Civil Engineering

Model Question Papers

For Undergraduate Program

The model question papers are suggestive blueprints. The primary aim of these question papers is to bring clarity about the process of connecting questions to performance indicators and hence to course outcomes. Further, these question papers demonstrate how bloom's taxonomy can be used to understand the quality of question papers and their effectiveness in assessing higher order abilities. The structure of question papers, number of questions, choices given, time given for examination etc., can vary based on the practices of the University or college.

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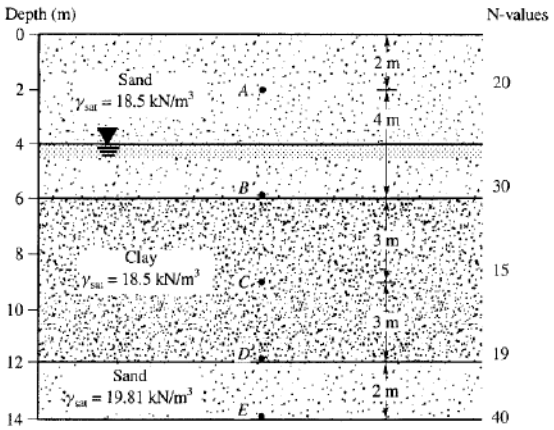
Course Name: Advanced Geotechnical Engineering

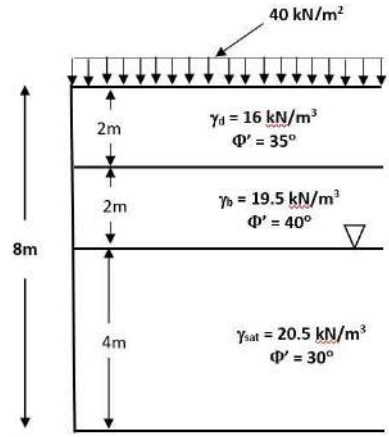
Course Outcomes (CO):

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

1. Plan soil exploration program, interpret the results and prepare soil exploration report.
2. Compute active and passive earth pressure.
3. Carry out stability analysis of finite and infinite slopes with some field problem.
4. Compute safe bearing capacity of shallow foundations.
5. Design pile and pile group.
6. Carry out settlement analysis of footings.
7. Assess the potential of soil for the design of landfills and reinforced earth wall.

Model Question Paper
Total Duration (H:M):3:00
Course :Advanced Geotechnical Engineering
Maximum Marks :100

Q.No.	Questions	Marks	CO	BL	PO	PI Code
1a	You are appointed as site engineer and have been tasked to carry out site investigations for an earth dam construction site. Describe the investigation procedure and discuss what information is required for the preparation and presentation of the report.	8	CO1	L3	1	1.3.1
1b	A standard penetration test was carried out at a site. The soil profile is given in figure 1(b) below with the penetration values. The average soil data are given for each layer. Compute the corrected values of N and plot showing the variation of observed and corrected values with depth.  **Fig 1(b)**	6	CO1	L3	4	1.3.1
1c	The unit weight of a soil of a 30° slope is 17.5kN/m^3. The shear parameters c and ϕ for the soil are 10 kN/m^2 and 20° respectively. Given that the height of the slope is 12 m and the stability number obtained from the charts for the given slope and angle of internal friction is 0.025, compute the factor of safety.	6	CO3	L2	1	1.3.1
2a	For the retaining wall shown in figure 2(a), draw the active earth pressure distribution diagram and obtain total active force on the wall.	8	CO2	L3	2	2.1.2

	 **Fig 2(a)**					
2b	A retaining wall 4.5 m high with a vertical back supports a horizontal fill weighing 18.60 kN/m^3 and having ϕ = 32°, δ = 20°, and c = 0. Determine the total active thrust on the wall by Culmann's graphical method.	12	CO2	L3	1	1.3.1
3a	A canal having side slope 1:1 is proposed to be constructed in cohesive soils to a depth of 4.5m below the ground surface. The soil properties are a given below; ϕ_u=15°, c_u=10kN/m^2. e=1.0 G=2.65. find the factor of safety with respect to cohesion against failure of bank slopes; i) When the canal is full of water and. ii) When there is sudden draw down of water in canal.	8	CO3	L3	2	2.1.2
3b	Determine the depth at which a circular footing 2m diameter be founded to provide a factor of safety of 3.0. If it has to carry a safe load of 1500 kN. The foundation soil has c=15 kN/m^2, ϕ=30° and unit weight of soil γ=18kN/m^3.	7	CO4	L3	2	2.1.2
3c	A large scale bearing capacity test on a footing of size 1.05mX1.05m at a depth of 1.5m yielded an ultimate value of 141 kN. Unconfined compressive tests on the soft saturated clay yielded a strength of 0.03 N/mm^2. If the unit weight of the soil is 16 kN/m^3, how much does the test value differ from that obtained using Terzaghi's bearing capacity equation?	5	CO4	L3	2	2.1.2
4a	Design a pile foundation system in 20 m thick soft clay with undrained cohesion of 60kPa, density of 18kN/m^3 and water content of 30%. The clay layer is underlined by hard rock. The pile foundation should carry a load of 6500 kN. Take liquid limit=60%, G=2.7.	12	CO5	L3	2	2.2.3
4b	A soil profile at a site consists of 4.0m of medium sand with dry unit weight of 17 kN/m^3, underlain by a normally consolidated layer of 2.0m thick clay. The initial void ratio of clay is 1.0 its saturated unit weight is 20 kN/m^3 and its liquid limit is 50%. The ground water table is at the top of the clay layer. A square footing 2m x 2m is founded at a depth of 1.0 m below the GL at the site. The load on the footing is 1200 kN. Calculate the settlement of footing due to consolidation of the clay layer.	8	CO6	L3	2	2.1.2
5a	Check the reinforced earth wall shown in figure 5(a) for stability against a) sliding b) over turning and c) bearing failure. Although BC is a rough face, assume it to be smooth.	8	CO7	L3	2	2.1.2

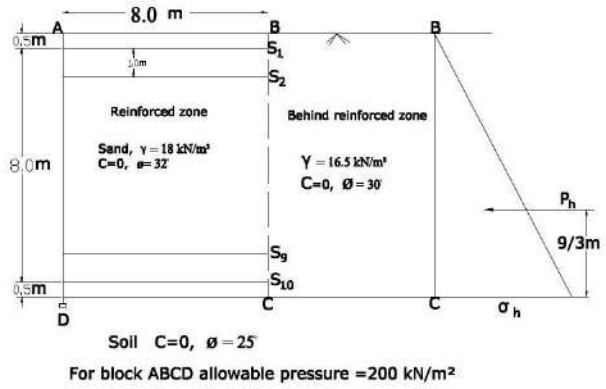
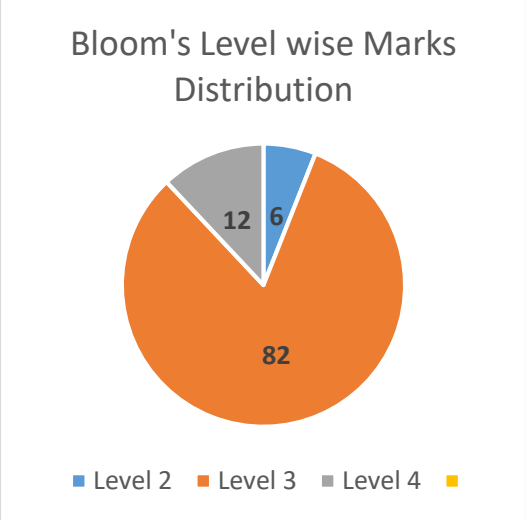
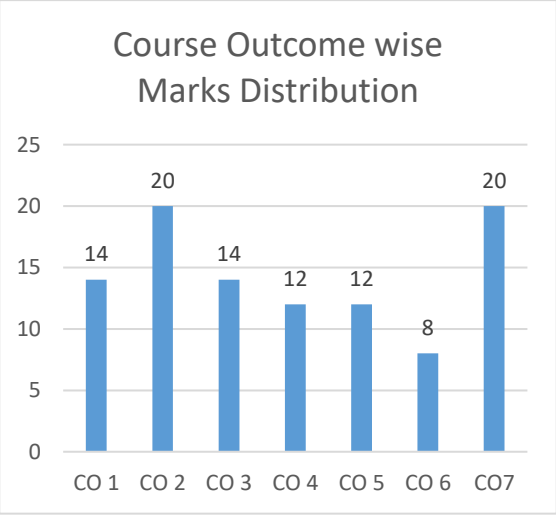


Fig 5(a)

5b	Site A and Site B are two sites located at a distance 20km and 30km respectively from a city. Below table gives the details for both sites. i) What criterions to be considered while selecting a landfill site? ii) Compare the score of both sites and suggest which site is best suited for constructing a landfill.	12	CO7	L4	2	2.1.2

Parameters	weightage	Sensitivity indices				SiteA	Site B
		0.25	0.50	0.75	1.00		
Distance (km)	100	10	20	30	40	20	30
Population within 500m	300	200	400	600	800	600	400
Depth to GW (m)	400	40	30	20	10	20	40
Soil type	200	Clay	Silt	Sand	Gravel	Silt	gravel





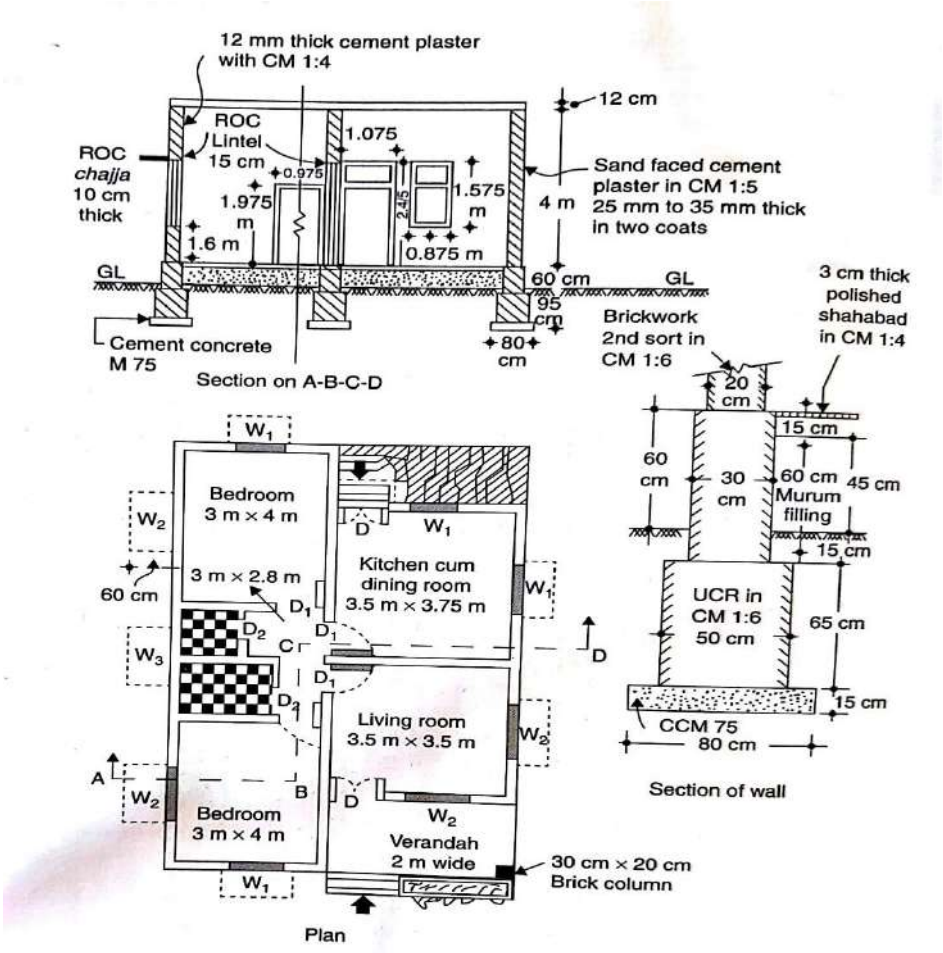
BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)
CO – Course Outcomes
PO – Program Outcomes; PI Code – Performance Indicator Code

Course Name: Construction Project Management

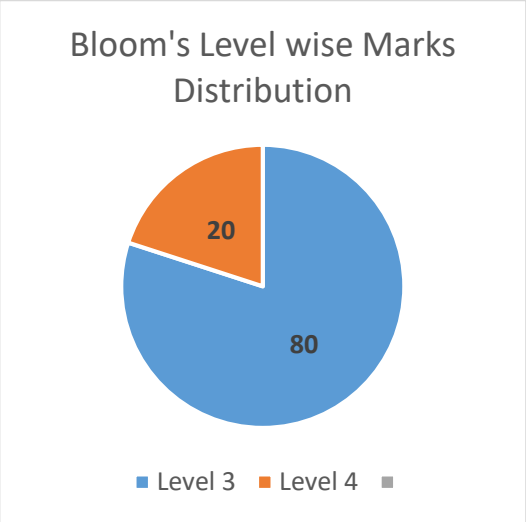
Course Outcomes (CO):

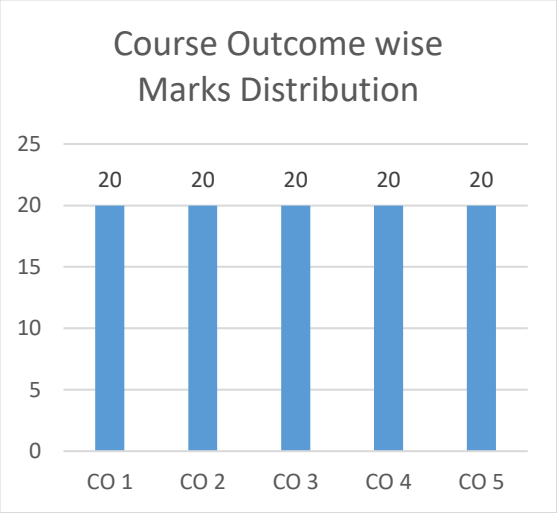
1. Determine the inter-relationships of construction drawings and specifications and their working in construction engineering and management.
2. Develop Work Breakdown Structure (WBS) for various types of buildings.
3. Construct a construction project schedule by combining the WBS, duration and networking methods.
4. Develop a safety protocol for various construction projects depending on the site conditions in alignment with SP 70 2001 manual.
5. Analyse the various site conditions on a construction project and select construction equipment best suited for those conditions.

Model Question Paper
Total Duration (H:M): 3:00
Course: Construction Project Management
Maximum Marks :100

Q.No	Questions	Marks	CO	BL	PI
1	Analyze the given drawing to determine the scope of work and sequence the activities in order of their construction. 	20	CO1	L3	2.1.2

<table>
<tr><th>Q.No</th><th>Questions</th><th>Marks</th><th>CO</th><th>BL</th><th>PI</th></tr>
<tr><td>2</td><td>There is an immediate need for the construction of a small concrete bridge between two villages before the monsoon season arrives, as an assistant engineer in the PWD, your preceding officer has asked to create a third-level WBS accounting for all the major milestones to be achieved to aid the estimation process.</td><td>20</td><td>CO2</td><td>L3</td><td>3.2.1</td></tr>
<tr><td>3</td><td>The following data is for a construction of a commercial complex which your company is about to build. The activities, durations and the interdependencies were finalized in the planning meeting. Analyze and determine the earliest duration to execute the project. Also, determine if there are additional days, other than the planned durations for the non-critical activities.
<table>
<tr><th>Activity</th><th>Duration (Weeks)</th><th>Interdependency</th></tr>
<tr><td>Site Clearance</td><td>4</td><td>-</td></tr>
<tr><td>Surveying</td><td>2</td><td>Site Clearance</td></tr>
<tr><td>Excavation</td><td>4</td><td>Site Clearance, Surveying,</td></tr>
<tr><td>Foundation</td><td>5</td><td>Excavation</td></tr>
<tr><td>Superstructure</td><td>15</td><td>Foundation</td></tr>
<tr><td>Plastering</td><td>4</td><td>Superstructure</td></tr>
<tr><td>Painting</td><td>6</td><td>Superstructure, Plastering</td></tr>
<tr><td>Flooring</td><td>4</td><td>Plastering, Flooring</td></tr>
<tr><td>Clean up</td><td>2</td><td>Plastering, Painting, Flooring.</td></tr>
</table></td><td>20</td><td>CO3</td><td>L3</td><td>2.2.3</td></tr>
<tr><td>4</td><td>Develop a detailed safety protocol in accordance with SP 70 (Handbook on Construction safety practices) for the following projects:
i. Residential Apartment Complex
ii. Highway Construction</td><td>20</td><td>CO4</td><td>L3</td><td>2.2.3</td></tr>
<tr><td>5</td><td>An electrical sub-station is to be built on a 7 acres of land. The following is the scope of work to be completed by your company. The project is to be completed in 4 months.
i. Clearing of vegetation on site, which includes trees, shrubs and grass.
ii. Removing of top 1 meter soil and hauling it off to a dump site located 8 KMs from the worksite.
iii. Compacting the natural ground for 94 % Proctor Density.
iv. Placing of aggregates to the specified level as mentioned in the drawing.
v. Compacting the placed aggregates for Modified Proctor Density of 98 %.
vi. Excavating for 85 piers of specified diameter.
vii. Placing Concrete in the piers.
viii. Asphalt of 6 inches over the aggregate base for the entire sub-station.
ix. Machine control is to be used for excavation and aggregate placement.
Analyze the scope of the project and select at least two types of construction equipment to be used for this project. Compare and finalize the best fit.</td><td>20</td><td>CO5</td><td>L4</td><td>2.2.3</td></tr>
</table>





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Course Name: Advanced Project Management

Course Outcomes (CO):

1. Assess the importance of monitoring and control phase during the execution of a construction project.
2. Combine estimating and scheduling and develop a cost loaded schedule which will combine both cost and time aspects into one cost loaded schedule.
3. Develop earned value reports to know the progress of the project at any instant of the project duration.
4. Evaluate the various bidding strategies employed in construction.
5. Conduct risk analysis to determine the probable risks involved and place appropriate mitigation measures in place.

Model Question Paper
Total Duration (H:M): 3:00
Course: Advanced Project management
Maximum Marks :100

<table>
<tr><th>Q.No</th><th>Questions</th><th>Marks</th><th>CO</th><th>BL</th><th>PI</th></tr>
<tr><td>1</td><td>The following is the planned crew and quantity for the excavation activity. The scheduled work days is 6 days. The planned quantity is 3000 Cubic meters. Determine the planned total cost and unit cost for this activity.

<table>
<tr><th>Labor Force Required</th><th>Total Number</th><th>Per Day Rates</th></tr>
<tr><td>Back Hoes</td><td>07</td><td>₹ 1000/day</td></tr>
<tr><td>Operators</td><td>07</td><td>₹ 550/day</td></tr>
<tr><td>Dump Trucks</td><td>10</td><td>₹ 600/day</td></tr>
<tr><td>Dump Truck Drivers</td><td>10</td><td>₹ 350/day</td></tr>
</table>

After 3 days, the following is the report generated from the site.

Amount of work done: 1200 cubic meters. The crew worked for 8 hours/day for all the 3 days. Determine the cost that was spent for these 3 days. Comment on the productivity of the crew. Calculate the cost required to complete the work in the remaining 3 days. Analyze the given situation and determine whether additional crew is a better option compared to over-time for the existing crew.</td><td>20</td><td>CO1</td><td>L4</td><td>2.2.1</td></tr>
<tr><td>2</td><td>A typical small house construction project consists of the following operations along with the time set for its completion.

<table>
<tr><th>Operation (Activities)</th><th>Time (in days)</th><th>Cost (in Rupees)</th></tr>
<tr><td>Survey, design and Layout</td><td>6</td><td>10000</td></tr>
<tr><td>Construction of foundation</td><td>5</td><td>26000</td></tr>
</table>
</td><td>20</td><td>CO2</td><td>L4</td><td>13.1.3</td></tr>
</table>

Q.No	Questions	Marks	CO	BL	PI

Construction of Superstructure	11	80000
Roofing	5	34000
Fixing door and window frames	3	16000
Plumbing and Drainage	4	12000
Electric Fitting	4	19000
Plastering	4	7000
Flooring	4	32000
Carpentry work	2	10000
Painting	3	8000

The project starts on Monday 16th November 2018. Assume 5 days-work week. The following data was collected from the job site.

Operation	**Percentage Complete**	**Actual Cost (in Rupees)**
Survey, design and Layout	100 %	11600
Construction of foundation	100 %	25200
Construction of Superstructure	80 %	76000
Roofing	25 %	12000

At present the data date is Friday, 11-12-2018.

i. Determine the total duration of the project. State any assumptions you make.

ii. Compile PV (Planned Value), EV (Earned Value) and AC (Actual Cost) from the data provided.

iii. Analyze the status of the project (using EVA) and create a status report. Comment on the forecast of the project.

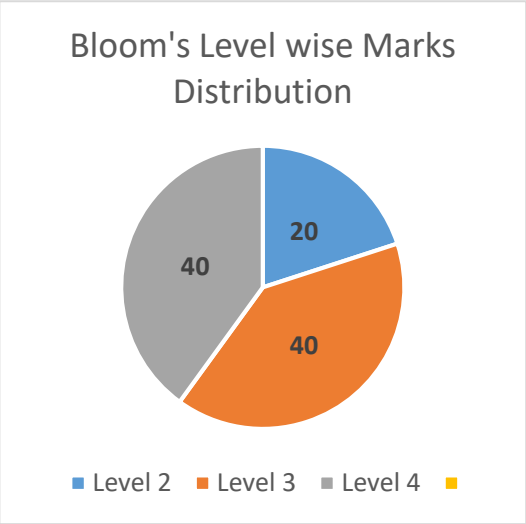
3a

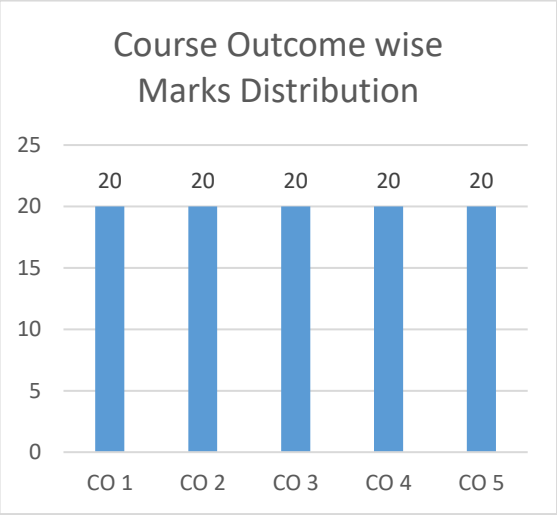
A project consists of 8 activities from A to F. The following is the progress report sent to you from the field after 2 months. The project was planned to be completed till activity D after 2 months. Analyse the project. Also comment on the status of each individual activity in terms of profit/loss.

S. No.	Activity	Planned Value	Actual Cost	Percentage Complete
1	A	10000	9500	100%
2	B	25000	26300	100%
3	C	32000	35000	96%
4	D	28000	17000	72%
5	E	56000	30000	46%

20 CO3 L3 11.3.1

Q.No	Questions	Marks	CO	BL	PI
	6 F 87000 24000 34% 7 G 96000 8 H 68000				
4a	There is a call for tender for construction of stadium in your city, only few reputed private construction companies have been asked to participate in the tender by the governing body, your company is one of them. Your boss asks you to prepare the necessary document which is required for the tendering work for the construction of stadium.	12	CO4	L2	11.3.1
4b	Discuss the different type of bidding models	08	CO4	L2	1.3.1
5	Your company has just won a bid to construct an electrical sub-station over 5 acres of land which is covered with vegetation. The major activities of the project are site clearance, surveying, subgrade base, piers and bolts, control room, asphalt base, painting and clean-up. Evaluate the project and list all risks that could occur on this project. List the mitigation techniques to be placed to counter the identified risks.	20	CO5	L3	2.1.1





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Course Name: Design of RCC Structures

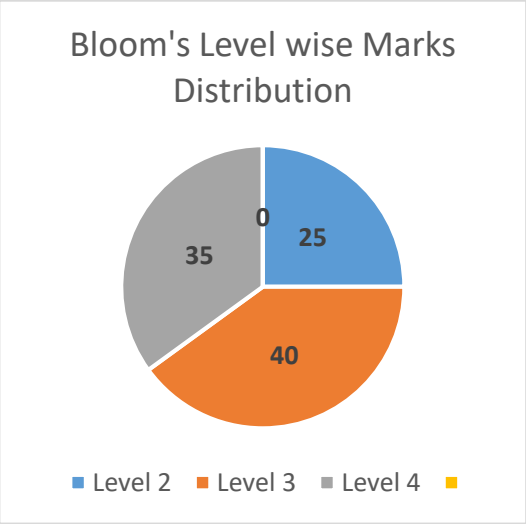
Course Outcomes (CO):

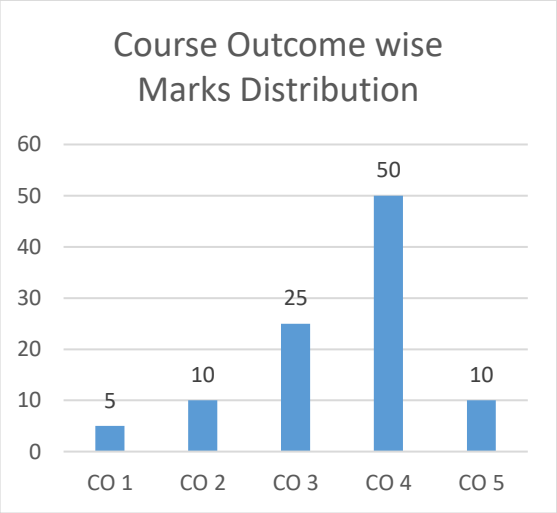
1. Assess different design philosophies of R.C.C. structure and relative merits and demerits.
2. Analyze the structure for different methods under limit state design philosophy.
3. Estimate the moment carrying capacity and serviceability criteria of various structural elements.
4. Design the reinforced concrete sections such as beams, slabs, columns, footings and staircase.
5. Detail the bar bending scheme of the RCC structural elements.

Model Question Paper
Total Duration (H:M):3:00
Course: Design of RCC Structures
Maximum Marks :100

Q.No	Questions	Marks	CO	BL	PI
1(a)	What are the different limit states of design? What are the merits of limit state design over other philosophies?	10	2	L2	1.3.1
1(b)	A RC beam 200mm wide and 500mm deep is reinforced with 3nos of 16mm dia bars. Find moment of resistance of beam. Effective span is 5m. If effective cover is 40mm find safe working load as well as super imposed load. Use M25 grade concrete and Fe500 grade steel.	10	3	L3	1.3.1
2(a)	Derive the stress block parameters for compressive force Cu and Tensile force Tu using limit state method of design.	5	1	L2	1.3.1
2(b)	A singly reinforced rectangular section of breadth 200mm and effective depth 400mm is made up of concrete of M20 grade and steel of Fe500 grade. Find out following 1. Calculate maximum moment of resistance that a given section can offer and also what is corresponding area of steel. 2. Find moment of resistance and area of steel if depth of N.A. is restricted to 0.3d. 3. If c/s is reinforced with 4% of c/s size of beam find X_u for steel to fail and also moment of resistance at that instance. 4. Check whether given c/s can withstand an ultimate B.M. of 100kNm. If not suggest alternate solution.	15	3	L4	1.3.1
3	A Room is having clear dimensions of 3m x 6m. The superimposed live load on slab is 10 kN/m^2, at service state. The slab is simply supported on all the four sides on a wall of 300mm thickness. The corners are held down. Decide whether the slab is designed as one way slab or two way	20	4	L3	2.3.1

Q.No	Questions	Marks	CO	BL	PI
	slab giving proper justifications. Design the slab using M-20 grade of concrete and Fe-415 grade of steel. Sketch the reinforcement details.				
4	A rectangular beam of effective span 6m needs to be designed. The superimposed load on the beam is 50kN/m. The c/s size of the beam is restricted to 300mmX600mm by the architect. List out different types of beams that can be provided under these circumstances. Design the beam which gives you optimal solution.	20	4	L4	2.3.1
5(a)	State and explain the basic assumptions made for design of columns under axial compression and uniaxial bending.	10	4	L2	1.3.1
5(b)	Design a rectangular R.C. footing for an R.C. column 230 mm x 450 mm carrying an axial load of 1500 kN. The S.B.C. of the soil is 150 kN/m^2. Sketch the reinforcement details.	10	5	L3	2.3.1





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Course Name: Environmental Engineering (15ECVC204)
Course Outcomes (CO):

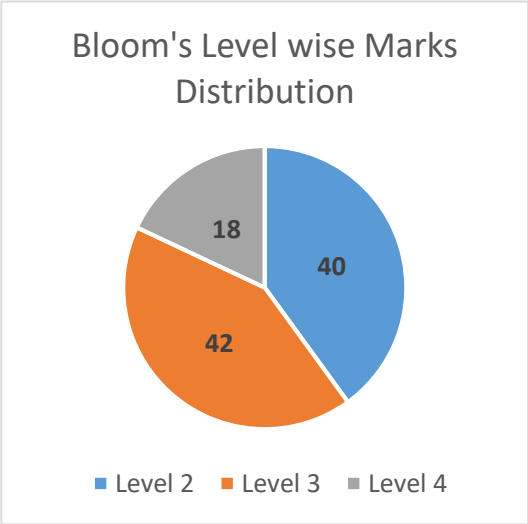
1. Discuss the impact of human activities on environment
2. Predict the population at the end of the design period and estimate the water demand of the city
3. Calculate the BHP of pump to lift the water from the source and convey to the treatment plant
4. Analyze the quality of water and design the treatment units required to meet BIS guidelines.
5. Calculate the capacity of storage reservoir required for the distribution of water
6. Estimate the quantity of sewage generated for different sewerage systems and design the sewer for different depths of flow to ensure self –cleansing velocity
7. Analyze the constituents of concern in domestic waste water and describe the appropriate processes for target pollutants to be removed.
8. Design the treatment process to treat the waste water to meet the desired limits
9. Explain the process of self-purification of the sources of disposal and determine the degree of treatment of sewage based on source of disposal of waste water

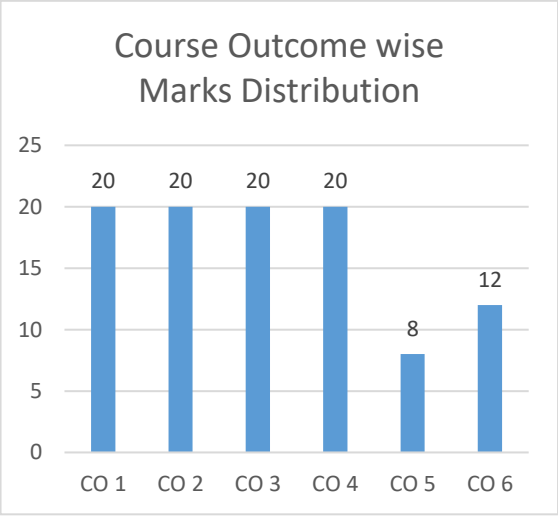
Model Question Paper
Total Duration (H:M):3:00
Course: Environmental Engineering
Maximum Marks: 100

<table>
<tr><th>Q.No</th><th>Questions</th><th>Marks</th><th>CO</th><th>BL</th><th>PI</th></tr>
<tr><td>1(a)</td><td>Predict the population of the city in the year2040 and also estimate the design demands of the water supply scheme. The census report is as follows:
<table>
<tr><th>Census Year</th><th>Population</th></tr>
<tr><td>1960</td><td>31500</td></tr>
<tr><td>1970</td><td>37800</td></tr>
<tr><td>1980</td><td>51700</td></tr>
<tr><td>1990</td><td>57400</td></tr>
<tr><td>2000</td><td>59200</td></tr>
<tr><td>2010</td><td>67500</td></tr>
</table>
Assume that the city is rapidly advancing.</td><td>10</td><td>CO2</td><td>L3</td><td>1.1.1</td></tr>
<tr><td>1(b)</td><td>Discuss the impact of human activities on environment</td><td>06</td><td>CO1</td><td>L2</td><td>7.1.1</td></tr>
</table>

<table>
<tr><th>Q.No</th><th>Questions</th><th>Marks</th><th>CO</th><th>BL</th><th>PI</th></tr>
<tr><td>1 (c)</td><td>Discuss the criteria for selection of an indicator organisms</td><td>04</td><td>CO4</td><td>L2</td><td>1.2.1</td></tr>
<tr><td>2 (a)</td><td>For the water supply of a small town, water is required to be pumped from a tube well to an overhead tank. Work out the capacity of the pump. The data are given as below.
Daily demand of water 750 m^3
Hours of pumping 8
Water table below ground level 8 m
Height of the tank above ground level 14 m
Loss of head in the pump and rising main 1.75 m</td><td>10</td><td>CO3</td><td>L3</td><td>1.3.1</td></tr>
<tr><td>2 (b)</td><td>Enumerate the impurities in ground water which should be taken into account in deciding the potability of a sample. State the effects when they exceed the prescribed BIS limits.</td><td>10</td><td>CO4</td><td>L2</td><td>1.2.1</td></tr>
<tr><td>3 (a)</td><td>Design Clari-flocculation units to treat 15 MLD of water.</td><td>12</td><td>CO4</td><td>L3</td><td>2.1.2</td></tr>
<tr><td>3(b)</td><td>For the water supply of a small rural town with daily requirements of 225 m^3 of water, it is proposed to construct a distribution reservoir. The pattern of draw off is as follows
<table>
<tr><td>7am--8 am</td><td>30% of day’s supply</td></tr>
<tr><td>8 am---5 pm</td><td>35% of day’s supply</td></tr>
<tr><td>5 pm –6.30pm</td><td>30% of day’s supply</td></tr>
<tr><td>6.30pm ---7</td><td>05% of day’s supply</td></tr>
</table>
The pumping is done at a constant rate of 8 hours/day (8am- 4 pm). Determine the total capacity of service reservoir .The population of the town is 50,000.</td><td>08</td><td>CO5</td><td>L3</td><td>1.3.1</td></tr>
<tr><td>4(a)</td><td>Design a combined outfall sewer running 70 % full at maximum flow of sewage for a city having catchment area of 200 hectare, rainfall intensity 20 mm/hr all of which is runoff. Projected population of the city is 4 lakh. Water to the city is supplied from the water works at a rate of 250 lpcd. The sewer is to be laid at a slope of 1 in 450. Take N= 0.013.</td><td>8</td><td>CO6</td><td>L4</td><td>2.1.2</td></tr>
<tr><td>4(b)</td><td>The following observation was made on a 3% dilution of sewage.</td><td>6</td><td>CO7</td><td>L3</td><td></td></tr>
</table>

Q.No	Questions	Marks	CO	BL	PI
	DO of aerated water for dilution 3 mg/l DO of diluted sample after 5 day incubation 0.8 mg/l DO of original sample 0.6 mg/l Calculate BOD, Ultimate BOD and 3 days BOD at 37 ^{0} C. Take k= 0.23/d				1.1.1
4(c)	Explain the working of a grit chamber with a neat sketch	6	CO7	L2	1.3.1
5(a)	Design ASP to treat settled sewage of 10 MLD having a BOD of 180 mg/l ,it is desired to produce a filter effluent having a BOD 20 mg/l	12	CO8	L4	2.1.2
5(b)	A city discharges 1500l/s of sewage into a stream whose minimum rate of flow is 6000l/s. The 5 day BOD for sewage is 200 mg/l and that of river is 1 mg/l .The DO content of stream is 90 % of the saturation DO. If the minimum DO to be maintained in the stream is 4.5 mg/l, determine the degree of sewage treatment required. Assume K_D= 0.1/day and K_R= 0.3/day.	8	CO9	L3	1.3.1





BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)
CO – Course Outcomes
PO – Program Outcomes; PI Code – Performance Indicator Code