systems and travel patterns
1.3 Systems approach
1.4 Trip based and Activity based approach

**Unit 2: Urban Transportation Planning**

2.1 Goals, Objectives and Constraints
2.2 Inventory, Model building,
2.3 Forecasting and Evaluation
2.4 Study area delineation
2.5 and UTP survey

**Unit 3: Trip Generation**

3.1 Trip classification
3.2 Productions and attractions
3.3 Trip rate analysis
3.4 Multiple regression models
3.5 Category analysis

**Unit4: Trip Distribution& Modal Split**

4.1 Growth factor models
4.2 Gravity model
4.3 Opportunity model
4.4 Mode choice behavior

4.5 Trip end and trip interchange models
4.6 Probabilistic models, Utility functions, Logit models

**Unit 5: Traffic Assignment**
5.1 Transportation networks, Minimum Path Algorithms
5.2 Assignment methods – All or Nothing assignment
5.3 Capacity restrained assignment and Multi path assignment
5.4 Route-choice behavior

**Unit 6: Land Use Transportation Models**
6.1 Urban forms and structures,
6.2 Location models, Accessibility
6.3 Land use models - Lowry derivative models
6.4 Quick response techniques
6.5 Non-Transport solutions for transport problems
6.6 Preparation of alternative plans
6.7 Evaluation techniques
6.8 Plan implementation - Monitoring - Financing of Project

**Text Books/ Reference Books**

1. J.D.D Ortuzar and L.G. Willumsen, 1990, Modelling Transport, John Wiley & Sons.
2. M.E. Ben Akiva and S.R. Lerman, 1985, Discrete Choice Analysis: Theory and Application to Travel Demand, The MIT Press, Cambridge Massachusetts.
3. B.G.Hutchinson, 1974, Principles of Urban Transport Systems Planning, McGraw Hill Book Company.
4. L.R. Kadiyali, 2006, Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi.


**Software required/Weblinks:**
https://nptel.ac.in/courses/124107007/23
https://nptel.ac.in/courses/105107067/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-723) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-723.1. | - | 1 | - | 1 | - | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-723.2. | 1 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 |
| BCE-DS-723.3. | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 2 |
| BCE-DS-723.4. | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 1 | 2 | 1 | - | 2 | 3 | 2 |
| BCE-DS-723.5. | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 2 |
| BCE-DS-723.6. | 2 | 2 | 3 | 1 | 2 | 2 | 2 | - | 1 | 2 | 2 | 2 | 3 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-724: ENVIRONMENTAL LAWS & POLICY

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Environmental Engineering-I**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-724.1 Explain the concept of environment, nature and eco-system
BCE-DS-724.2 Infer from environmental laws and policies
BCE-DS-724.3 Relate to the concept of sustainable development
BCE-DS-724.4 Assess environment and conflicts management
BCE-DS-724.5 Compare national and international laws

### PART-A

**Unit 1: Introduction**

1.1 Overview of environment, nature and eco system

**Unit 2: Laws & Policies**

2.1 Concept of laws and policies, Origin of environmental law, Introduction to environmental laws and policies

**Unit 3: Infrastructure**

3.1 Environment and Governance, sustainable development and environment understanding, Climate change, carbon crediting, carbon foot print etc.

### PART-B

**Unit 4: Laws**

4.1 Introduction to trade and environment. International environmental laws

**Unit 5: Built Environment**

5.1 Right to Environment as Human Right International Humanitarian Law and Environment, environment and conflicts management

**Unit 6: Practical Applications**

6.1 Famous international protocols like Kyoto.

**Text Books/ Reference Books:**


1. Summet Malik, Environmental Law, Volume-II, Eastern Book Company
2. Matthew John Franchetttiand DefneApul, Carbon Footprint Analysis, Concepts, Methods, Implementation & Case Studies, CRC Press
3. Jacqueline Peel and Ruth Mackenzie, Principles of Environmental Law, Philippe Sands , 4th Edition, Cambridge University Press

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-724) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-724.1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| BCE-DS-724.2 | - | - | 2 | - | - | - | - | 2 | 1 | - | - | - | 2 | 2 |
| BCE-DS-724.3 | 1 | - | - | - | - | - | 2 | - | - | 3 | 2 | 2 | - | - |
| BCE-DS-724.4 | - | - | - | 2 | - | 2 | - | - | - | - | - | - | - | - |
| BCE-DS-724.5 | - | - | - | - | 2 | - | - | - | - | - | 2 | - | - | - |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-725: PHYSICO-CHEMICAL PROCESSES FOR WATER AND WASTEWATER TREATMENT

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Environmental Engineering-II**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-725.1 Experiment with qualitative aspects of water treatment
BCE-DS-725.2 Decide appropriate water treatment techniques to be used
BCE-DS-725.3 Identify environmental problems and develop science-based solutions
BCE-DS-725.4 Analyzephysico-chemical and biological processes and their applications
BCE-DS-725.5 Design water treatment systems.

**PART-A**

**Unit 1: Water Purification**
1.1 Water purification in natural systems
1.2 Physical processes, chemical processes and biological processes
1.3 Primary, secondary and tertiary treatment
1.4 Unit operations, unit processes. Aeration and gas transfer, Sedimentation, different types of settling,
1.5 Sedimentation tank design

**Unit 2: Coagulation**
2.1 Coagulation and flocculation, coagulation processes
2.2 Stability of colloids, destabilization of colloids
2.3 Destabilization in water and wastewater treatment
2.4 Transport of colloidal particles
2.5 Design aspects

**Unit 3: Filtration**
3.1 Filtration processes
3.2 Hydraulics of flow through porous media
3.3 Rate control patterns and methods
3.4 Filter effluent quality parameters, mathematical model for deep granular filters
3.5 Slow sand filtration, rapid sand filtration, pre-coat-filtration, design aspects

**PART-B**

**Unit 4: Disinfection**
4.1 Disinfection: Types of disinfectants
4.2 Kinetics of disinfection, chlorination and its theory
4.3 Design of Chlorinators.
4.4 Precipitation
4.5 Hardness removal, Iron, Mn, and heavy metal removal;

**Unit 5: Adsorption**

5.1 Adsorption equilibria and adsorption isotherm
5.2 Rates of adsorption
5.3 Sorption kinetics in batch reactors, continuous reactors
5.4 Factors affecting adsorption.

**Unit 6: Ion Exchange Processes**
6.1 Ion Exchange-exchange processes
6.2 Materials and reactions, Methods of operation
6.3 Application, design aspects. Membrane Processes
6.4 Reverse osmosis,
6.5 Ultrafiltration
6.6 Electrodyalisis

**Text Books/ Reference Books:**


1. Gilbert Masters, Introduction to Environmental Engineering and Science, Prentice Hall, New Jersey.
2. P. AarneVesilind and Thompson, 2008, Introduction to Environmental Engineering, Second Edition.
3. H.S. Peavy and G.Tchobanoglous, 1985, Environmental Engineering, Mc-Graw -Hill International Editions, New York.
4. MetCalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.
5. Manual on Water Supply and Treatment, Ministry of Urban Development, New Delhi.


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
**Course Articulation Matrix**

| CO Statement (BCE-DS-725) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-725.1 | 3 | | | | | | | | 2 | 2 | | | | |
| BCE-DS-725.2 | | 2 | | 3 | 2 | 2 | 2 | 2 | | 2 | 2 | | | |
| BCE-DS-725.3 | | | | | 3 | 2 | | 2 | 2 | | | | | |
| BCE-DS-725.4 | | | | | | | | | | 2 | 1 | | | |
| BCE-DS-725.5 | | | 3 | | | | | 3 | 2 | | 2 | 2 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-726: ENGINEERING RISK & UNCERTAINTY

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-726.1 Identify non deterministic Civil Engineering problems
BCE-DS-726.2 Apply design and decision making to identified problems
BCE-DS-726.3 Use stochastic methods
BCE-DS-726.4 Simulate model design
BCE-DS-726.5 Contrast the simulated models

**PART-A**

**Unit 1: Non-Deterministic Problems**
1.1 Identification non-deterministic problems in civil engineering
1.2 modeling of non-deterministic problems in civil engineering

**Unit 2: Decision making**
4.1 Design and decision making

**Unit 3: Stochastic concepts**
3.1 Development of stochastic concepts

**PART-B**

**Unit 4: Real Design**
4.1 Simulation models
4.2 Relevant real design

**Unit 5: Simulation models**
5.1 Simulation models
5.2 Relevance to Real Design

**Unit 6: Decision Problems**
6.1 Decision problems in various areas of civil engineering

**Text/ Reference Books**:

1. Mohammadand Mark P. Kaminskiy, Reliability Engineering and Risk Analysis, Taylor & Francis

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

**Course Articulation Matrix**

| CO Statement | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-726.1 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-726.2 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-726.3 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-726.4 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-726.5 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 1 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-728A: BRIDGE ENGINEERING

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 2-0-2 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

BCE-DS-728A.1. Relate to the basic concept of Bridge Engineering and IRC Loading as per IRC 6.
BCE-DS-728A.2. design piers and abutments
BCE-DS-728A.3. Apply seismic design and aerodynamic stability considerations
BCE-DS-728A.4. design and analyse the bridge components in AutoCAD and STAAD Pro.

**PART-A**

**Unit 1: General**
1.1 General; classification of bridges, site selection, geometric and hydraulic design consideration.
1.2 Planning the different parts of a particular bridge on AutoCAD 2D and 3D.

**Unit 2: Loading standards**
2.1 Loading standards for highway and railway bridges.
2.2 General design consideration; optimum spans.
2.3 Applying different types of Loads on the Bridge Pavement and analyze the same on STAAD Pro.

**Unit 3: Culverts**
3.1 Concrete bridges: Culverts; Slab, T-beam,
3.2 Box girder bridges, balanced cantilever bridge
3.3 Using of MS Excel for making the Designing Sheets of culverts and box – girder bridges.
3.4 Visualizing the effect of loading through SFD and BMD on STAAD Pro.

**PART-B**

**Unit 4: Cable stayed bridge**
4.1 Cable stayed bridge, extrados bridges; arch bridge.
4.2 Special requirements for Prestressed Concrete bridges.
4.3 Designing the different forms of Cable – Stayed Bridges on AutoCAD.

**Unit 5: Steel bridges**
5.1 Steel bridges: plate girder bridge, truss bridge.
5.2 Suspension cable bridge.
5.3 Analyzing the Steel Truss Bridge on STAAD Pro.

**Unit 6: Substructures**
6.1 Design of piers and abutments, pile and well foundations,
6.2 Bearings and expansion joints, special wearing coats;
6.3 Seismic design considerations

**Text Books/ Reference Books:**

1. Khanna and Justo, Bridge engineering
2. Krishna Raju, Bridge engineering

**Software required/Web links:**

https://nptel.ac.in/
https://swayam.gov.in/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-728A)** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-728A.1 | 1 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | - | - | 1 | 2 | 1 | 2 |
| BCE-DS-728A.2 | 3 | 3 | 3 | - | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-728A.3 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| BCE-DS-728A.4 | 1 | 2 | 3 | 1 | 1 | 2 | 1 | 2 | - | - | 1 | 2 | 1 | 1 |

**BCE-DS-729: Disaster Risk Reduction**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

BCE-DS-729.1 develop the basic conceptual understanding of disasters.
BCE-DS-729.2 determine the approaches of Disaster Management.
BCE-DS-729.3 build skills to respond to disaster
BCE-DS-729.4 acquire the disaster management techniques during pre and post – disaster scenarios.

**PART A**

**Unit 1:Understanding the Concept of Disaster**

1.1 Concepts of Disaster
1.2 Types of Disasters
1.3 Levels of Disasters
1.4 Concept of Risk and Vulnerability Assessment

**Unit 2:Hazard Assessment**

2.1 Frequency and Forewarning Levels of Disasters
2.2 Damage Potential of Disasters
2.3 Concept of Hazard Assessment
2.4 Dimensions of Vulnerability Factors

**Unit 3:Disaster Management**

3.1 Concept of Risk Management
3.2 Disaster Management Cycle
3.3 Response and Recovery Cycle
3.4 Mitigation and Preparedness

**PART B**

**Unit 4:Capacity Building**

4.1 Concept of Capacity Building
4.2 Components of Capacity Building
4.3 Resource Availability and Management
4.4 BIS Guidelines

**Unit 5:Planning**

5.1 Coping Strategies
5.2 Safety Plans and Norms
5.3 Disaster Management Planning
5.4 Disaster Management Act and Policy in India

**Unit 6:Case Studies**

6.1 Earthquake and its related disaster risk reduction techniques
6.2 Flood and its related disaster risk reduction techniques
6.3 Tsunami and its related disaster risk reduction techniques
6.4 Draught and its related disaster risk reduction techniques
6.5 Cyclones and its related disaster risk reduction techniques

**Text Books/ Reference Books:**


1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
3. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
4. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.


**Software required/Weblinks:**
**https://nptel.ac.in/courses/124/107/124107010/**

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
**Course Articulation Matrix**

| CO Statement (BCE-DS-729) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-729.1 | 2 | | 1 | | | 2 | 3 | 2 | | | | | 3 | 2 |
| BCE-DS-729.2 | | 1 | | | | | 2 | | | | | | 2 | 3 |
| BCE-DS-729.3 | | | | | 2 | | | | | 3 | 2 | | 3 | 2 |
| BCE-DS-729.4 | | | | 2 | | | | 3 | 2 | 3 | | | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-730: Advanced Design of Concrete Structures**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 2-0-2 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Design of Concrete Structures**
**Course Type: Domain Specific Elective**

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

BCE-DS-730.1. Analyze different types of rigid frames for vertical and horizontal loads by approximate methods.

BCE-DS-730.2. Design Fixed and Continuous beams, Staircases, Retaining walls, Foundations and Water Tank

BCE-DS-730.3. Design different Civil Structures on STAAD PRO

BCE-DS-730.4. Measure the various losses in pre-stressed concrete beam

**PART-A**

**Unit 1: Building frames**

1.1 Introduction to different types of building frames
1.2 Types of loads acting on Buildings
1.3 Approximate method of analysis of rigid frame for vertical loads by Substitute Frame method
1.4 Approximate method of analysis of rigid frame for lateral loads by
  1.4.1 Portal Frame method
  1.4.2 Cantilever method
1.5 Analysis of a typical building frame structures using Staad Pro

**Unit 2: Fixed and Continuous Beams**

2.1 Review of concepts of design of R.C.C.
2.2 Concepts of redistribution of moments in Statically Indeterminate Structures
2.3 Design of Fixed beams using IS 456:2000, SP16 and reinforcement detailing as per SP34
2.4 Design of Continuous beams using IS 456:2000, SP16 and reinforcement detailing as per SP34
2.5 Design a continuous beam using Staad Pro

**Unit 3: Staircases and Flat slabs**

3.1 Types of staircase and their structural behaviour
3.2 Design of straight stair case
3.3 Design of Dog-Legged stair case
3.4 Types and components of Flat Slab
3.5 Design of Flat Slab
3.6 Draw reinforcement detailing in different types slabs in Auto cadd
3.7 Design a typical slab section in Staad Pro/ ETabs

**PART-B**

**Unit 4: Foundations and Retaining Walls**

4.1 Design of Raft Foundation
4.2 Design of Piles and Pile Cap
4.3 Introduction to various types of Retaining walls
4.4 Loads acting on various components of Cantilever and Counterfort Retaining walls
4.5 Design of Cantilever Retaining wall
4.6 Draw reinforcement details in retaining walls in Auto cadd
4.7 Design a Retaining wall using Staad Pro

**Unit 5: Water tanks**

5.1 General Design requirements of Water Tanks as per IS 3370:2009
5.2 Joints in Water Tanks
5.3 Design of Circular Tank resting on ground with Flexible and Rigid Base
5.4 Design of Rectangular Tank resting on ground with Flexible and Rigid Base
5.5 Draw reinforcement details of different types of water tank

5.6 Design a water tank using Stadd pro/ ETabs

**Unit 6: Prestressed concrete**

6.1 Basic Concepts
6.2 Classification and types of Prestressing
6.3 Prestressing Systems
6.4 Losses of Prestress
6.5 Properties of materials
6.6 Analysis of Beams for flexure
6.7 Moment of Resistance of Rectangular and T-Section for flexure as per IS:1343-2012

**Text/Reference Books:**


1 Punmia & Jain et al, R.C.C. Designs, Jain Book Agency.
2 Pillai & Menon, Reinforced Concrete Design, Tata McGraw Hill.
3 N. Subramanian, Design of Reinforced Concrete Structures, Oxford University Press
4 Sinha, Reinforced Concrete Design, S.N. Education, Laxmi Publications.
5 Krishna Raju N, Pre-Stressed Concrete, Tata McGraw Hill.
6 IS:456-2000, Indian Standard of Practice for Plan and Reinforced Concrete.
7 IS:1343-2012, IS Code of Practice for Pre-stressed Concrete
8 IS:3370-2009, Indian Standard Code of Practice for Liquid Retaining Structures.
9 SP 16, 1980: Design Aids for Reinforced Concrete to IS:456-1978SP 34, 1987:Handbook on Concrete Reinforcement and Detailing.


**Software required / Web links**
http://nptel.ac.in/courses/105105105/
http://nptelvideos.in/2012/11/design-of-reinforced-concrete-structures.html

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |

| | |
|---|---|
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination
**Course Articulation Matrix**

| CO Statement (BCE-DS-730) | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-730.1 | 3 | 3 | 2 | - | 2 | 1 | - | 2 | 3 | 1 | 1 | 2 | 2 | 2 |
| BCE-DS-730.2 | 3 | 3 | 2 | - | 2 | 1 | - | 2 | 2 | - | 1 | 2 | 3 | 3 |
| BCE-DS-730.3 | 3 | 3 | 2 | - | 2 | 1 | - | 2 | 2 | - | 1 | 2 | 3 | 3 |
| BCE-DS-730.4 | 3 | 3 | 2 | - | 2 | 1 | - | 2 | 2 | - | 1 | 2 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-731: Metro Systems and Engineering**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, At the end of this course, the student will be able to:-
BCE-DS-731.1. Establish the requirements of metro for a city

BCE-DS-731.2. Describe the basic planning, routing and financing involved for a Metro Project

BCE-DS-731.3. Explain the various inter-disciplinary involvements required for a Metro Project

BCE-DS-731.4. Analyse the available construction technologies for Metro Projects

**Part-A**

**Unit 1: Overview**
1.1. Construction methods for: Elevated and underground Stations
1.2. Viaduct spans and bridges
1.3. Underground tunnels
1.4. Depots
1.5. Commercial and Service buildings

**Unit 2: Initial Surveys & Investigations**
2.1. Basics of Construction Planning & Management
2.2. Construction Quality & Safety Systems
2.3. Carbon credits and clear air mechanics

**Unit 3: Traffic integration**
3.1. Multimodal transfers and pedestrian facilities
3.2. Environmental andsocial safeguard
3.3. Track systems-permanent way
3.4. Facilities Management

**Part-B**

**Unit 4: Electronics and Communication Engineering**
4.1. Signaling systems
4.2. Automatic fare collection
4.3. Operation Control Centre
4.4. SCADA and other control systems
4.5. Platform Screen Doors

**Unit 5: Mechanical Engineering**
5.1. Rolling stock

5.2. Vehicle dynamics and structure
5.3. Tunnel Ventilation systems
5.4. Air conditioning for stations and buildings
5.5. Fire control systems; Lifts and Escalators

**Unit 6: Electrical Engineering**
6.1. OHE
6.2. Traction Power
6.3. Substations- TSS and ASS
6.4. Power SCADA
6.5. Standby and Back-up systems

**Reference Books:**

1. Satish Chandra, Railway Engineering
2. C Venkataramaiah, Transportation Engineering – II
3. Saxena, Railway Engineering

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-731)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-731.1 | 3 | - | - | - | 2 | - | - | - | - | - | 2 | 1 | 1 | 2 |
| BCE-DS-731.2 | 3 | - | - | - | 2 | 2 | - | - | 2 | - | - | 2 | 1 | 3 |
| BCE-DS-731.3 | 2 | 3 | - | 2 | - | - | 2 | - | - | - | - | - | 1 | 3 |
| BCE-DS-731.4 | - | - | - | - | - | - | - | 2 | - | 3 | - | - | 2 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-732: Construction Safety**

| | | | |
|---|---|---|---|
| Credits 3 | | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

BCE-DS-732.1. Relate to the concept of safety in construction.

BCE-DS-732.2. Comprehend safety in various construction operations.

BCE-DS-732.3. Apply National Building Code Provisions on construction safety

BCE-DS-732.4. Ensure safety while handling construction material and equipment.

BCE-DS-732.5. Develop management plans to prevent accidents during constructions.

**PART-A**

**Unit 1: Basic Philosophy**

1.1 Introduction to Construction Industry, safety issues in construction- Human factors in construction safety management.
1.2 Roles of various groups in ensuring safety in construction industry.
1.3 Accident and Hazards – their causes & effect, accident investigation and reporting. Monitoring of safety performance.
1.4 Treatment of injuries and rehabilitation. Safety Budget, Safety officers.

**Unit 2: Safety in Various Construction Operation**
2.1 Safety in various construction operations.
2.2 Excavation- under- water works- under-pinning & shoring
2.3 Tunneling, Blasting.
2.5 Indian Standards on construction safety- National Building Code Provisions on construction safety.

**Unit 3: Safety in Demolition Operations**

3.1 Planning & permit.
3.2 Precautions prior to demolition; protection of public.
3.3 Precautions during demolition; sequence of demolition operations from safety point.

**PART-B**

**Unit 4: Safety in Material Handling**

4.1 Safety in material handling and equipment.
4.2 Safety in storage & stacking of construction materials.
4.3 Safety in the use of construction equipment

**Unit 5: Working at Heights**

5.1 Fall protection in construction OSHA 3146 – OSHA requirement for working at heights
5.2 Safe access and egress – safe use of ladders.
5.3 Scaffoldings, requirement for safe work platforms, stairways, gangways and ramps –
5.4 Fall prevention and fall protection, safety belts, safety nets, fall arrestors, controlled access zones.

**Unit 6: Contract Labour**

6.1 Contract Labor (R&A) Act and Central Rules: Definitions, Registration of Establishments,
6.2 Licensing of Contractors, Welfare and Health provisions in the Act and the Rules, Penalties,
6.3 Framing contract conditions on safety, and related matters, relevance of ergonomics in construction safety.
6.4 Training of Building workers, General Safety, Health & Well fare provisions, Penalties.
6.5 Safety monitoring systems – working on fragile roofs, work permit systems, height pass – accident case studies

**Text Books/ Reference Books:**


1. R, Butter Worth's, 1985, Construction hazard and Safety Hand book' by Hudson.
2. V.J.Davies and K.Thomasin , 1990, Construction Safety Hand Book' by, Thomas Telford Ltd., London.
3. Charles D. Reese & James V. Edison, Handbook of OSHA Construction Safety and Health.
4. The National Building Code, BIS, (2017)
5. Jnathea D.Sime, 1988, Safety in the Build Environment
6. Gupta A K, Reliability Maintenance and Safety Engineering, Laxmi Publications, New Delhi.
7. John V. Grimoldi , Safety Management, AITBS Publishers and Distributors, New Delhi.


**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement ( BCE-DS-732) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-732.1 | 1 | 1 | 3 | 1 | - | 2 | 3 | 3 | 1 | - | - | 1 | 1 | - |
| BCE-DS-732.2 | - | 1 | 2 | - | 1 | 2 | - | 3 | 3 | - | - | 2 | 1 | - |
| BCE-DS-732.3 | 1 | 2 | 3 | - | 2 | 1 | 3 | - | - | - | 3 | - | 3 | 3 |
| BCE-DS-732.4 | - | - | - | 3 | 3 | - | - | - | - | 2 | 3 | - | 2 | 3 |
| BCE-DS-732.5 | 2 | - | - | 3 | - | - | 2 | - | 2 | 3 | - | 3 | -s | 2 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

## BCE-DS-733: INFRASTRUCTURE PLANNING AND MANAGEMENT

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

BCE-DS-733.1 Describe the basic concepts related to Infrastructure Projects
BCE-DS-733.2 Explain the role of private sector in infrastructure growth
BCE-DS-733.3 Describe the strategies for successful Infrastructure Project implementation
BCE-DS-733.4 Develop management system for infrastructure
BCE-DS-733.5 Understand the role of Sustainable in Infrastructure development

### PART-A

**Unit 1: introduction to infrastructure**

1.1. Definition of Basic Terminologies
1.2. Types of Infrastructure
1.3. An overview of the Power Sector, Water Supply and Sanitation Sector, Road, Rail, Air and Port Transportation Sectors, Telecommunications Sector, Urban and rural Infrastructure
1.4. Role of Infrastructure in Economic Development
1.5. Indian Scenario in Respect of Adequacy and Quality

**Unit 2: Infrastructure planning**

2.1 Goals and Objectives of Infrastructure Planning
2.2 Casual Factors Influencing the Demand for Infrastructure
2.3 Techniques to Estimate Supply and Demand for Infrastructure
2.4 Models to Forecast the Demand and Level of Service of Infrastructure

**Unit 3: Strategies for Infrastructure Projects**

3.1 Risk Management Framework for Infrastructure Projects
3.2 Shaping The Planning Phase of Infrastructure Projects to Mitigate Risks
3.3 Introduction to Fair Process and Negotiation
3.4 Negotiating with multiple Stakeholders on Infrastructure Projects

### PART-B

**Unit 4: Challenges to Infrastructure Planning and Implementation**

4.1 Mapping and Facing the Landscape of Risks in Infrastructure Projects
4.2 Economic and Demand Risks: The Case study for Political Risks
4.3 Socio-Environmental Risks
4.4 Cultural Risks in International Infrastructure Projects

4.5 Legal and Contractual Issues in Infrastructure
4.6 Challenges in Construction and Maintenance of Infrastructure

**Unit 5: Sustainable Development of Infrastructure**

5.1 Information Technology and Systems for Successful Infrastructure Management
5.2 Innovative Design and Maintenance of Infrastructure Facilities
5.3 Infrastructure Modeling and Life Cycle Analysis Techniques
5.4 Capacity Building and Improving the Governments Role in Infrastructure Implementation
5.5 Infrastructure Management Systems and Future Directions

**Unit 6: Private Involvement in Infrastructure**

6.1 A Historical Overview of Infrastructure Privatization
6.2 The Benefits of Infrastructure Privatization
6.3 Problems with Infrastructure Privatization
6.4 Challenges in Privatization of Water Supply, power: A Case Study
6.5 Privatization of Infrastructure in India: Case Study
6.6 Privatization of Road Transportation Infrastructure in India

**Text Books/ Reference Books**

1. Goodman, Alvin S. and Makarand Hastak. Infrastructure Planning Handbook: 2006.
2. Revelle, C.S., Whitlatch, E.E. and Wright, J.R. Civil and Environmental Systems Engineering; Prentice Hall, 2004.
3. Hudson, W.R., Haas, R. and Uddin, W. Infrastructure Management; McGraw Hill, 1997.
4. Verma S.P. ed. "Infrastructure in India's Development: Power, Transport and Communication", Institute of Public Administration, New Delhi, 2004
5. Grigg, Neil, Infrastructure engineering and management, Wiley, (1988).
6. Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994).
7. Munnell, Alicia, Editor, Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June (1990).
8. World Development Report 1994: Infrastructure for Development (1994).

**Software required / Web links:**

https://archive.nptel.ac.in/courses/105/106/105106115/
https://archive.nptel.ac.in/courses/105/106/105106188/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-733 ) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PS O 1 | PS O 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-733.1 | 2 | - | 1 | - | - | 1 | 2 | - | - | 1 | 1 | - | - | 1 |
| BCE-DS-733.2 | 2 | - | 1 | - | 2 | 3 | 3 | 3 | 3 | 2 | - | 2 | - | 2 |
| BCE-DS-733.3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | - | 3 | 3 |
| BCE-DS-733.4 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | - | 3 | 2 | - | 1 | 3 | - |
| BCE-DS-733.5 | 2 | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | - | 1 | 2 | - | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-821: AIRPORT PLANNING AND DESIGN

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Transportation Engineering**
**Course Type: Domain Specific Elective**

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

BCE-DS-8211. Explain the different components of airport and aircrafts.
BCE-DS-821.2. Analyse the requirements of an airport layout with respect to codal provisions.
BCE-DS-821.3. Design the airport runway geometric and length.
BCE-DS-821.4. Describe various elements of Taxiways in airport
BCE-DS-821.5. Undertake aprons and pavement planning
BCE-DS-821.6. Plan airport terminals

**PART-A**

**UNIT-I: Introduction**

1.1 Classification of airports
1.2 Aircraft characteristics
1.3 Aircraft Controls, Airport Site and Size selection
1.4 Airport Obstructions

**UNIT-II: Runway Orientation**

2.1 Runway orientation
2.2 Wind rose diagram
2.3 Runway configurations

**UNIT-III: Runway Geometric And Length**

3.1 Runway geometric elements
3.2 Runway width, the transverse grade, the longitudinal grade, the rate of change longitudinal grade, sight distance requirements
3.3 Basic runway length
3.4 Corrections to basic runway length.

**PART-B**

**UNIT-IV: Taxiways**

4.1 Taxiway requirements- alignment geometry
4.2 Length and the width of the taxiway,
4.3 The transverse and the longitudinal grades, the sight distance and the design of the turning radius
4.4 Exit taxiway, the turnaround taxiway and taxi lane.

**UNIT-V: Aprons and Parking**

5.1 Types of aprons
5.2 Aprons- planning and design

5.3 Design principles of critical, semi-critical, non-critical airport pavements- FAA and PCA methods
5.4 Aircraft parking

**UNIT-VI: Terminal Planning and Hangers**

6.1 Airport terminal and amenities ; Airport lighting and marking
6.2 Airport landscaping, grading and drainage general
6.3 Air traffic control lighting and signing;
6.4 Airport safety; Environmental impact of airports;

**References:**


1. N.J. Ashford, P.H. Wright,1992, Airport Engineering, 3rd Edition, John Wiley.
2. R.M. Horonjeff, F.X. Mc Kelvey, W.J Sproule, Seth Young,2009, Planning and Design ofAirports,FifthEdition,TMH International Publishers.


**Supplementary Reading:**


1. Khanna, Arora and Jain,2001, Planning and Design of Airports, Nemchand Bros.
2. Wells, Alexander; Young, Seth, July 2009, Airport Planning & Management,,5th Edition,McGraw Hill
3. De N. Richard, &Odoni, 2004, Airport Systems: Planning, Design, and Management, 1st Edition, McGraw Hill Amedeo.
4. Traffic Flow Fundamentals, May 1989, Prentice Hall
5. F. L. Mannering, 2008, Principles of Highway Engineering and Traffic Analysis, 4th Edition, John Wiley.


**Software required / Web links:**

http://nptel.ac.in/courses/105107120/
http://nptel.ac.in/courses/105101083/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-821) | PO 1 | PO 2 | PO 3 | PO 5 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-821.1 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | - | 1 | - | - | 2 | 2 | 1 |
| BCE-DS-821.2 | 1 | 2 | 3 | 1 | 1 | 1 | 1 | - | 1 | - | - | 2 | 3 | 1 |
| BCE-DS-821.3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | - | 1 | - | - | 2 | 3 | 1 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-821.4 | 2 | 2 | 3 | 1 | 2 | 1 | 2 | - | 2 | - | - | 2 | 3 | 1 |
| BCE-DS-821.5 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 1 |
| BCE-DS-821.6 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-822: CONSTRUCTION EQUIPMENTS & AUTOMATION

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

BCE-DS-822.1 Apply concept of construction automation
BCE-DS-822.2 Compare conventional methods to mechanized methods
BCE-DS-822.3 Describe the capabilities and applications of construction equipments in real life scenarios
BCE-DS-822.4 Emphasize the quality control using different concrete related equipment.
BCE-DS-822.5 Justify the role of drones and robots in construction on economic basis.

**PART-A**

**Unit 1: Construction Equipment & Automation: Conventional**
1.1 Conventional construction methods Vs Mechanized methods
1.2 Advantages and disadvantages of Mechanized methods.

**Unit 2 Earthmoving Equipments**
2.1 Earth movers
2.2 Dewatering equipments

**Unit 3 Concrete related equipments**
3.1 Mixing
3.2 transporting & placing

**Unit 4 Plastering machines**
4.1 Pre-stressing jacks
4.2 Grouting equipment

**Unit 5 Cranes**
5.1 Hoists and other equipment for lifting
5.2 Equipment for transportation of materials

**Unit 6 Equipment Productivities**
6.1 Use of Drones for spread out sites
6.2 Use of robots for repetitive activities

**Text Books/ Reference Books:**

1. R.L. Peurifoy, W.B. Ledbetter, and Schexnayder, 2005, Construction Planning Equipment and Methods, McGraw Hill. Singapore.
2. S.C. Sharma, 2008, Construction Equipment and Management, Khanna Publishers, Delhi.
3. S.V. Deodhar, 2008, Construction Equipment and Job Planning, Khanna Publishers Delhi.
4. Mahesh Varma, 2003, Construction Equipment and its planning and application, Metropolitan Book Company, New Delhi.

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-822)** | **PO1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-822.1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-822.2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-822.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-822.4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-822.5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-823: AIR, NOISE POLLUTION AND CONTROL

| | | | |
|---|---|---|---|
| Credits 3 | | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

BCE-DS-823.1. Relate to the concept of ambient air quality
BCE-DS-823.2. Describe the long- term effects of air pollution on the planet- Global Climate Change, Ozone Holes
BCE-DS-823.3. Develop analytical, computational and research skills in this field
BCE-DS-823.4. Emphasize the particulate quality control using different related equipment
BCE-DS-823.5. Recognize different quality control principles forGas contaminants
BCE-DS-823.6. Estimate the cost of air pollution control systems

**UNIT 1: Introduction**

1.1. Structure and composition of Atmosphere – Sources and classification of air pollutants
1.2. Ambient Air Quality and Emission Standards
1.3. Air Pollution Indices – Emission Inventories

**Unit-2: Effects**

2.1 Effects of air pollutants on human health, vegetation & animals, Materials & Structures
2.2 Effects of air Pollutants on the atmosphere, Soil & Water bodies
2.3 Long- term effects on the planet – Global Climate Change, Ozone Holes

**Unit 3: Air Pollution Monitoring and Modelling**

3.1 Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants
3.2 Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion
3.3 Wind profiles and stack plume patterns- Transport & Dispersion of Air Pollutants – Modeling Techniques
3.4 Air Pollution Climatology

**Unit 4: Controlof Particulate Contaminants**

4.1 Factors affecting Selection of Control Equipment
4.2 Gas Particle Interaction, – Working principle, Design and performance equations of Gravity Separators, cyclones, Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations
4.3 Process Control and Monitoring – Costing of APC equipment
4.4 Case studies for stationary and mobile sources

**Unit 5: Controlof Gaseous Contaminants**

5.1 Factors affecting Selection of Control Equipment – Working principle

5.2. Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters
5.3. Process control and Monitoring - Operational Considerations - Costing of APC Equipment
5.4. Case studies for stationary and mobile sources

**Unit 6: Automobile and Noise Pollution:**
6.1. Vehicular Pollution: Automobile emission- Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions
6.2. Prevention and control of vehicular pollution.
6.3. Noise Pollution: Sources and Effects of Noise Pollution
6.4. Measurement – Standards –Control and Preventive measures
6.5. Sources types and control of indoor air pollutants
6.6 Sick building syndrome types – Radon Pollution and its control

**Text Books/ Reference Books:**
1. Y. Anjaneyulu, Air Pollution & Control Technologies, 2002, Allied Publishers (P) Ltd.,India.
2. C.Stern Arthur,2006 Air Pollution, (Vol.I – Vol.VIII), Academic Press.
3. Daniel Vallero, 2008, Fundamentals of Air Pollution, Fourth Edition.
4. H.F. Liu David, B. G. Liptak, 2000, Air Pollution, Lweis Publishers.
5. K. Wang Lawrence, C. ParelraNorman, Yung Tse Hung,2004, Air Pollution Control Engineering, Tokyo.
6. Noel de Nevers, 1995, Air Pollution Control Engg, Mc Graw Hill, New York.
7. T. Davis Wayne, 2000, Air Pollution Engineering Manual, John Wiley & Sons, Inc.

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-823) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-823.1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-823.2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-823.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-823.4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-823.5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-823.6 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-824A: ENVIRONMENTAL GEO-TECHNOLOGY**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 2-0-2 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** The student will be able to
**BCE-DS-824A.1** Describe the concepts and principles of Geoenvironmental Engineering
**BCE-DS-824A.2**Identify sources and types of wastes
**BCE-DS-824A.3** Familiarize about landfill, clay liner design and Geosynthetics
**BCE-DS-824A.4** Contrast various soil remediation and investigation methods

**PART A**

**UNIT 1: Sources and Site Characterization**
1.1 Scope of Geo-environmental Engineering,
1.2 Various Sources of Contaminations,
1.3 Need for contaminated site characterization
1.4 Role of soil in geoenvironmental applications

**UNIT-2: Sources and classification of wastes**
2.1 Classification of waste,
2.2 Characterization solid wastes,
2.3 Environmental Concerns with waste

**UNIT-3: Soil- water Contamination Interaction**
3.1 Soil mineralogy characterization and its significance in determining soil behavior
3.2 Soil-water interaction and concepts of double layer
3.3 Forces of interaction between soil particles.

**PART B**

**UNIT-4: Landfills**
4.1 Types of landfills and Site Selection,
4.2 Waste Containment liners
4.3 Leachate collection system, Cover system, Gas collection system.
4.4 Stability of landfills

**UNIT-5: Remediation Techniques**
5.1 Objectives of site remediation,
5.2 Selection and planning of remediation methods
5.3 Introduction to Bioremediation, Phytoremediation, electro-kinetic remediation, thermal remediation

**Unit –6: Geosynthetics in Environmental Geotechnics:**
6.1 Application of geo synthetics in solid waste management,
6.2 Rigid or flexible liners,
6.3 Bearing capacity of compacted fills,
6.4 Foundation for waste fill ground.

**Text Books/ Reference Books:**

1. Rowe, R. K., Geotechnical & Geoenvironmental Engineering Handbook, Kluwer Academic, 2001.
2. Reddi, L. N. and lnyang, H. I, Geoenvironmental Engineering Principles and Applications, Marcel. Dekker, Inc., New York , 2000.
3. Sharma H.D. and Reddy K.R.,Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies John Wiley & Sons, Inc., USA, 2004.
4. Bagchi,A.,Design of landfills and integrated solid waste management John Wiley & Sons, Inc., USA, 2004.


**Software required / Web links:**
https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-ce27/
http://www.digimat.in/nptel/courses/video/105102160/L34.html

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-824A)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-824A.1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | - | - | 3 | 2 |
| BCE-DS-824A.2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | - | - | 3 | 3 |
| BCE-DS-824A.3 | 3 | 3 | 3 | 2 | 3 | 2 | - | 2 | 3 | 3 | - | 1 | 3 | 2 |
| BCE-DS-824A.4 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | - | 2 | 2 | 2 | 2 | 3 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-825A: INTELLIGENT TRANSPORTATION SYSTEM

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 2-0-2 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Transportation Engineering**
**Course Type: Domain Specific Elective**

**Course outcomes:** At the end of the course, students will be able to
BCE-DS-825A.1. Comprehend the latest techniques of transportation systems.
BCE-DS-825A.2. Implement the various data collection techniques to determine the real-problem of the transport system.
BCE-DS-825A.3. Identify the importance of telecommunication in ITS systems.
BCE-DS-825A.4. Recommend needs and uses of ITS in various functional areas of ITS.

### PART-A

**Unit-1: Introduction**

1.1 Introduction to Intelligent Transportation Systems (ITS)
1.2 Definition of ITS and Identification of ITS Objectives
1.3 Historical Background, Benefits of ITS.

**Unit-2:Data Collection**

2.1 ITS Data collection techniques
2.2 Detectors, Automatic Vehicle Location (AVL)
2.3 Automatic Vehicle Identification (AVI)
2.4 Geographic Information Systems (GIS)
2.5 Video data collection.

**Unit-3: Telecommunication**

3.1 Telecommunications in ITS
3.2 Importance of telecommunications in the ITS system
3.3 Information Management, Traffic Management Centres (TMC)
3.4 Vehicle, Road side communication
3.5 Vehicle Positioning System

### PART-B

**Unit-4: Advanced Management System**

4.1 Advanced Traffic Management Systems (ATMS)
4.2 Advanced Traveller Information Systems (ATIS), Commercial Vehicle Operations (CVO)
4.3 Advanced Vehicle Control Systems (AVCS)
4.4 Advanced Public Transportation Systems (APTS
4.5 Advanced Rural Transportation Systems (ARTS)

**Unit-5: ITS Needs and Services**

5.1 ITS User Needs and Services
5.2 Travel and Traffic management
5.3 Public Transportation Management, Electronic Payment
5.4 Commercial Vehicle Operations, Emergency Management
5.5 Advanced Vehicle safety systems, Information Management

**Unit-6: ITS Applications**

6.1 Application of GIS in ITS, GIS Data Models,Projections and Coordinate Systems
6.2 Spatial Database Structure
6.3 Sources of Spatial Database
6.4 Use of GIS in analysis of real time traffic situation, automatic Vehicle Location
6.5 Hands out Assignment on GIS application

**Text Books/ Reference Books:**

1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC)byKan Paul Chen, John Miles.
2. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.
3. National ITS Architecture Documentation, US Department of Transportation, 2007 CD- ROM).
4. Chowdhury, M. A., and Sadek, A., Fundamentals of Intelligent Transportation Systems Planning, Artech House, 2003
5. Turban, E., and Aronson, J. E., Decision Support Systems and Intelligent Systems, 5th Edition, Prentice Hall, 2004

**Software required/Weblinks:**

1. https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete_48.pdf
2. Arc GIS
3. Machine Learning
4. MAT LAB

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests

Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-825A) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-825A.1 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | - | 3 | - | 1 | 1 | 2 | 3 |
| BCE-DS-825A.2 | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | - | - | - | - | 3 | 2 |
| BCE-DS-825A.3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | - | 2 |
| BCE-DS-825A.4 | 3 | 3 | 3 | 1 | 3 | 1 | 2 | - | - | - | - | 2 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-826 PORT AND HARBOUR ENGINEERING**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**CourseType: Domain Specific Elective**

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

BCE-DS-826.1 Illustrate the concept of construction and planning of Harbors.
BEC-OS-806.2 Summarize the design parameters of ports and harbors.
BCE-DS-826.3 Enlist various components of the ports.
BCE-DS-826.4 Identify the facilities and requirements of Ports.
BCE-DS-826.5 Classify the requirements for dry and wet docks.
BCE-DS-826.6 Relate to the concept of waterways.

**PART-A**

**Unit 1: Harbor Planning**

1.1 Types of water transportation
1.2 Water transportation in India
1.3 Requirements of ports and harbors
1.4 Classification of harbors
1.5 Selection of site and planning of harbors
1.6 Location of harbor

**Unit 2: Traffic estimation**

2.1 Master plan,
2.2 Ship characteristics,
2.3 Harbor design,
2.4 Turning basin,
2.5 Harbor entrances,

**Unit 3: Type of docks**

3.1 location and number,
3.2 Site investigations – hydrographic survey, topographic survey, soil investigations
3.3 Current observations, tidal observations
3.4 Docks and Repair Facilities
3.5 Construction of breakwaters, berthing structures - jetties, fenders, piers, wharves, dolphins, trestle, moles
3.6 Harbour docks, use of wet docks, design of wet docks, repair docks, lift docks, dry docks, keel and bilge blocking

**Unit 5 construction of dry docks**,

5.1 Gates for dry docks, pumping plant,

5.2 Floating docks, slipways, locks, size of lock,
5.3 Lock gates, types of gates;

**Unit 6 Navigational Aids: Requirements of signals,**

6.1 Fixed navigation structures, necessity of navigational aids, light houses, beacon lights, floating navigational aids, light ships, buoys, radar;
6.1 Dredging and Coastal Protection: Classification, types of dredgers, choice of dredger, uses ofdredged materials, coastal erosion and protection,
6.3 Sea wall, revetment, bulkhead, coastal zone and beach profile;
6.4 Port facilities: Port development, port planning, port building facilities, transit sheds, warehouses, cargo handling facilities,
6.1 Container handling terminal facilities, shipping terminals, inland port facilities. Inland waterways, Inland water transportation in India,
6.2 Classification of waterways, economics of inland waterways transportation, national waterways.

**Text Books/ Reference Books:**

1. Bindra, Docks and Harbour Engineering
2. R. Srinivasan, Harbour Dock and Tunnel Engineering.

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-OS-826) | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-826.1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-826.2 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-826.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-826.4 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-826.5 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| BCE-DS-826.6 | 2 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 1 | 2 | 2 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-827 CONSTRUCTION PRODUCTIVITY**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:**At the end of this course, the student will be able to
BCE-DS-827.1. Relate the impacts of productivity with typical bench marks
BCE-DS-827.2. Develop daily progress report
BCE-DS-827.3. Utilize various productivity measurement techniques
BCE-DS-827.4. Explain productivity improvement measures
BCE-DS-827.5. Use of specialist software such as Vico for productivity studies

**PART-A**

**Unit 1: INTRODUCTION**
1.1 Definition of Productivity
1.2 Impact of productivities on construction duration and costs

**Unit 2: CONSTRUCTION EQUIPMENTS**
2.1 Measuring productivities of construction equipment
2.2 Staff and Labour and typical benchmarks for the same

**Unit 3: PRODUCTIVITY ANALYSIS-1**
3.1 Productivity analysis from Daily Progress Reports
3.2 Lean Construction concepts of Value Adding activities
3.3 Non-Value Adding Activities and Non-Value Adding but Necessary Activities

**PART-B**

**Unit 4: PRODUCTIVITY ANALYSIS-1I**
4.1 Productivity measurements
4.2 Special Lean Construction-oriented field methods such as Work Sampling
4.3 Takt time analysis

**Unit 5: SURVEYS**
5.1 Foreman Delay Surveys
5.2 Productivity improvement measures such as Value Stream Mapping
5.3 Location-Based management Systems,
5.4 Good Housekeeping, etc.

**Unit 6: SOFTWARES**
6.1 Use of specialist software such as Vico for productivity studies

**Text Books/ Reference Books:**

1. James J. Adrian, Construction Productivity: Measurement and Improvement
2. Eddy M Rojas, Construction Productivity (English)
3. K. K. Chitkara, Construction Project Management: Planning, Scheduling and Controlling 3rd Edition, Tata McGraw-Hill Education India

**Software required/Weblinks:**

https://nptel.ac.in/courses/105103093/21
https://nptel.ac.in/course.html
https://nptel.ac.in/courses/105106149/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS 827) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-827.1 | 3 | 1 | 3 | 3 | 2 | 3 | 2 | - | - | 3 | 2 | - | 2 | 3 |
| BCE-DS-827.2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - | 2 | 2 | 2 | 3 |
| BCE-DS-827.3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | - | - | 3 | 1 | - | 3 | 2 |
| BCE-DS-827.4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - | 3 | 2 | 1 | 3 |
| BCE-DS-827.5 | 3 | - | 2 | - | - | 2 | - | - | - | - | - | - | 1 | 1 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-828: SUSTAINABLE CONSTRUCTION METHODS

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes;** At the end of this course, the student will be able to
BCE-DS-828.1. Apply the basics of foundations construction
BCE-DS-828.2. Describe the various types of formwork in conventional vs modular construction
BCE-DS-828.3. Utilize precast concrete construction methods.
BCE-DS-828.4. Evaluate potential to reduce the negative environmental impacts of construction activity.
BCE-DS-828.5.Examine the current LEED rating system for new construction
BCE-DS-828.6. Analyze case studies of green construction projects

**PART-A**

**Unit 1: Foundations**
1.1 Types of foundations and construction methods;

**Unit 2: Formwork**
2.1 Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs;
2.2 conventional framed structure with blockwork walls);
2.3 Modular construction methods for repetitive works;

**Unit 3: Precast concrete**
3.1 Precast concrete construction methods;
3.2 Basics of Slip forming for tall structures;
3.3 Basic construction methods for steel structures;
3.4 Basics of construction methods for Bridges;
3.5 Identification of cutting-edge sustainable construction materials, technologies, and

**PART-B**

**Unit 4: Project management**
4.1 project management strategies for use in the construction industry and
4.2 evaluation of their potential to reduce the negative environmental impacts of construction activity.

**Unit 5: New Construction rating**
5.1 Examination of the current LEED for New Construction rating system,
5.2 case study analysis of highly successful recent "green construction projects" through student team assignments and presentations.

**Unit 6: LEED**

6.1 Preparation for the LEED Green Associate professional licensing exam

**Text Books/ Reference Books:**

1. W. T. Segui, LRFD Steel Design, 2nd Ed., PWS Publishing, Boston.
2. C.G. Salmon and J.E. Johnson, Steel Structures: Design and Behavior, 1990 3rd Edition,Harper & Row, Publishers, New York.
3. Khanna and Justo, Bridge Engineering.
4. Krishna Raju, Bridge engineering.

**Software required/Weblinks:**

https://nptel.ac.in/
https://swayam.gov.in/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-828) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-828.1 | 3 | - | 2 | 3 | - | - | 2 | 2 | - | - | 1 | 2 | 1 | 2 |
| BCE-DS-828.2 | - | 2 | - | 3 | 2 | - | 3 | 1 | 3 | - | 1 | 2 | 3 | 2 |
| BCE-DS-828.3 | 3 | - | - | 2 | 1 | 2 | 3 | 3 | 2 | 1 | - | 3 | 3 | 2 |
| BCE-DS-828.4 | - | 2 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-828.5 | 3 | - | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-828.6 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-829: SOLID AND HAZARDOUS WASTE MANAGEMENT

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to
BCE-DS-829.1. Relate to codal provisions of solid and hazardous waste management.
BCE-DS-829.2. Differentiate between hazardous and radioactive waste.
BCE-DS-829.3. Develop possible biological treatment of hazardous waste materials.
BCE-DS-829.4. Estimate Environmental risk due to solid waste
BCE-DS-829.5. Analyze different methods of Physicochemical Treatment of Solid and Hazardous Waste
BCE-DS-829.6.Conduct environmental audit, pollution prevention and facility development

**PART-A**

**Unit 1: Municipal Solid Waste Management – Fundamentals**
1.1 Municipal solid waste (management and handling) rules
1.2 Hazardous waste (management and handling) rules
1.3 Biomedical waste handling rules;
1.4 Flyashrules;recycled plastics usage rules; batteries (management and handling) rules, Sources; composition; generation rates;
1.5 Collection of waste; separation, transfer and transport of waste;
1.6 Treatment and disposal options

**Unit 2: Hazardous Waste Management – Fundamentals**
2.1 Characterization of waste; compatibility and flammability of chemicals
2.2 Fate and transport of chemicals; health effects
2.3 Radioactive Waste Management – Sources, measures and health effects
2.4 Nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options

**Unit 3: Environmental Risk Assessment**
3.1 Defining risk and environmental risk
3.2 Methods of risk assessment; case studies
3.3 Landfill design,Landfill design for solid and hazardous wastes
3.4 Leachate collection and removal; landfill covers; incineration

**PART-B**

**Unit 4: Physicochemical Treatment of Solid and Hazardous Waste**
4.1 Chemical treatment processes for MSW (combustion, stabilization and solidification of hazardous wastes);

4.2 Physicochemical processes for hazardous wastes (soil vapour extraction, air stripping, chemical oxidation);
4.3 Ground water contamination and remediation

**Unit 5: Biological Treatment of Solid and Hazardous Waste**
5.1 Composting; bioreactors; anaerobic decomposition of solid waste
5.2 principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation

**Unit 6: Regulations**
6.1 Current management practices,
6.2 Environmental audit, pollution prevention, facility development and operation, site remediation: quantitative risk assessment, site and subsurface
6.3 Characterization, containment, remedial alternatives.

**Text Books/ Reference Books:**


1. John Pichtel, Waste Management Practices 2005, Taylor and Francis Group.
2. M.D. LaGrega, P.L. Buckingham, and Evans, J.C. 1994, Hazardous Waste Management, McGraw Hill International Editions, New York.
3. R.J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York.


**Software required/Weblinks:**
http://www.iswa.org.
http://enfor.nic.in.
https://nptel.ac.in/syllabus/syllabus_pdf/105106056.pdf

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-829) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-829.1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-829.2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-829.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-829.4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-829.5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-829.6 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-830: PRESTRESSED CONCRETE

| | |
|---|---|
| Credits 3 | Max. Marks : 200 |
| L-T-P 3-0-0 | Continuous Evaluation : 100 |
| Examination Duration 3 hrs | End Semester Exam : 100 |

**Pre-requisites**: **None**
**Course Type: Domain Specific Elective**

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

BCE-DS-830.1 Describe evolution of process of prestressing in comparison to RCC.
BCE-DS-830.2 Explain the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.
BCE-DS-830.3 Find out losses in the prestressed concrete
BCE-DS-830.4 Analyseprestressed concrete axial, flexure members for Flexure.
BCE-DS-830.5 Design prestressed concrete Type 1 deck slab,beam/ girders satisfying the serviceability and strength provisions of the Indian Standards (IS: 1343-2012).
BCE-DS-830.6 Develop skills to utilize the relevant software in the analysis and design of prestressed concrete members.

**PART-A**

**Unit-1: Introduction**
1.1 Basic Concepts of Prestressing
1.2 Terminology
1.3 Advantages of Prestressed Concrete
1.4 Applications of Prestressed Concrete
1.5 Materials for Prestressed Concrete-High Strength Concrete, High Tensile Steel

**Unit-2: Prestressing Systems**
2.1 Tensioning Devices
2.2 Pre-tensioning Systems
2.3 Post-tensioning Systems

**Unit-3: Losses of Prestress**
3.1 Nature of losses of Prestress
3.2 Loss due to Elastic Deformation of Concrete
3.3 Loss due to Shrinkage of Concrete
3.4 Loss due to Creep of Concrete
3.5 Loss due to Relaxation of stress in steel
3.6 Total losses allowed for in Design

**PART-B**

**Unit-4: Analysis of Members**
4.1 Analysis of members under axial tension
    4.1.1. Analysis at transfer
    4.1.2. Analysis at service loads

4.1.3. Analysis at ultimate loads

4.2 Analysis of members under flexure at service loads

4.2.1. Based on stress concept

4.2.2. Based on force concept

4.2.3. Based on load balancing concept

**Unit-5: Analysis of members under flexure**

5.1 Cracking moment

5.2 Kern points

5.3 Pressure line

5.4 Analysis for ultimate strength

5.4.1. Variation of stress in steel

5.4.2. Condition at ultimate limit state

**Unit-6: Design of prestressed members**

6.1 Design of members under axial tension

6.2 Design of members for flexure

6.2.1. Preliminary design

6.2.2. Final design for type I members

**Text Books:** `


1. N.Krishna Raju, Prestressed Concrete, Tata-McGraw Hill, Delhi.
2. P. Dayaratram, Prestressed Concrete structures, Oxford & IBH Co., Delhi.
3. Jain & Jai Krishna, Plain & Reinforced Concrete, Vol- II, Nem Chand & Co., Roorkee.
4. IS 1343-1980 Code of Practice for Prestressed Concrete, Bureau of Indian standards, New Delhi.
5. IS 456-2000 Code of Practice for Plain and Reinforced, Bureau of Indian standards, New Delhi.


**Software required / Web links:**

http://nptel.ac.in/courses/105106117/

http://nptel.ac.in/courses/105106118/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each PART-A and PART-B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-830) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-830.1 | 3 | 2 | 2 | 2 | 1 | 1 | - | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| BCE-DS-830.2 | 3 | 1 | 1 | 2 | - | 2 | 3 | 1 | 1 | - | 2 | 1 | 3 | 3 |
| BCE-DS-830.3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 3 | 3 |
| BCE-DS-830.4 | 1 | 3 | 3 | 3 | 2 | - | - | 1 | 1 | - | 2 | 2 | 3 | 3 |
| BCE-DS-830.5 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 3 | 3 |
| BCE-DS-830.6 | 2 | 2 | 2 | 2 | 3 | 2 | - | - | 1 | - | 3 | 3 | 3 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

### BCE-DS-831A: REPAIRS & REHABILITATION OF STRUCTURES

| | | | |
|---|---|---|---|
| Credits 3 | | Max. Marks | : 200 |
| L-T-P 2-0-2 | | Continuous Evaluation | : 100 |
| Examination Duration 3 hrs | | End Semester Exam | : 100 |

**Pre-requisites: Concrete Technology**
**Course Type: Domain Specific Elective**

**Course Outcomes: At the end of this course, the student will be able to:**
BCE-DS-831A.1. Describe maintenance and Repair Strategies, Repair and Rehabilitation
BCE-DS-831A.2. Evaluate damaged structures according to inspection and assessment procedures
BCE-DS-831A.3. Relate to the concept of special Concretes and usage of concreting in repair work
BCE-DS-831A.4. Perform the advanced experiments related to Special Concrete and NDTs.

**PART-A**

**Unit 1: Introduction**
1.1 Maintenance and Repair Strategies, Repair and Rehabilitation, Importance of Maintenance
1.2 Various aspects of Inspection, Assessment procedure for evaluating a damaged structure
1.3 Strength and Durability of Concrete- Quality assurance for concrete –Strength
1.4 Performing the NDT on existing Structures such as Visual Inspection, Rebound Hammer Test.

**Unit 2: Durability and Thermal properties**
2.1 Durability and Thermal properties, of concrete – Cracks, different types,
2.2 Causes – Effects due to climate, temperature, Sustained elevated temperature,
2.3 Corrosion and Special Concretes- Polymer concrete, Sulphur infiltrated concrete.

**Unit 3: Fibre reinforced concrete**
3.1 Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete
3.2 Self-compacting concrete, Geopolymer concrete,
3.3 Reactive powder concrete, Concrete made with industrial wastes
3.4 Performing Strength and Workability Experiments in laboratory for Fibre – Reinforced Concrete
3.5 Performing Strength and Workability Experiments in laboratory for Sustainable Concrete

**PART-B**

**Unit 4: Repair and Protection Methods**
4.1 Techniques for Repair and Protection Methods- Non-destructive
4.2 Testing Techniques, Epoxy injection, Shoring, Underpinning,
4.3 Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection
4.4 Performing experiments related to Cathodic Protection in Laboratory

**Unit 5: Repair, Rehabilitation and Retrofitting**
5.1 Repair, Rehabilitation and Retrofitting of Structures- Evaluation of root causes
5.2 Underpinning & shoring; some simple systems of rehabilitation of structures
5.3 Analyzing the existing structures on STAAD Pro/ ETABS for vulnerability assessment and providing best solution for retrofitting techniques.

**Unit 6: Guniting, shotcreting**
6.1 Guniting, shotcreting; Non-Destructive testing systems; Use of external plates,
6.2 carbon fibre wrapping and carbon composites in repairs – Perform experiments

6.3 Strengthening of Structural elements, Repair of structures distressed due to corrosion
6.4 NBC Guidelines regarding Fire, Leakage and Seismic Activities

**Text Books/ Reference Books:**
1. Poonam I Modi and Chirag N. Patel, Reappear and Rehabilitation of Concrete Structures.f
2. Varghese, Maintenance, Repair & Rehabilitation & Minor Works of Buildings.

**Software required/Weblinks:**
https://nptel.ac.in/
https://swayam.gov.in/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| **CO Statement (BCE-DS-831A)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-831A.1 | 3 | 2 | - | 3 | 2 | 1 | - | 2 | - | 2 | 1 | 2 | 1 | 2 |
| BCE-DS-831A.2 | 1 | 2 | 1 | 3 | 2 | 3 | 3 | 1 | 3 | - | 1 | 2 | 3 | 2 |
| BCE-DS-831A.3 | - | - | - | 2 | 2 | 2 | 3 | 3 | 2 | - | - | 2 | 2 | 2 |
| BCE-DS-831A.4 | 3 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | 2 | 3 | 1 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

## BCE-DS-832: ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSES

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-832.1. Describe environmental impact assessment (EIA) as an environmental management tool.
BCE-DS-832.2. Trace the evolution of EIA.
BCE-DS-832.3. Discuss what forecasting of environmental changes entails.
BCE-DS-832.4. Explain strategic environmental assessment (SEA).
BCE-DS-832.5. List and comply with the environmental clearance procedures in India.
BCE-DS-832.6. Plan an environmental impact assessment study.

**PART-A**

**Unit 1: Broad components of EIA**

1.1 Introduction, definitions and concepts, rationale and historical development of EIA,
1.2 EIA for civil engineers, Initial environmental examination, environmental impact statement, environmental appraisal,
1.3 environmental impact factors and areas of consideration. Pertinent institutional information, unique pollution problems, existing visual quality, public participation techniques.
1.4 Composite consideration, potential cultural resources, potential visual impacts, geographical study area.

**Unit 2: Methodologies:**

2.1 Measurement of environmental impact, organization, scope and methodologies of EIA pertinent environmental factors.
2.2 Six generic steps, descriptive checklists, simple interaction matrix, stepped matrix, uniqueness ratio, habitat evaluation system. Public involvement techniques, comprehensive environmental impact study,
2.3 Various project types, archaeological properties, leachate testing, evaluation species, proposing agency,
2.4 EIA Models.

**Unit 3: Status of EIA in India & Environmental management:**

3.1 EIA Regulations in India,
3.2 Case studies from hydropower projects, hazardous industries and mining, Principles, problems and strategies;
3.3 Review of political, ecological and remedial actions.
3.4 Future strategies; multidisciplinary environmental strategies, the human, planning, decision-making and management dimensions.

**PART-B**

**Unit 4: Environmental Audit:**

4.1 Definitions and concepts, partial audit, compliance audit, methodologies and regulations, Introduction to ISO and ISO 14000.

4.2 EMAS regulations, Wider application of system-based approach.

**Unit 5: EMS and Standardization**

5.1 Local infrastructure development and environmental management: A system approach,

5.2 Regional environmental management system, Conversion plan development and implementation strategies

5.3 Environmental management systems in local government.

**Unit 6: LCA and Carbon trading:**

6.1 Life cycle assessment

6.2 Triple bottom line approach; Industrial Ecology. Ecological foot printing,

6.3 Design for Environment, Future role of LCA, Product stewardship, design, durability and justifiability, measurement techniques and reporting, Energy foot printing,

6.4 Food foot printing and Carbon foot printing. GHG emissions, global warming, climate change and Carbon credits, CDM,

6.5 Initiatives in India; Sustainable development; Future scenarios

**Text Books/ Reference Books:**


1. L. W. Canter,1997, Environmental Impact Assessment, 2nd Ed., McGraw-Hill.
2. P. Judith and G. Eduljee, 1994, Environmental Impact Assessment for Waste Treatment and Disposal Facilities, John Wiley & Sons.
3. G. Burke, B. R. Singh and L. Theodore, 2000, Handbook of Environmental Management and Technology, 2nd Ed., John Wiley &Sons.
4. C. H. Eccleston, Environment Impact Statements, 2000, A Comprehensive Guide to Project and Strategic Planning, John Wiley & Sons.
5. R. Welford, 1996, Corporate Environmental Management - Systems and Strategies, Universities Press.
6. K. Whitelaw and Butterworth, 1997, ISO 14001: Environmental System Handbook.
7. The Economist Intelligence Unit, Best Practices - Environment, 1993,Universities Press.
8. R. Therivel, John Glasson, Andrew Chadwick, 2005, Introduction to Environmental Impact Assessment (Natural and Built Environment), Routledge.


**Software required/Weblinks:**

https://nptel.ac.in/courses/120108004/module3/lecture3.pdf
https://nptel.ac.in/syllabus/syllabus_pdf/105103024.pdf

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |

| | |
|---|---|
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-832) | PO1 | PO2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | P S O 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-832.1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-832.2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-832.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-832.4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-832.5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-832.6 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-833: EARTHQUAKE ENGINEERING**

| | | | |
|---|---|---|---|
| Credits 3 | | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Engineering Mechanics for Civil Engineers**
**Course Type: Domain Specific Elective**

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

| | |
|---|---|
| BCE-DS-833.1 | Distinguish the different types of dynamic loads, mathematical modelling, degree of freedom and mode shapes. |
| BCE-DS-833.2 | Apply the concept of Multi Degree of Freedom System |
| BCE-DS-833.3 | Relate to the elements of seismology |
| BCE-DS-833.4 | Design ductile detailing of linear structural elements as per IS 13920:1993. |
| BCE-DS-833.5 | Choose the codal provisions to real life problems as per IS 1893:2002. |
| BCE-DS-833.6 | Compute response of Structures to Earthquake |

**PART-A**

**UNIT 1: Theory of Vibrations**

1.1 Theory of Vibrations; Concept of inertia and damping - Types of Damping
1.2 Difference between static forces and dynamic excitation - Degrees of freedom –
1.3 SDOF idealization - Equations of motion of SDOF system for mass as well as base excitation
1.4 Free vibration of SDOF system - Response to harmonic excitation
1.5 Impulse and response to unit impulse
1.6 Duhamel integral

**UNIT 2: Multiple Degree of Freedom System**

2.1 Multiple Degree of Freedom System; Two degree of freedom system
2.2 Normal modes of vibration - Natural frequencies - Mode shapes –
2.3 Introduction to MDOF systems - Decoupling of equations of motion
2.4 Concept of mode superposition (No derivations);

**Unit 3: Seismology**

3.1 Elements of Seismology; Causes of Earthquake - Geological faults –
3.2 Tectonic plate theory - Elastic rebound – Epicentre; Hypocentre - Primary,
3.3 shear and Raleigh waves - Seismogram - Magnitude and intensity of earthquakes –
3.4 Magnitude and Intensity scales - Spectral Acceleration - Information on some disastrous earthquakes;

**PART-B**

**Unit 4: Response of Structures to Earthquake**

4.1 Response of Structures to Earthquake; Response and design spectra
4.2 Design earthquake - concept of peak acceleration - Site specific response spectrum
4.3 Effect of soil properties and damping - Liquefaction of soils –
4.4 Importance of ductility - Methods of introducing ductility into RC structures

**Unit 5: Design Methodology**
5.1 Design Methodology IS 1893, IS 13920 and IS 4326 –
5.2 Codal provisions
5.3 Design of Structural Members as per the codes

**Unit 6: Earthquake control Measures**
6.1 Base isolation techniques
6.2 Vibration control measures
6.3 Important points in mitigating effects of earthquake on structures

**Text Books/ Reference Books:**

1. S.K. Duggal,Earthquake Resistant Design of Structures, Oxford University Press.
2. T. Pauley, & M.J.N Priestley, Seismic Design of Reinforced concrete and Masonry buildings, John Willey & Sons.
3. A.K. Chopra, Dynamics of Structures, Prentice-Hall International.
4. P. Agarwal, and M. Shrikhande,Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd.
5. Jai Krishna, A.R.Chandershekaran&Brajesh Chandra, Elements of Earthquake Engineering, South Asian Publication, New Delhi.
6. Clough &Penzion, Dynamics of Structures, McGraw Hill.
7. George G. Penelis and A.J.Kapoor, Earthquake Resistant Concrete Structures, E & FN Sons, Madras.
8. Mario Paz, Structural Dynamics, CBB Publication New Delhi.


**Software required / Web links:**
http://nptel.ac.in/courses/105101004/
http://nptel.ac.in/courses/105108076/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-833) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-833.1 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 3 |
| BCE-DS-833.2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| BCE-DS-833.3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-833.4 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 |
| BCE-DS-833.5 | 3 | 3 | 2 | 3 | 3 | - | - | - | - | - | - | 3 | 3 | 2 |
| BCE-DS-833.6 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

**BCE-DS-834: GEOGRAPHIC INFORMATION SYSTEMS AND SCIENCE**

| | | | |
|---|---|---|---|
| Credits 3 | | Max. Marks | : 200 |
| L-T-P | 2-0-2 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: Surveying & Geomatics**
**Course Type: Domain Specific Elective**

**Course Outcomes:**At the end of this course, the student will be able to:
BCE-DS-834.1. Relate the principles of GIS into the field applications
BCE-DS-834.2. Develop map symbolization and spatial analysis
BCE-DS-834.3. Utilize various Digital Data Creating and Editing techniques
BCE-DS-834.4. Explain about Global Navigation Satellite Systems
BCE-DS-834.5 IntegrateGeospatial Technologies

**PART-A**

**Unit 1:**
1.1 Introduction to GIS; Thinking Spatially Data Models;
1.2 GIS Spatial and Attribute Types
1.3 Investigation of geographic information systems (GIS) and science (GIScience) including theory and applications areas.

**Unit 2:**
2.1 Projections; Coordinate Systems
2.2 Datums Attribute Types, Map Types Map Symbolization
2.3 Scale; Cartography Topology
2.4 Use of a current widely-used GIS computer software system

**Unit 3:**
1.1 Aspects of geographic data entry and editing, map development and display
1.2 Basic Spatial Analysis: Classifying Features and selecting features by location
1.3 Attribute Data and Tables; Querying Joining or Relating Tables

**PART-B**

**Unit 4:**
4.1 Relationship of GIS to the Global Positioning System (GPS) and satellite generated data
4.2 Introduction to Remote Sensing and Image Processing
4.3 Finding and Exploring Digital Data Creating and Editing Data: Digitizing; Attributing Data
4.4 Vector Spatial Analysis & Raster Spatial Analysis

**Unit 5:**
5.1 Data Modeling; Sampling, Scale
5.2 Spatial Autocorrelation
5.3 Interpolation; Data Quality; Scripting

**Unit 6:**

6.1 Integration of Geospatial Technologies: Global Navigation Satellite Systems
6.2 GPS Basics; Data Collection Techniques and Equipment
6.3 The Future of GIS; Case Study

**Text Books/ Reference Books:**


1. Paul A. Longley, Michael F. Goodchild , Geographic Information Systems and Science
2. Heywood Pearson Education India, An Introduction to Geographical Information Systems.
3. Kali CharanSahu, Remote Sensing and Geographical Information Systems Paperback


**Software required/Weblinks:**

https://nptel.ac.in/courses/105107155/
https://nptel.ac.in/courses/105102015/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-834) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-834.1 | 3 | 2 | 3 | - | 2 | 3 | - | - | 2 | 3 | 2 | - | 3 | 2 |
| BCE-DS-834.2 | 3 | 3 | 2 | - | 3 | 3 | - | - | 3 | - | 2 | 2 | 2 | 1 |
| BCE-DS-834.3 | 3 | 2 | 3 | - | 3 | 3 | - | - | 3 | 3 | 1 | - | 3 | 3 |
| BCE-DS-834.4 | 3 | 3 | 3 | - | 3 | 3 | - | - | 3 | - | 3 | 2 | 2 | 3 |

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-835: Fire Resistant Construction**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-835.1: Categorize design consideration of the building
BCE-DS-835.2: Classify fire severity to design the building
BCE-DS-835.3: Design a fire resistant concrete building
BCE-DS-835.4: Design a fire resistant Steel Structures

**Part A**

**Unit 1: Fire Resistance**
1.1. Basic Concept of Fire Resistance
1.2. Process of combustion in fire
1.3. Effect of fire load & ventilation condition on enclosure fire
1.4. Growth and Decay of Fire in Enclosure

**Unit 2: Design Consideration**
2.1 Structural Design for Fire Condition
2.2 Design Objectives
2.3 Design Process
2.4 Loads for Structural Fire Design
2.5 Levels of Sophistication in the Design Process

**Unit 3: Fire Severity**
3.1 Fire Severity for Design
3.2 Standard Fire Exposure
3.3 Realistic Fire Exposure
3.4 Fire Resistance of Elements Exposed to the Standard Fire
3.5 Failure Criteria

**PART B**

**Unit 4: Fire Resistance Design of Concrete Structures**
4.1 Properties Normal Strength Concrete under Fire
4.2 Properties of High Strength concrete under fire
4.3 Properties of Steel Reinforcement under fire
4.4 Analysis of Compression Member
4.5 Analysis of Flexural Member
4.6 Shear and Torsion

**Unit 5: Fire Resistance Design of Steel Structures**
5.1 Steel Behavior at Elevated Temperatures
5.2 Thermal Properties of Steel

5.3 Mechanical Properties of Steel
5.4 Composite Floor Behavior at Elevated Temperatures
5.5 Design Procedure
5.6 Design of Steel column
5.7 Design of Steel Frame
5.8 Design of Steel Frame
5.9 Design of Steel Connection

**Unit 6: Fire Protection Material**

6.1 Spray-Applied Fire-Resistive Materials (SFRM)
6.2 Intumescent Coatings
6.3 Gypsum Board Products
6.4 Fibrous Board and Mat Products
6.5 Concrete and Masonry

**Text Books/ Reference Books:**

1. Bureau of Indian Standards, " HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP- 32)", BIS 1987 and 1989.
2. Markus,T.A. & Morris, E.N., "BUILDING CLIMATE AND ENERGY" Pitman publishing limited. 1980.
3.Croome,J.D.&Roberts,B.M.,"AIRCONDITIONING AND VENTILATION OF BUILDINGS VOL-1".Pergamon press.
3. Building Services Design - T.W.MEVER
4. Building Engineering & System Design - F.S.MERRIT & J. AMBROSE
5. SP-35 (1987): Handbook of Water supply & drainage-BIS
6. N.B.C.-2007 BIS
7. Concept of building fire safety - D.EGAN.
8. Design of fire resisting structures - H.L. MALHOTRA. List of reference materials/books/2
9. An introduction to fire dynamics -D.DRYSDALE
10. Structural fire protection Edt by T.T.LIE
11. Elevator technology - G.C.BARNEY
12. HEATING VENTILATING AND AIR CONDITIONING Analysis and Design - Faye C. McQuiston and Jerald D. Parker.
13. Building Maintenance Management-R.LEE
14. Developments In Building Maintenance -I.EJ. GIBSON
15.Concrete Structures: materials, Maintenance And Repair D.CAMPBELL,ALLEN & H.ROPER

**Software required/Weblinks:**

https://nptel.ac.in/
https://swayam.gov.in/
https://nptel.ac.in/courses/105/102/105102176/

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement (BCE-DS-835 | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-835.1 | 3 | 2 | 1 | 1 | | | 3 | 2 | - | 3 | 2 | 3 | 2 | 2 |
| BCE-DS-835.2 | 3 | 2 | 1 | 3 | 2 | 3 | | | 3 | 2 | 3 | 3 | 2 | 3 |
| BCE-DS-835.3 | 3 | - | 1 | 2 | 2 | | - | 3 | - | - | 3 | 2 | 3 | 2 |
| BCE-DS-835.4 | 2 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 3 | 2 | 2 | 1 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-836: Heritage Conservation**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

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

**BCE-DS-836.1.**Know and understand about world heritage.
**BCE-DS-836.2**. Understand the importance of Conserving heritage.
**BCE-DS-836.3.**Know about the history of conservation movement and emergence of conservation.
**BCE-DS-836.4**. Understand conservation approaches in cultural heritage
**BCE-DS-836.5**. Understand conservation approaches in geo-ecological heritage
**BCE-DS-836.6.**Know ex-situ & in-situ conservation.

**PART-A**

**Unit 1: World Heritage Studies:**
1.1 Concepts of World Heritage
1.2 UNESCO World Heritage Convention
1.3 Operational Guidelines, Process of inscription and monitoring, State of Conservation (SoC)
1.4 Live experience of 43rd UNESCO World Heritage Committee sessions.

**Unit 2: Conserving heritage: Socio-political and Ecological Perspectives**
2.1. World Heritage Conservation from global and local perspectives
2.2. Global environmental history and politics
2.3. Natural resource conflicts; Culture-nature linkages in Heritage
2.4. Ecology and the Human Interface
2.5. Heritage and Sustainable Tourism.

**Unit 3: History of conservation movement and emergence of conservation**
3.1. Definitions and terminologies in conservation; Principles and Approaches of conservation
3.2. Global Perspective on heritage conservation (UNESCO, IUCN, ICCROM, UNWTO)
3.3. Heritage Practice areas, Conservation Ethics, and Open source (literature pool and datasets);
3.4. Understanding Heritage: Types of Heritage
3.5. Heritage conservation - Need, Debate and purpose. Defining Conservation, History of Conservation Movement

**PART-B**

**Unit 4: Conservation approaches in Cultural Heritage**
4.1. Architectural Conservation and Historic Building Preservation;
4.2. Role of Museums; Understanding the building and composition; Basics of material science;

4.3. Preservation and restoration techniques; Sustainable Urban Planning and Rural Development; Conservation planning interventions; Role of Government organizations; Community based cultural heritage resource management;
4.4. Monument conservation and the role of Archaeological Survey of India; case studies of sites such as Hampi, Golconda, Mahabalipuram

**Unit 5: Conservation approaches in Geo-ecological Heritage**
5.1. Geo-ecological heritage of India and world; Opportunities and Challenge
5.2. Biodiversity loss and protected area management
5.3. Principles of ecological restoration; Protocols to monitor ecological values
5.4. Introduction to Earth History and Earth Systems; Geomorphology and Palaeontology.

**Unit 6: Ex-situ & In-situ conservation**
6.1. Institutional mechanism of natural heritage conservation in India
6.2 Protected Area network and its management
6.3. National Parks, Wildlife Sanctuaries, Conservation and Community Reserves, Tiger Reserves, Biosphere Reserves etc. Working plans
6.4. Management plans; basics of habitat and wildlife management; community conservation areas and wildlife outside PAs; species conservation and recovery programmes for globally threatened species including terrestrial, freshwater and marine species
6.5.Role of zoos, aquariums and botanic gardens in conservation; introduction/reintroduction and translocation.

**Text/Reference Books:**


1. Appleyard, D. (Ed.). (1979). The Conservation of European Cities. Massachusetts: M.I.T. Press.
2. Basu, S., Mukerji A (Eds.) (2017). Integrated Urban Conservation: An Approach towards Development, ISBN: 978-93-5268-866-1, Kharagpur: Department of Architecture and Regional Planning, IIT, Kharagpur.
3. Croci, G. (1998). The Conservation and Structural Restoration of Architectural Heritage. Southampton, UK: WIT Press.
4. Fitch, J.M. (Reprint edition 1990). Historic Preservation: Curatorial Management of the Built World. Virginia: University Press of Virginia.
5. Cullinane, J. J. (2012). Maintaining and Repairing Old and Historic Buildings. Wiley-Blackwell.
6. Evans, N.L. (2014). An Introduction to Architectural Conservation: Philosophy, Legislation and Practice. London: RIBA Publishing.
7. Feilden, B. M. (2003). Conservation of Historic Buildings. London: Routledge.
8. Glendenning, M. (2013). The Conservation Movement: A History of Architectural Preservation: Antiquity to Modernity. London: Routledge.
9. Stipe, R.E. (2003). A Richer Heritage: Historic Preservation in the Twenty-first Century. North Carolina: The University of North Carolina Press.


**Software required / Web links:**

**https://wii.gov.in/msc_hcm_syllabus_2019**

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |

| | |
|---|---|
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

**Course Articulation Matrix**

| CO Statement ( BCE-DS-836) | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BCE-DS-836.1** | 3 | 1 | - | - | 2 | - | - | - | - | - | - | - | - | 1 |
| **BCE-DS-836.2** | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | - | 1 |
| **BCE-DS-836.3** | 3 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | 2 | - | - | 1 |
| **BCE-DS-836.4** | 2 | 3 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | 2 | 2 |
| **BCE-DS-836.5** | 3 | 3 | 1 | 3 | 1 | - | - | - | - | - | - | - | 1 | 2 |
| **BCE-DS-836.6** | 2 | 3 | 3 | 2 | 2 | 3 | 2 | - | 1 | 2 | - | 1 | - | 3 |

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**
(Deemed to be University under section 3 of the UGC Act 1956)

**BCE-DS-837: Water Auditing**

| | | | |
|---|---|---|---|
| Credits | 3 | Max. Marks | : 200 |
| L-T-P | 3-0-0 | Continuous Evaluation | : 100 |
| Examination Duration | 3 hrs | End Semester Exam | : 100 |

**Pre-requisites: None**
**Course Type: Domain Specific Elective**

**Course Outcomes:** At the end of this course, the student will be able to:
BCE-DS-837.1 Relate to concept of water demand
BCE-DS-837.2 Apply water conservation principle
BCE-DS-837.3 Utilize water auditing laws in practical problems
BCE-DS-837.4 Recommend methodology for water auditing

**PART-A**

**Unit 1: Introduction**
1.1 Estimation of water demand
1.2 Factors affecting variation in demand, constraints.
1.3 Projections for future demands, additional demand management through treated waste water and efficient storm water management.
1.4 Existing sources of fresh water, intake structures, conveyance of water.

**Unit 2: Water Conservation**
2.1 Water conservation as a measure to meet future water demands
2.2 Conjunctive water use, rain water harvesting techniques, catchment planning,
2.3 Watershed management
2.4 Institutional and policy aspects with creating and understanding of the traditional practices.

**Unit 2: Water Laws**
3.1 An overview of water law in India
3.2 Evolution of water law, key features of water law, evolving water law and policy,
3.3 Water sector reforms, water law reforms,
3.4 The mosaic of water law.

**PART-B**

**Unit-4: Water Conservation Practices**

4.1 Water conservation as a measure to meet future water demands
4.2 Conjunctive water use, rain water harvesting techniques, catchment planning,
4.3 watershed management, institutional and policy aspects with creating and understanding of the traditional practices.

**Unit-5: Water Audit Methods**
5.1 Steps of water audit, water supply and usage study,
5.2 process study, discharge analysis, water audit report, benefits of water audit.
5.3 Introduction to water audit software like PODIUMSim, AWWA software, IWMI software

**Unit-6: Water Audit of Sectors**

6.1 Domestic sector
6.2 Industrial sector
6.3 Irrigation sector
6.4 Review of case studies

**Text Books/ Reference Books:**

1. Water Supply & Sanitary Engineering, G.S.Birdie, J.S.Birdie, 10$^{th}$ Edition, Dhanpat Rai Publishing Company (2015)
2. Water Supply Engineering, S.K.Garg, Khanna Publishers, 2010, Khanna Publishers
3. Water Law in Inda- An Introduction to Legal Instruments. 2011. Philippe Cullet and Sujith Koonan Print ISBN-13: 9780198070818, Published to Oxford Scholarship Online: September 2012
4. CPHEEO Water Manual

**Instructions for paper setting:** Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 20 marks.

**Distribution of Continuous evaluation table**

| | |
|---|---|
| Sessional- I | 30% |
| Sessional- II | 30% |
| Assignment | 20% |
| Class Performance | 10% |
| Attendance | 10% |

**Assessment Tools:**

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

| **CO Statement (BCE-DS-837)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O 1** | **PS O 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCE-DS-837.1 | 2 | | 1 | | | 2 | 3 | 2 | | | | | 3 | 2 |
| BCE-DS-837.2 | | 1 | | | | | 2 | | | | | | 2 | 3 |
| BCE-DS-837.3 | | | | | 2 | | | | | 3 | 2 | | 3 | 2 |
| BCE-DS-837.4 | | | | 2 | | | | 3 | 2 | 3 | | | 3 | 3 |

# SEMESTER-VIII

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

**(Deemed to be University under section 3 of the UGC Act, 1956)**

### PROJ-CE-800A: SUMMER INTERNSHIP-IV

| | | | |
|---|---|---|---|
| Credits 10 | | Max. Marks | : 300 |
| Practical/Week 20 weeks | | Continuous Evaluation | : 200 |
| | | End Semester Exam | : 100 |

**Prerequisites: None**
**Course Type: Project Work**

**Course Outcomes:** At the end of this course, the student will be able to:
PROJ-CE-800A.1. Acquire fundamental principles of Engineering.
PROJ-CE-800A.2. Have in depth understanding and technical competency in relevant field
PROJ-CE-800A.3. Explore the various possibilities of a career in this field
PROJ-CE-800A.4. Formulate solutions to Engineering problems
PROJ-CE-800A.5. Generate reports on the experiences and project carries out

Every student will have to undergo Industrial Training for atleat 20 weeks in the relevant field of Engineering in which he/she is enrolled for B.Tech programme in $8^{th}$ semester. Respective Head of Department will approve the Industry/Organization for training. During this course of time, he/she will be regularly monitored and evaluated. On the completion of training duration, he/she will have to submit the training report, deliver a seminar about the work/project undertaken during the training and will have to appear for viva. The evaluation of the industrial training shall be made as per following:

**Continuous Evaluation during training:**

| | | |
|---|---|---|
| 1. Evaluation by the Supervisor in the Industry | : | 75 marks |
| 2. Evaluation by Faculty Mentor during training visit | : | 50 marks |
| 3. Internal seminar/ Presentation | : | 75 marks |
| Total Internal Marks | : | **200** |

**External Evaluation after training:**

| | | |
|---|---|---|
| 1. Project Report | : | 30 marks |
| 2. Seminar/Presentation | : | 20 marks |
| 3. Viva | : | 50 marks |
| | | ------------------ |
| Total External marks | | **100** |
| **Total Credits** | **:** | **10** |

The parameters for evaluation during the training for Supervisor shall be as under:

| | | Marks |
|---|---|---|
| a) | Work/Project undertaken | 15 |
| b) | Punctuality/Regularity | 10 |
| c) | Discipline/Overall Conduct/Relations with Seniors and others | 10 |
| d) | Eagerness to acquire technical knowledge | 20 |
| e) | Overall Proficiency achieved during training | 10 |
| f) | Any contribution to the organization | 10 |
| | | ------- |

**Total** **75**

The parameters for evaluation by the faculty during training shall be as under:

a) Maintenance of Training Diary and Regularity 10
b) Relations with Seniors and others 10
c) Overall Conduct 10
d) Willingness to Work 10
e) Proficiency achieved 10
-------
**Total** **50**

**ARTICULATION MATRIX**

| **CO Statement ( PROJ-CE-800A)** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROJ-CE-800A.1 | 2 | 2 | 3 | - | 1 | 2 | 2 | - | - | - | - | - | 3 | 2 |
| PROJ-CE-800A.2 | 2 | 1 | - | - | - | 1 | 1 | - | - | 2 | 2 | - | 2 | 3 |
| PROJ-CE-800A.3 | 3 | 3 | - | 2 | 3 | - | 1 | 1 | - | 3 | - | - | 1 | 3 |
| PROJ-CE-800A.4 | 3 | 2 | 2 | 2 | 1 | 2 | -3 | 2 | 2 | 2 | - | 1 | 3 | 3 |
| PROJ-CE-800A.5 | 2 | 2 | 2 | 2 | 1 | 1 | 3 | 2 | 1 | 3 | 2 | 2 | 3 | 2 |

**Appendix-A : List of courses having relevance to the Local/Regional, National and Global Development needs**

| Course Code | Course Name | Regional | National | Global |
|---|---|---|---|---|
| BPH-106 | Physics for Engineers | | | √ |
| BMA-102 | Mathematics –I | | | √ |
| BEE-103 | Basic of Electrical and Electronics Engineering | | | √ |
| BME-101A | Engineering Graphics & Design | | | √ |
| BPH-151A | Physics Lab | | | √ |
| BEE-151A | Basic Electrical Engineering Lab | | | √ |
| CDC-PC-101 | Professional Communication-I | | √ | √ |
| BHM-MC-001 | Constitution of India | √ | √ | |
| BCH-106 | Chemistry | | | √ |
| BMA-202 | Mathematics –II | | | √ |
| BCS-101A | Programming for Problem Solving | | | √ |
| BME- 102 | Workshop / Manufacturing Practices | | √ | |
| BCH-151A | Chemistry Lab | | | √ |
| BCS-151A | Programming for Problem Solving Lab | | | √ |
| CDC-PC-102 | Professional Communication-II | | √ | √ |
| BCH-MC-002 | EVS | √ | √ | |
| BHM-MC-004 | Quantitative Aptitude | | | √ |

| | | | | |
|---|---|---|---|---|
| BHM-MC-008 | Quantitative Aptitude and Personality Development-II | | | √ |
| BHM-MC-009 | Quantitative Aptitude and Personality Development-III | | | √ |
| BCE-DS-302A | Engineering Mechanics for Civil Engineers | √ | √ | √ |
| BCE-DS-303 | Disaster Preparedness & Planning | √ | √ | |
| BCE-DS-324 | IOT Enabled Smart Infrastructure | √ | √ | √ |
| DTI-300 | Design, Thinking and Innovation-I | | √ | |
| BCE-DS-405 | Energy Science & Engineering | | √ | |
| BCE-DS-407 | Building Construction | √ | √ | √ |
| BCE-DS-406 | Transportation Engineering | | √ | √ |
| DTI-400 | Design, Thinking and Innovation-II | √ | √ | |
| BCE-DS-523 | Engineering Materials for Sustainability | √ | √ | √ |
| BCE-DS-606 | Environmental Engineering-II | √ | | |
| BCE-DS-604A | Construction Engineering & Management | √ | √ | |
| BCE-DS-621A | Traffic Engineering and Management | √ | | |
| BCE-DS-624 | Environmental Systems | | √ | √ |
| BCE-DS-702A | Structural Analysis-II | | √ | √ |
| BCE-DS-724 | Environmental Laws and Policy | | √ | |
| BCE-DS-726 | Engineering Risk & Uncertainty | | √ | √ |
| BCE-DS-823 | Air, Noise Pollution and Control | √ | √ | |
| BCE-DS-824A | Environmental Geo-technology | √ | √ | |
| BCE-DS-828 | Sustainable Construction Methods | √ | √ | |
| BCE-DS-829 | Solid and Hazardous Waste Management | √ | √ | |

**Appendix-B : List of courses having focus on Employability, Entrepreneurship and Skill Development**

| Course Code | Course Name | Employability | Entrepreneurship | Skill development |
|---|---|---|---|---|
| BME-101A | Engineering Graphics & Design | | | √ |
| BCS-101A | Programming for Problem Solving | | | √ |
| BME- 102 | Workshop/Manufacturing Practices | | | √ |
| BCS-151A | Programming for Problem Solving Lab | | | √ |
| Proj-CE-300A | Summer Internship-I | √ | | |
| BCE-DS-302A | Engineering Mechanics for Civil Engineers | | | √ |
| BCE-DS-351A | Computer-aided Civil Engineering Drawing Lab | √ | | |
| BCE-DS-406 | Transportation Engineering | | | √ |
| BCE-DS-403 | Surveying & Geomatics | √ | | √ |
| BCE-DS-453 | Surveying & Geomatics Lab | | | √ |
| BCE-DS-455 | Transportation Engineering Lab | | | √ |
| BCE-DS-505A | Structural Analysis-I | √ | | |
| BCE-DS-502 | Geotechnical Engineering | √ | | |
| BCE-DS-552 | Geotechnical Engineering Lab | | | √ |
| BCE-DS-601A | Estimation, Costing and Valuation | √ | | |
| BCE-DS-606 | Environmental Engineering - II | √ | | |
| BCE-DS-652 | Environmental Engineering Lab | √ | | √ |
| Proj-CE-700A | Project Phase-II | | √ | |
| Proj-CE-800A | Summer Internship-IV | √ | | |

**Appendix-C : List of Courses having focus on Environment and Sustainability, Professional Ethics, Human Values and Gender Equality**

| Course Code | Course Name | Environment and Sustainability | Professional Ethics | Human Values | Gender Equality |
|---|---|---|---|---|---|
| BCH-MC-002 | EVS | √ | | | |
| BCE-DS-303 | Disaster Preparedness & Planning | √ | | | |
| BHM-MC-008 | Quantitative Aptitude and Personality Development-II | | √ | | |
| BHM-MC-009 | Quantitative Aptitude and Personality Development-III | | √ | | |
| BCE-DS-405 | Energy Science & Engineering | √ | | | |
| BCE-DS-422 | Introduction to Sustainable development | √ | | | |
| BCE-DS-423 | Transformation to Green Buildings | √ | | | |
| BCE-DS-523 | Engineering Materials for Sustainability | √ | | | |
| BCE-DS-507 | Environmental Engineering-I | √ | | | |
| BCE-DS-524 | Green and Renewable Energy | √ | | | |
| BCE-DS-652 | Environmental Engineering Lab | √ | | | |
| BCE-DS-606 | Environmental Engineering - II | √ | | | |
| BCE-DS-724 | Environmental Laws and Policy | √ | | | |
| BCE-DS-725 | Physico-Chemical Processes for Water and Wastewater Treatment | √ | | | |
| BCE-DS-823 | Air, Noise Pollution and Control | √ | | | |
| BCE-DS-824A | Environmental Geo-technology | √ | | | |
| BCE-DS-828 | Sustainable Construction Methods | √ | | | |
| BCE-DS-829 | Solid and Hazardous | √ | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Waste Management | | | | |
| BCE-DS-832 | Environmental Impact Assessment and Life Cycle Analyses | √ | | | |