**Total No. of Questions : 8]** **SEAT No. :**

**P4159** **[Total No. of Pages : 4**

# [4960]-1

## M.E. (Civil) (Construction & Management)

## MATHEMATICS

## (2008 Pattern) (Semester - I)

***Time : 4 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Attempt any three questions from section - I and three questions from section - II.***
2) ***Answers to the two sections should be written in two separate answer books.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator is allowed.***
5) ***Assume Suitable data whenever necessary.***

## SECTION - I

***Q1)*** A Contractor has kept the data regards the delays and penalties on his previous 10 construction projects, as below : **[18]**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Project | : | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Delay (in days) | : | 40 | 5 | 30 | 80 | 15 | 95 | 10 | 100 | 25 | 50 |
| Penalty (in lac Rs.) | : | 15 | 3 | 10 | 25 | 6 | 50 | 5 | 35 | 25 | 32 |

Use Monte Carlo simulation, Simulate the mean delay and mean penalty which the contractor should consider for 5 of his future projects.

***Q2)*** a) In a bolt factory machines M1, M2, M3 manufactures 30, 40 and 45 percent of the totals respectively, of their products 5, 4 and 3 percent are defectives respectively. One bolt is drawn at random from the product and is found to be defective. What is the probability that it is manufactured by the machine M3? **[6]**

***P.T.O.***

b) A random variable has the following probability distribution. **[6]**

| x | : | 4 | 5 | 6 | 8 | 9 |
|---|---|---|---|---|---|---|
| P(x) | : | 0.1 | 0.3 | 0.4 | 0.2 | 0.15 |

Find the expectation and standard deviation of the random variable.

c) Define the probability and point out its limitations. **[4]**

***Q3)*** a) Explain Griffi's waiting line model application in equipment management with an example. **[6]**

b) Explain with examples application of normal distribution in civil engineering. **[4]**

c) Explain in detail : **[6]**

i) Nunally model

ii) Vorster-sears model

***Q4)*** A company is planning to market a new product which requires an investment of Rs. 90,000. The producer is expected to have life cycle of one year. With the help of private consultant, the management has projected the probabilities of various levels of selling price, variable cost and sales volume as follows : **[16]**

| Selling Price (in Rs.) | Probability | Variable Cost (in Rs.) | Probability |
|---|---|---|---|
| 50 | 0.25 | 25 | 0.20 |
| 60 | 0.50 | 30 | 0.60 |
| 80 | 0.30 | 40 | 0.25 |

| Sales Volume | Probability |
|---|---|
| 4000 | 0.20 |
| 6000 | 0.30 |
| 8000 | 0.30 |

Assuming the factors in the table to be statistically independent, conduct 10 simulation trials and

a) Calculate the average profit

b) Test the economic variability of the proposal if the money is borrowed at 20% per annum.

## SECTION - II

***Q5)*** a) Calculate the coefficient of correlation between x and y series from the following data and culculate probable error and coefficient of determination also. **[6]**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| x | : | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 |
| y | : | 64 | 65 | 68 | 66 | 70 | 75 | 60 | 65 |

b) Explain the role of regression analysis in resources management. **[5]**

c) From the following data, calculate. **[5]**

i) Two regression equations

ii) Estimate value of x when y = 75

Mean for x = 36 Standard deviation for x = 11

Mean for y = 85 Standard deviation for y = 8

and Correlation coefficient (r) = 0.66

***Q6)*** a) Given the following data, related purchase and sales, obtain two regression equations by the method of least squares and estimate the likely sales when purchase equal to 120. **[8]**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Purchase(x) | : | 60 | 75 | 100 | 80 | 85 | 55 | 77 | 90 | 87 | 50 |
| Sales (y) | : | 110 | 125 | 132 | 120 | 135 | 98 | 128 | 140 | 98 | 85 |

b) Explain utility of quality control charts in concreting activity through a graphical representation. **[8]**

***Q7)*** a) Explain the following : **[10]**

i) Spearman's Rank Correlation coefficient in HRM.

ii) Poisson distribution applications in project management.

b) In a certain trivariate distribution $s_1 = 3$, $s_2 = s_3 = 5$, $r_{12} = 0.7$, $r_{23} = 0.6$, $r_{31} = 0.5$, find **[8]**

i) Partial correlation coefficient $r_{13.2}$

ii) Multiple correlation coefficient $R_{1.32}$

iii) Regression coefficient $b_{13.2}$

***Q8)*** a) In a sample of 500 parts manufactured by a factory the number of defectives was found to be 30. The company however claimed that only 5% of their product is defective. Is the claim tenable? (Given value of z at 5% level is 1.645). **[8]**

b) A simple random sample of size 40 is drawn from a finite population consisting of 110 units. If the population standard deviation is 12.6. Find the standard error of sample mean when the sample is drawn **[8]**

i) with replacement.

ii) without replacement

● ● ●

Total No. of Questions :8]

SEAT No. :

**P4950**

[Total No. of Pages :2

# [4960]-10
# M.E. (Civil) (Const. & Mgmt.)
# VALUE ENGINEERING
# (2008 Course) (Semester -I) (Elective - II)

*Time : 4 Hours]* *[Max. Marks :100*

***Instructions to the candidates:***

1) ***Answer any 3 questions from each section.***
2) ***Figures to the right indicate full marks.***

## SECTION - I

***Q1)*** What is difference between the cost, price, and value? Discuss the factors affecting the value of a commodity? How the types of value are used?

**[3+5 +10=18]**

***Q2)*** Differentiate between value engineering and value management; giving examples. Highlight the advantages of each. **[8+8=16]**

***Q3)*** With a flow diagram detail out the procedure for conducting the value engineering and explain each step in detail; with examples. **[16]**

***Q4)*** Explain the following:

a) Land Reversion. **[4]**

b) Depriciation in value. **[4]**

c) Deferred value. **[4]**

d) Distress value. **[4]**

## SECTION - II

***Q5)*** Explain the FAST diagram used for determining the alternative solution for the economic design of a warehouse foundation and detail out all the steps conducted, highlighting advantages and dis-advantges. **[18]**

***P.T.O.***

***Q6)*** Explain how value engineering will be applied to suggest the use of pre-engineered construction as against the conventional construction adopted for a factory shed to be prepared for cultivating flowers. **[16]**

***Q7)*** Explain how value engineering will be applied to recommend the use of the jointless premix flooring for an industrial plant as against the conventional flooring. **[16]**

***Q8)*** Explain in brief:

a) Softwares available for value engineering applications. **[4]**

b) Role of experts in value analysis. **[4]**

c) Value index and its utility in value management. **[4]**

d) Multi-decision criteria and support system used for ranking the alternatives. **[4]**

*EEE*

Total No. of Questions : 10]

SEAT No. :

P4222

[Total No. of Pages : 3

# [4960] - 100

## M.E. (Mechanical) (Design Engineering)

## PROCESS EQUIPMENT DESIGN

## (2008 Pattern)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates :-***

1) ***Answer any three questions from each Section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Your answer will be valued as a whole.***
6) ***Use of logarithmic tables, slide rules, Mollier chart, electronic steam table and electronic pocket calculator and steam table is allowed.***
7) ***Assume suitable data, if necessary giving reasons.***

## SECTION - I

***Q1)*** a) Explain significance of following preliminaries in process equipment design. (any four) **[8]**

i) Design stress

ii) Weld joint efficiency

iii) Corrosion allowance

iv) Dilation of pressure vessel.

v) Factor of safety

b) A storage tank 6 m in diameter and 7.5 m in height has to be provided with self supported conical roof. The slope of self supported conical roof is 1 in 5. Roof is subjected to a superimposed load of 125 kg/m$^2$. Density of plate material is 8000 kg/m$^3$. E = 2 × 10$^6$ kg/cm$^2$.

Calculate minimum thickness required for fabrication of self supported conical roof. **[6]**

c) What are Hortonspheres? **[2]**

***P.T.O.***

***Q2)*** a) What is intragranular corrosion and stress corrosion? Explain the ways to avoid or reduce these types of corrosion. **[4]**

b) Explain the method for calculating thickness of torispherical head subjected to i. internal and external pressure. **[8]**

c) List the theories of failure and explain any one of them. **[4]**

***Q3)*** a) Explain skirt supports and design aspect related t them. **[8]**

b) What are entrainment separators? Explain their applications. **[4]**

c) What is gasket factor? Explain gasket selection and classification. **[4]**

***Q4)*** a) A pressure vessel is to be designed for an internal pressure of $0.6N/mm^2$. The vessel has nominal diameter of 1.2 m. The material used for vessel has permissible stress of $120N/mm^2$. If the weight of vessel and its content is 3000kg and torque due to offset piping is 450 N.m. . Find stresses due to combined loading. **[10]**

b) Explain reinforcement of nozzles. **[6]**

***Q5)*** Write short notes on any three. **[18]**

a) Expansion joint used in process piping systems.

b) Floating roof type storage tank.

c) Design of saddle support.

d) Protective coatings and their applications.

## SECTION -II

***Q6)*** a) Explain design considerations for shell and tube heat exchanger. **[8]**

b) Differentiate between vacuum filters and centrifugal filters. Explain either rotary disc filter or leaf filter. **[8]**

***Q7)*** a) What are the types of baffles used in heat exchanger? **[4]**

b) Explain effect of wind load and seismic load on tall vessels. **[6]**

c) What is an entrainment separator. **[2]**

d) What types of loses are possible in storage of volatile liquids. **[4]**

***Q8)*** a) Explain important features of packed or plate columns. **[8]**

b) With neat sketches explain construction, working and main design considerations of rotary drier. Give it's applications. **[8]**

***Q9)*** a) Explain determination of power requirements of agitator. **[4]**

b) Give classification of vacuum pumps or explain any one metering pump. **[6]**

c) What are integral, fabricated and formed nozzles. **[6]**

***Q10)*** Write short note on any three of following **[18]**

a) Types of agitators

b) Vacuum Crystallizer

c) Inspection of pressure vessels

d) Process flow diagrams

**Total No. of Questions : 8]** **SEAT No. :**

**P4165** **[Total No. of Pages : 2**

# [4960]-11

## M.E. (Civil) (Semester - I)

## CONSTRUCTION & MANAGEMENT

## Project Risk Analysis and Mitigation Techniques

## (2008 Pattern) (Elective - II)

***Time : 4 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answer three questions from each Section. Que 1 & Que 5 are compulsory.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic calculator is allowed.***
6) ***Assume suitable data, if necessary.***

### SECTION - I

***Q1)*** a) Explain identifying risk events in road projects. **[4]**

b) What are stages in Investment life-cycle? Enlist it. **[4]**

c) Explain decision tree analysis. **[10]**

***Q2)*** a) Explain 3 point estimated method in risk analysis. **[6]**

b) Focus on details of RAMP process in details. **[10]**

***Q3)*** a) Explain use of risk prompts. **[6]**

b) Write a note on MOU/JV in real estate, identify a risk in it with example. **[10]**

***Q4)*** a) Explain risk profile method in detail. **[8]**

b) What is certinity index method. Explain with example. **[8]**

***P.T.O.***

## SECTION - II

***Q5)*** a) Focus on risk mitigation by eliminition and transferring method? **[8]**

b) Enlist the techniques for coverage of risk, explain any one details. **[10]**

***Q6)*** Write a detail note on Delay in meeting obligation by client policy, quote two examples. **[16]**

***Q7)*** a) Explain the loss of profit Policy. **[8]**

b) Explain settlement of claims policy. **[8]**

***Q8)*** a) What is Loss of performance of construction equipment policy? Explain in brief. **[8]**

b) Explain in short (BIP) - Bidding Indemnity Policy. **[8]**

Total No. of Questions : 8]

SEAT No. :

**P4951**

[Total No. of Pages :2

# [4960]-12
# M.E.(Civil)(Const. & Mgmt.)
# CONSTRUCTION CONTRACTS ADMINISTRATON & MANAGEMENT
# (2008 Course)(Semester-II)

*Time :4Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***

## SECTION-I

***Q1)*** Compare and Contrast between the different forms of BOT contracts explaining their suitability in particular types of applications. **[16]**

***Q2)*** Compare 2 stage tendering with single stage tendering. Elaborate on 2 bid and 3 bid systems in detail. **[8+8]**

***Q3)*** In the notice inviting tender for the design and construction of a marine prestressed concrete precart segmental bridge supported on pneumatic caissons, total project cost of which is estimated at 250 crores to be completed in 24 calendar months, draft suitable pre-qualifications for the selection of contractor, so as to ascertain his:- **[18]**

a) Financial capability

b) Past experience on similar projects

c) Present techno-managerial capability

d) Plant and Machinery capacity

***Q4)*** Explain in detail:-

a) Unbalanced bid **[8]**

b) Revocation of tender **[8]**

***P.T.O.***

## SECTION-II

***Q5)*** Explain following contract conditions **[18]**

a) Defective work

b) Subletting

c) Time as an essence of contract

d) Penalty and Liquidated damages

e) Termination by breach

f) Dispute resolution

***Q6)*** With respect to Indian contract Act 1872 elaborate:- **[16]**

a) Valid execuses for non-performance

b) Communication and acceptance of proposals

c) Joint and Several liability

d) Compensation

***Q7)*** With respect to the Indian Arbitration and Conciliation Act (1994) elaborate:- **[16]**

a) Duties of arbitrator

b) Role of court/ judiciary

c) Speaking awards

d) Grounds for challenge

***Q8)*** Explain in detail the following:-

a) 4 types of FIDIC documents and where they are applicable **[8]**

b) Conditions of Particular Applications(COPA) **[8]**

Total No. of Questions : 8]

SEAT No. :

**P4952**

[Total No. of Pages : 3

# [4960]-13

## M.E. (Civil) (Const. & Mgmt.)

## PROJECT ECONOMICS & FINANCIAL MANAGEMENT

## (2008 Course) (Semester - II)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any 3 questions from each section.***
2) ***Figures to the right indicate full marks.***

## SECTION - I

***Q1)*** What is capital budgeting? Highlight the role of the financial manager in the process of capital budgeting? Discuss the objectives of financial management and explain the concept of financial discipline with example.

**[4+4+6+2]**

***Q2)*** Compare and contrast between the equity finance and debt finance. Discuss importance of the debt: equity ratio in the generation as well as the management of the financial liabilities. Explain sources of the equity finance.

**[6+4+6]**

***Q3)*** An equipment has an initial cost of Rs. 75 lakhs. Annual Maintenance costs are at 2%. Equipment life is 5 years. At the end of the 3rd year an additional repairs and replacement of parts cost is occurring which is 3% in excess. In the first year of use, the equipment generates a business equivalent to 10% of the initial cost, in the 2nd year 20% of the initial cost, in the 3rd year 40% of the initial cost, in the 4th year 50% of the initial cost and in the final year 25% of the initial cost.

Determine yearly cashflows and decide whether to invest in the equipment or not, if the IRR expected is at 14%. Consider minimum 2 trials for the IRR.

**[4+12]**

***P.T.O.***

***Q4)*** a) Determine the time value of Rs. 100 in tabular form, over a period of 10 years at the following interest rates : 5%, 10%, 15%, 20%. What do you infer from the results as a financial analyst? Explain. **[12]**

b) Explain concept and formula for the modified payback period. Where is it used? **[6]**

## SECTION - II

***Q5)*** a) Determine any 3 types of the ARR for the following cash flows **[12]**

| Year | Cash Inflow (Rs.) (Lakhs) | Cash outflow Rs. (Lakhs) |
|---|---|---|
| 1 | 60 | 300 |
| 2 | 120 | 200 |
| 3 | 180 | 150 |
| 4 | 240 | 100 |
| 5 | 320 | 50 |

Consider initial investment as Rs. 100 lakhs. Also consider tax on income at 20%.

b) Explain how the machinery depriciation is accounted and used for calculations of income tax. **[6]**

***Q6)*** A portfolio consists of 3 assets in the proportion of 20 : 30 : 50. The risk - return characteristics are as follows. **[18]**

| | Asset 1 | Asset 2 | Asset 3 |
|---|---|---|---|
| Risk | 8% | 16% | 10% |
| Return | 12% | 20% | 18% |

Determine the combined risk - return characteristics for the complete portfolio when:

a) There is no co-relation between the market prices of the assets;

b) There exists a perfect +ve co-relation between the market prices of all the assets;

c) There exists a perfect –ve co-relation between the market prices of all the assets.

***Q7)*** Discuss the merits and de-merits of

a) Financial ratios used in analysis. **[6]**

b) Double entry concept and the going concern concept. **[4]**

c) Micro - finance. **[6]**

***Q8)*** a) Highlight any 8 tender conditions which affect the estimation of the contractor's cash flow management for raising the working capital, by clearing mentioning the provisions made in each condition and considering its effect on the cash flow requirements. **[8]**

b) Explain with diagrams, the Capital Asset Pricing Models (CAPM) studied and used by the investors for financial analysis. **[8]**

Total No. of Questions : 8]

SEAT No. :

**P4166**

[Total No. of Pages : 3

# [4960]-14

## M.E. (Civil) (Construction Management)

## OPERATION RESEARCH

### (2008 Pattern) (Semester - II)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer 3 from questions Section - I and Section - II, Question No. 1 and Question No. 5 are compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***
5) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator is allowed.***

## SECTION - I

***Q1)*** a) Find the maximum value of $Z = 2X_1 + 3X_2$ **[12]**

Subject to $X_1 + X_2 \leq 30$

$$X_2 \geq 3,$$
$$X_2 \leq 12,$$
$$X_1 - X_2 \leq 0$$
$$0 \leq X_1 \leq 20$$

b) Write down advantages of linear programming. **[6]**

***Q2)*** a) Explain the methods of solving the maximization problem in a transportation model. **[10]**

b) Find the basic feasible solution of the following transportation problem by north west corner rule. Aslo find the optimal transportation plan. **[6]**

| | 1 | 2 | 3 | 4 | 5 | Avialable |
|---|---|---|---|---|---|---|
| A | 4 | 3 | 1 | 2 | 6 | 80 |
| B | 5 | 2 | 3 | 4 | 5 | 60 |
| C | 3 | 5 | 6 | 3 | 2 | 40 |
| D | 2 | 4 | 4 | 5 | 3 | 20 |
| Required | 60 | 60 | 30 | 40 | 10 | 200 Total |

***P.T.O.***

***Q3)*** a) Solve the following assignment problem. **[10]**

| | I | II | III | IV | V |
|---|---|---|---|---|---|
| 1 | 11 | 17 | 8 | 16 | 20 |
| 2 | 9 | 7 | 12 | 6 | 15 |
| 3 | 13 | 16 | 15 | 12 | 16 |
| 4 | 21 | 24 | 17 | 28 | 26 |
| 5 | 14 | 10 | 12 | 11 | 13 |

b) Explain convex function and convex set. **[6]**

***Q4)*** a) What is Hessian matrix and explain its significance? **[8]**

b) Give the algorithm of Newton's method. **[8]**

## SECTION - II

***Q5)*** a) Use Fibonnaci method to maximize $Z = 24X\text{-}2X^3$ in the range 0 to 10 to an accuracy of 1% carry out only 4 iteration. **[9]**

b) What is unbalanced Transportation problem? How will you solve it? **[9]**

***Q6)*** Sovle the following non-linear programming problem, using the Lagrangean multipliers : **[16]**

$$\text{Optimize } Z = 4(X_1)^2 - 2(X_2)^2 + (X_3)^2 - 4(X_1X_2),$$
$$\text{Subject to } (X_1)+(X_2) + (X_3) = 15,$$
$$2(X_1) - (X_2) + 2(X_3) = 20,$$
$$(X_1),(X_2),(X_3) \geq 0$$

***Q7)*** a) What are the applications of simulation in the field of civil engineering? **[8]**

b) What is simulation? State the advantages of simulation technique and state limitations of it. **[8]**

***Q8)*** a) Explain the basic characteristics of two person, zero sum games. **[8]**

b) A self-service store employs one cashier at its counter. Nine customers arrive on an average avery 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time, find. **[8]**

i) Average number of customers in the system.

ii) Average number of customers in the queue or average queue length.

iii) average time a customer spends in the system.

iv) Average time a customer waits before being served.

**Total No. of Questions : 8]** **SEAT No. :**

**P4167** **[Total No. of Pages : 2**

# [4960]-15

## M.E. (Civil) (Construction & Management) (Semester - II)

## ADVANCED CONSTRUCTION TECHNOLOGY

### (2008 Pattern) (Elective - III)

***Time : 4 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of calculator is allowed.***
6) ***Assume Suitable data if necessary.***

## SECTION - I

***Q1)*** Discuss the challenges faced in the project of construction of Atomic power station w.r.t. following points. **[18]**

a) Environmental issues

b) Resource management

c) Planning and scheduling

d) Risk Management

***Q2)*** a) Give the sequence of operations for following types of bridges with neat diagrams. **[8]**

i) Cable stayed bridge

ii) Suspension bridge

b) State the importance of Accuracy in the successful completion of construction of a suspension bridge. Discuss this statement w.r.t. following stages of construction. **[8]**

i) Fabrication and installation of various members

ii) Abutment construction

iii) Fabrication of suspenders

iv) Construction of Deck slab

***P.T.O.***

***Q3)*** a) Discuss advanced methods used to control seepage through earthen dam. **[8]**

b) Discuss various equipments used on a construction a gravity dam. Also, discuss the equipment planning involved. Use suitable data. **[8]**

***Q4)*** Discuss the sequences followed in the strengthening of bridge piers. **[16]**

## SECTION - II

***Q5)*** Write the sequence of operations used for Cut and Cover tunnel. Explain with the help of neat sketches. **[18]**

***Q6)*** What are the applications of diaphragm wall? Give with detailed sketch, the sequence of operations followed in the construction of diaphragm wall. Also, discuss the materials used as the slurry. **[16]**

***Q7)*** a) What are the challenges faced while carrying out maintenance of underground railway. **[8]**

b) Write the sequence of construction of jetty. **[8]**

***Q8)*** Give the types of Fast Track Construction methods that are commonly used today. Discuss any one of it w.r.t. following points. **[16]**

a) Method of construction

b) Advantages over the conventional methods

**Total No. of Questions : 8]** **SEAT No. :**

**P4168** **[Total No. of Pages : 2**

# [4960]-16

## M.E. (Civil Construction & Management)

## INFRASTRUCTURE DEVELOPMENT

## (2008 Pattern) (Elective - III)

***Time : 4 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Question No. 1 and 5 are compulsory. Out of the remaining attempt any two questions from Section - I and two questions from Section - II.***
2) ***Answers to the two sections must be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, slide rule, Moiller charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data wherever necessary.***

### SECTION - I

***Q1)*** Explain the need for Public-Private partnership in India for the Infrastructure growth.
Discuss the advantages and limitations for the same.
Explain any one mechanism of PPP in detail. **[18]**

***Q2)*** What is FDI? **[2 + 4 + 8 + 2]**
Why does the Indian Government promotes FDI?
How much FDI is allowed in the different sub-sectors of Infrastructure existing and proposed in India?
What are the limitations of FDI?

***Q3)*** Enlist and explain the measures undertaken to minimize the use of fossil fuels. With suitable examples explain in detail the reliability and sustainability aspects of the alternative source of fuel. **[16]**

***Q4)*** Discuss the various challenges faced by planners while planning aviation projects in India. Identify the bottlenecks and suggest remedies for them.**[16]**

***P.T.O.***

## SECTION - II

***Q5)*** a) List out the areas from where the funds are created for planning of Rural Road Development and explain them. **[9]**

b) Explain the methodology and operations used for the SPV models for road and rail connectivity in development of major ports. **[9]**

***Q6)*** a) Rail transport is the key for speedy movement of raw materials and rapid industrialization. Enlist and explain various measures initiated by Indian Railways to achieve this objective. **[8]**

b) Explain in detail the scope for development and modernization of ports and the initiatives undertaken for development of shipping in India with suitable example. **[8]**

***Q7)*** a) What are the items to be studied to find out implementation of metro rail for a particular city? **[8]**

b) What are the parameters to be followed in monitoring Environmental Management System? **[8]**

***Q8)*** Write short notes on (any four) : **[16]**

a) Provisions made in National Electricity Policy.

b) Source of financing PPP model for Ports.

c) Provisions made in any one airport developed by private sector using PPP Model.

d) Policies and incentives followed by NHDP in road works.

e) Advantages of BRTS proposals.

Total No. of Questions : 8]

SEAT No. :

**P4953**

[Total No. of Pages : 2

# [4960]-17
# M.E. Civil (Const. & Mgmt.)
# INTERNATIONAL CONTRACTING
# (2008 Course) (Semester - II) (Elective - III)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any 3 questions from each section.***
2) ***Figures to the right indicate full marks.***

## SECTION - I

***Q1)*** Discuss the international contracting for construction projects in the context of

a) Necessity of collaborations and JV's. **[4]**

b) Exchange rate fluctuations and its impact on resource prices. **[4]**

c) Documentation needed w.r.t. resources mobilization. **[4]**

d) World bank criteria as regard pre-qualifications. **[6]**

***Q2)*** Elaborate on the RBS to be followed for the international contracts. Explain the 3 levels of analysis and why this approach is to be followed? How risks are minimized? **[6 + 6 + 4]**

***Q3)*** What are causes of claims? How the claims are legally justified based on the FIDIC clauses? Elaborate. Highlight on the documentation and the procedural aspects for establishment of the claims. **[4 + 4 + 8]**

***Q4)*** Discuss the following:

a) EPC Contracts. **[4]**

b) GMP Contracts. **[4]**

c) ESCROW account. **[4]**

d) PPP Projects. **[4]**

***P.T.O.***

## SECTION - II

***Q5)*** With respect to the Basrah Housing International project, explain citing examples:-

a) How the consortium was formed and why? **[6]**

b) Whether Iragi govt. officials played their role effectively. **[6]**

c) Financial Problems faced by the contractors and how they solved these problems & Conciliation. **[6]**

***Q6)*** Compare the Indian Arbitration Act (1996) with the UNICTRAL Provisions. Elaborate and discuss the benefits of Institutionalized Arbitration over adhoc arbitration. **[8 + 8]**

***Q7)*** Differentiate with examples between:

a) Mediation and Conciliation. **[6]**

b) DRB and arbitration. **[10]**

***Q8)*** Discuss the following:

a) Bank guarantees in international bids. **[6]**

b) FIDIC short forms of contract. **[4]**

c) Letter of Credit and its necessity, importance, (LOC) procedure, in international trading. **[6]**

Total No. of Questions :8]

SEAT No. :

**P4954**

[Total No. of Pages :2

**[4960]-18**

# M.E. (Civil) (Construction & Management)
# THRUST AREAS IN PROJECT MANAGEMENT
## (2008 pattern) (Open Elective) (Elective - IV) (Semester - II)

*Time : 4 Hours* *[Max. Marks :100*

***Instructions to candidates:***

1) ***Answer 3 questions from section I and 3 from section II.***
2) ***Figures to the right indicate full marks.***

## SECTION - I

***Q1)*** What is SWOT analysis? How the SWOT matrix is constructed and used in the profession. Perform SWOT analysis of the Indian construction sector. **[4+4+10]**

***Q2)*** What is project preplanning? What are the benefits when it is implemented on construction projects? Highlight the role of PDRI on industrial project. **[2+8+6]**

***Q3)*** Which are the 3 commonly adopted ISO certifications by the construction organisations? Explain in brief the salient features of each of these organisations. **[4+12]**

***Q4)*** Discuss with examples the following types of the leaderships:-

a) Lassaiz fairre.

b) Transactional.

c) Transformational.

Which type of leadership would you recommend for the complex types of the construction projects involving many multinational agencies and where the timely completion is targetted at? **[16]**

***P.T.O.***

## SECTION - II

***Q5)*** What is pre-engineered construction? What are its advantages? What are its limitations? Is it possible to pre- engineer all the types of construction projects? Why for any particular project, it is wise to pre- engineer the foundation construction? Why **[3+5+3+4+3]**

***Q6)*** Draw a schematic of the fast - track construction projects. What are the pre-requisites for the success of these projects? Discuss the uncertainties, challenges faced by adopting the fast - track construction? **[6+4+6]**

***Q7)*** Differentiate between:-

a) Generic and functional competencies. **[4]**

b) Competency mapping and competency assessment. **[4]**

c) Training needs analysis and gap analysis. **[4]**

d) Strategic planning and strategic management. **[4]**

***Q8)*** With respect to Project Partnering discuss:-

a) Formation of project charter and team selection. **[4]**

b) Setting up and implementation of common goals. **[4]**

c)) Monitoring the partnering firms performances. **[4]**

d) Leadership and managerial qualities needed for attainment or success on partnered projects. **[4]**

Total No. of Questions : 8]

SEAT No. :

**P4169**

[Total No. of Pages : 3

# [4960]-19

## M.E. (Civil - Hydraulics)

## COMPUTATIONAL METHODS IN HYDRAULICS

## (2008 Pattern)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, slide rule, non-programmable electronic pocket, calculator is allowed.***
6) ***Assume suitable data if necessary.***

## SECTION - I

***Q1)*** a) State the classification of second order partial differential equation? **[4]**

b) Write down the finite difference analogue of the equation, $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

Classify the equation $\frac{\partial^2 u}{\partial x^2} + 3\frac{\partial^2 u}{\partial x \partial y^2} + 4\frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$. **[6]**

c) Explain the applications of finite difference method in Hydraulic Engineering. **[6]**

***Q2)*** a) Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ at the pivotal points of the grid shown in the fig. 2. a. **[9]**

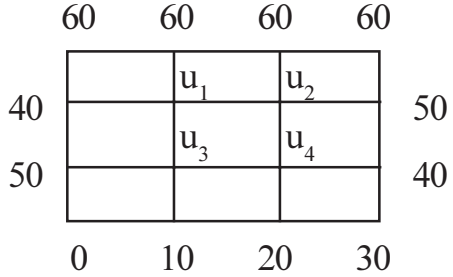



fig. 2. a.

***P.T.O.***

b) Sovle the partial differential equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides $x = y = 0, x = y = 0$ with $u = 0$ on the boundary and mesh length = 1. **[8]**

***Q3)*** a) Explain procedure to test significance and goodness s of fit. **[8]**

b) The pressure and volume of a gas are related by the equation $pv^b = a$, where a and b are constant. Develop this regression equation. **[9]**

| P | 0.5 | 1 | 1.5 | 2 | 2.5 | 3 |
|---|---|---|---|---|---|---|
| V | 1.62 | 1 | 0.75 | 0.62 | 0.52 | 0.46 |

***Q4)*** a) Fit a Normal distribution to the following data of weights of 100 students of Delhi University and test the goodness of fit. Take $\chi^2_{0.05} = 0.103$ for $\upsilon = 2$. **[8]**

| Weight (kg) | 60 - 62 | 63 - 65 | 66 - 68 | 69 - 71 | 72 - 74 |
|---|---|---|---|---|---|
| Frequency | 5 | 18 | 42 | 27 | 8 |

b) Explain (i) Markov Chain (ii) Markov process (iii) Simple and multiple regressions (iv) Beta β and Gamma γ distribution. **[8]**

## SECTION - II

***Q5)*** a) Discuss the transformation $w = \sqrt{z}$. Is it conformal at the origin? **[5]**

b) Show how you will use Schwarz-Christoffel transformation to map the semi infinite strip enclosed by the real axis and the lines $u = \pm 1$ of the $w$ plane in to the upper half of the Z-plane. **[5]**

c) Use trapezoidal rule of evaluate $\int_0^6 x \sec x \, dx$ using eight sub intervals. **[6]**

***Q6)*** a) Use Simpsons 1/3 rule to find $\int_0^{\pi} \sin x \, dx$ using 11 ordinates. **[8]**

b) Explain Newton-Cote's quadrature formula and hence how you obtain different numerical integration rules. **[8]**

***Q7)*** a) Use Cauchy's integral formula to evaluate $\oint \frac{\sin \pi z + \cos \pi z}{(z-1)(z-2)} dz$ C*is* $|z| = 2$.

**[8]**

b) Solve the following system of simultaneous equations by relaxation method. $10x - 2y - 2z = 6; -x + 10y - 2z = 7; -x - y + 10z = 8.$ **[9]**

***Q8)*** a) The following table gives the velocity v of a particle at time t : **[10]**

| t(sec) | 0 | 2 | 4 | 6 | 8 | 10 | 12 |
|---|---|---|---|---|---|---|---|
| v(m/s) | 4 | 6 | 16 | 34 | 60 | 94 | 136 |

Find the distance moved by the particle in 12 seconds and also the acceleration at t = 2 sec.

b) Solve the following using Gauss Quadrature formula $I = \int_0^{\pi} e^x \cos x \, dx$. **[7]**

**Total No. of Questions : 8]** **SEAT No. :**

**P4170** **[Total No. of Pages : 2**

# [4960]-20

## M.E. (Civil) (Theory) (Hydraulic Engineering)

## WATER RESOURCE PLANNING & MANAGEMENT

### (2008 Pattern) (Semester - I)

***Time : 3 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Answer to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

## SECTION - I

***Q1)*** a) Explain in brief the various steps involved in planning and development of water resources project. List out different types of data collected for multipurpose water resources project. **[12]**

b) What do meant by water resources planning? Explain the same with respect to its objectives and various parameters associated with it. **[6]**

***Q2)*** a) What do you understand by "Economic evaluation of water resources project" ? Explain in brief the various methods of it. **[8]**

b) Discuss in detail "Multi Objective Planning Models". **[8]**

***Q3)*** a) Explain the Necessity and Objectives of water resources planning and management. **[8]**

b) Explain the water users' co-operative societies with respect to its necessity, working procedure and advantages. **[8]**

***P.T.O.***

***Q4)*** a) Write the short note on the following :

i) Technological options for water resources development

ii) Engineering and Social aspects of water resources planning. **[8]**

b) Explain the "Benefit-Cost ratio method" with suitable example of water resource planning and management. **[8]**

## SECTION - II

***Q5)*** a) Explain the procedure for the formation of water users cooperative society. How does it works for water distribution for irrigation? **[8]**

b) Explain the salient features of Global water partnership. **[8]**

***Q6)*** a) What do you mean by an 'Integrated Approach to manage water resource'? List out its salient features. **[8]**

b) Explain with suitable example "State Water Disputes in India". **[8]**

***Q7)*** a) Discuss in detail the term "Feasibility Report" with reference to the water resource project - planning and management. **[8]**

b) Explain the term "Cash Flow Diagram". **[8]**

***Q8)*** a) What do you mean by Multi objective planning models? Explain it with suitable example. **[12]**

b) Write the short note on the following: **[6]**

i) ICID

ii) ICOLD

**Total No. of Questions : 8]** **SEAT No. :**

**P4171** **[Total No. of Pages : 2**

# [4960]-21

## M.E. (Civil) (Hydraulic Engg.)

## FLUID MECHANICS

### (2008 Pattern)

***Time : 3 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of Calculator is allowed.***
6) ***Assume Suitable data if necessary.***

## SECTION - I

***Q1)*** a) What is a source flow? Derive equation for its stream function and potential function. Draw the pattern of streamlines. **[8]**

b) Derive 3-D continuity equation in cylindrical and polar form. **[10]**

***Q2)*** a) Find the radius in a steady, fully developed, laminar flow in a circular pipe where the shear stress is equal to one half the wall shear stress. **[8]**

b) Derive equation for velocity distribution for flow between parallel plates with both plates stationary starting with Navier-Stokes equations. **[8]**

***Q3)*** a) What is boundary layer separation? Explain in detail. What are its effects? What are the controlling measures? **[8]**

b) A smooth plate 2 m wide and 2.5 m long is towed in oil (S=0.8) at a velocity of 1.5 m/s along its length. Find the thickness of boundary layer and shear stress at the trailing edge of the plate. $v_{oil} = 10^{-4}$ $m^2/s$. **[8]**

***P.T.O.***

***Q4)*** Write short notes on (any four) : **[16]**

a) Conformal mapping

b) Navier stokes equation

c) Boundary layer equations

d) Boundary layer over a flat plate

e) flow net

## SECTION - II

***Q5)*** a) Derive Reynolds equation of motion. **[10]**

b) Discuss factors affecting transition from laminar to turbulent flow. **[8]**

***Q6)*** a) Define isochoric process, isobaric process, isothermal process and adiabatic process. **[8]**

b) Derive equation for speed of sound for adiabatic process. **[8]**

***Q7)*** a) Derive energy equation for isothermal process. **[8]**

b) State Reynolds rules of averages. **[8]**

***Q8)*** Write short notes on (any 4) : **[16]**

a) Reynolds rule of averages

b) Characteristics of turbulent flows

c) Mach number

d) Effect of compressibility on drag

e) Normal shock wave

● ● ●

**Total No. of Questions : 8]** **SEAT No. :**

**P4172** **[Total No. of Pages : 2**

# [4960]-22

## M.E. (Civil) (Hydraulics) (Semester - I)

## REMOTE SENSING AND G.I.S. IN WATER RESOURCES ENGINEERING

## (2008 Pattern) (Elective - I)

***Time : 3 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume Suitable data if necessary***
6) ***All Questions are Compulsory.***

### SECTION - I

***Q1)*** a) Discuss the principles of photogrammetry and its applications in water resources. **[5]**

b) Write in brief on basic principles of Remote Sensing System. **[5]**

c) Write a note on Electromagnetic Spectrum. **[3]**

***Q2)*** a) State and explain the Displacement Law. **[4]**

b) Discuss in detail the interaction of EMR with 'Atmosphere'. **[4]**

c) Describe the stages of Remote Sensing with neat sketch. **[3]**

***Q3)*** a) Describe the important features of LANDSAT images. **[3]**

b) State the elements of image interpretation in short. **[5]**

c) What are FCC images? Write its disadvantages. **[5]**

***P.T.O.***

***Q4)*** a) Discuss various characters of IR images. **[3]**

b) Discuss the methods used corrections in images. **[5]**

c) Discuss the ORTHO rectification method. **[5]**

## SECTION - II

***Q5)*** a) Describe in brief Geographical Information System (GIS). **[5]**

b) Write in brief the Components of GIS. **[5]**

c) Discuss in short buffering. **[3]**

***Q6)*** a) What are Map Projections? **[4]**

b) Write a note on Raster Data Structure. **[4]**

c) Describe Supervised and unsupervised classification. **[3]**

***Q7)*** a) Discuss Errors in GIS. **[3]**

b) Describe Spatial and Attribute Database. **[5]**

c) Write an essay on Data collection and input processing in G.I.S. **[5]**

***Q8)*** a) Explain RS application in irrigation with flow chart. **[3]**

b) Write is short the software's used in GIS for Water Resources. **[5]**

c) Explain in brief 'DEM'. **[5]**

**Total No. of Questions : 12]**

**SEAT No. :** ____

**P4173**

**[Total No. of Pages : 4**

# [4960]-23

## M.E. (Civil) (Hydraulics) (Semester - I)

## DAM ENGINEERING

### (2008 Pattern) (Elective - I)

***Time : 3 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Solve Q.1 or Q.2, Q.3 or Q. 4, Q.5 or Q. 6 from Section-I.***
2) ***Solve Q.7or Q.8, Q.9 or Q.10, Q.11 or Q.l2 from Section- II.***
3) ***Answer any 3 questions from each section.***
4) ***Answers of the two sections should be written in separate books.***
5) ***Neat diagrams must be drawn wherever necessary.***
6) ***Figures to the right indicate full marks.***
7) ***Use of logarithmic tables, slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.***
8) ***Assume suitable data, if necessary.***

## SECTION - I

***Q1)*** a) Check the stability of gravity dam for reservoir full conditions. Considering weight of dam, water pressure and full triangular uplift pressure, a gravity dam 70 m height, 7 m top width, 60 m bottom width. The face exposed to water has slope of 1H:10V after a distance of 30 m from top. The free board is 3m. The d/s has a slope of 0.7H:1V after a vertical distance of 13 m from top. **[10]**

Take specific weight of concrete = 24 kN/$m^2$.

Coefficient of friction = N = 0.7.

Shear strength of concrete = 1400 kN/$m^2$.

b) Explain with neat sketch. How will you find the uplift pressure on a gravity dam with a drainage gallery? **[4]**

c) What is an elementary profile of a dam? Derive the expression for determining the base width of an elementary profile for no tension condition. **[4]**

***P.T.O.***

OR

***Q2)*** a) Write short notes on : **[10]**

i) Earthquake force on gravity dam .

ii) Drainage gallery in gravity dam.

b) State any four forces acting on gravity dam and write there equations.**[4]**

c) State middle third rule and with the help of sketch explain its significance. **[4]**

***Q3)*** a) What are the advantages of an Arch dam over Concrete Gravity dam? Explain arch action in detail. **[10]**

b) Discuss classification and forces acting on arch dam. **[6]**

OR

***Q4)*** a) What are the salient features of an arch dam? Explain different types of an arch dam. Derive an equation for best central angle of arch dam.**[10]**

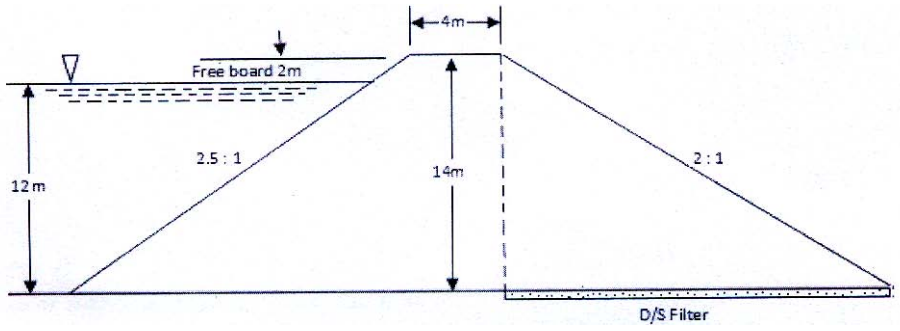
b) What are the limitations of thin cylinder theory? **[6]**

***Q5)*** a) State the importance of locating Phreatic line in an earth dam and explain the procedure of drawing Phreatic line in case of a homogeneous dam with horizontal drainage blanket. **[8]**

b) What is filter? Why is it provided? Write the design criteria of filter. Also state types of filters. **[8]**

OR

***Q6)*** a) Calculate the seepage discharge per meter length, through the body of a homogeneous earth dam as shown in following fig. the coefficient of permeability of the dam material may be taken as $8 \times 10^{-5}$m/sec. **[8]**



b) What is phenomenon and significance of : **[8]**

i) Steady seepage condition

ii) Sudden drawdown condition.

## SECTION - II

***Q7)*** a) Explain the concept and design of Buttress dam. Also discuss the merits and demerits of Buttress dam over gravity dam. **[10]**

b) Draw plan and elevation of a flat slab deck type buttress dam and describe the important features of the same. **[8]**

OR

***Q8)*** a) Enlist the various methods of construction of Rockfill dam. Explain any one in detail with neat sketches. **[10]**

b) Explain with the neat sketches: Various types of the Rockfill dam. **[8]**

***Q9)*** a) An ogee type spillway has 12 crest gates each having 10 m clear span. Find the maximum flood that can be safely passed by lifting all the gates when the maximum reservoir level is 105.00 m and crest level is 101.00 m. Take: C = 2.16, Kp = 0.05, Ka = 0.1. Neglect the velocity of approach. Also design the downstream profile on this spillway of gravity dam having downstream face slope 0.7H:1V. **[10]**

b) Explain necessity of inspection, maintenance and safety of spillway. **[6]**

OR

***Q10)***a) Discuss the various types of energy dissipater used below spillway in relation to the position of tail water depth and jump height curve. **[10]**

b) Explain in detail: **[6]**

i) Bucket type energy dissipater.

ii) Indian standard stilling basin.

***Q11)***a) Explain with neat sketch : **[10]**

i) Drum gate.

ii) Stoney gate.

b) What are sluices? What functions do they serve? Describe Dharwar and Belgam type briefly with the help of sketches. **[6]**

OR

***Q12)***a) Why gates are provided on spillways? Explain functioning of vertical lift gate and radial gate with help of sketch. **[10]**

b) Explain : **[6]**

i) Inclinometers.

ii) Vibrating wire pressure cell.

Total No. of Questions : 8]

SEAT No. :

**P4598**

[Total No. of Pages : 4

# [4960] - 24

## M.E. (Civil / Hydraulics)

## SYSTEMS TECHNIQUES IN WATER RESOURCES ENGINEERING

## (2008 Pattern) (Elective - I)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any 3 questions from each section.***
2) ***Answers to the two sections must be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data, if necessary.***

## SECTION - I

***Q1)*** a) Find the extreme points of the function **[12]**

$$f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$$

b) What is graphical optimization and what are its limitations? **[5]**

***Q2)*** a) Use Big M method to **[9]**

Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$,

Subject to $x_1 + 2x_2 + 3x_3 = 15$,

$2x_1 + x_2 + 5x_3 = 20$,

$x_1 + 2x_2 + x_3 + x_4 = 10$.

$x_1, x_2, x_3, x_4 \geq 0$

b) Explain the primal-dual relationship. **[4]**

c) Write the dual of the following primal LP problem **[4]**

Maximize $Z = 3x_1 + x_2 + 2x_3 - x_4$,

Subject to $2x_1 - x_2 + 3x_3 + x_4 = 1$,

$x_1 + x_2 - x_3 + x_4 = 3$,

$x_1, x_2 \geq 0$ and $x_3, x_4$ unrestricted in sign.

***P.T.O.***

***Q3)*** a) Discuss equivalence of a matrix game and LP. Explain the method of solving a game as LPP. **[8]**

b) Consider the following quadratic programming problem: **[8]**

Maximize $Z = f(X) = 8x_1 - x_1^2 + 4x_2 - x_2^2$,

Subject to $x_1 + x_2 \leq 2$ and $x_1, x_2 \geq 0$.

Use the Kuch-Tucker condition to determine the optimal solution.

***Q4)*** a) Solve the following LP problem by dynamic programming approach

Maximize $Z = 8x_1 + 7x_2$ **[9]**

Subject to $2x_1 + x_2 \leq 8$

$5x_2 + 2x_2 \leq 15$

$x_1, x_2 \geq 0$

b) What is the dynamic recursive relation? Describe the general process of backward recursion. **[7]**

## SECTION - II

***Q5)*** a) Arrivals of machinists at a tool crib are considered to be Poisson distributed at an average rate of 6 per hour. The length of time a machinist must remain at the tool crib is exponentially distributed with the average time being 0.05 hours. **[9]**

i) What the probability that a machinists arriving at the tool crib will have to wait?

ii) What the average number of machinists at the tool crib?

iii) The company will install a second tool crib when convinced that a machinist would expect to have to spend at least 6 minutes waiting and being serviced at the tool crib. By how much should the flow of machinist to the tool crib increase to justify the addition of a second tool crib?

b) What is annuity? Write short notes on present value of an annuity and amount of an annuity. **[8]**

***Q6)*** a) We have five jobs, each of which must go through the two machines A and B in the order AB. Processing times are given in the table below: **[8]**

*Processing time in hours*

| Job | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Machine A | 5 | 1 | 9 | 3 | 10 |
| Machine B | 2 | 6 | 7 | 8 | 4 |

Determine the sequence for the five jobs that will minimize the elapsed time T.

b) A company is interested in investing in any one of the following two projects. The relevant data pertaining to the two projects is given below. Rank the projects according to the B/C ratio and state which option would be the best? **[8]**

| Particulars | Project A | Project B |
|---|---|---|
| Initial investment (lakh rupees) | 40 | 50 |
| Net annual benefits (lakh rupees) | 8 | 7 |
| Useful life (years) | 14 | 11 |
| Salvage value (lakh rupees) | 1 | 2 |
| Discount rate | 10% | 10% |

***Q7)*** a) Consider the following nonlinear programming problem: **[8]**

Maximize $f(x) = x_1 + x_2$

Subject to $x_1^2 + x_2^2 \leq 1$

And $x_1, x_2 \geq 0$

Verify that this is a convex programming problem. Solve this problem graphically.

b) Determine the optimum strategies and value of the following game:**[8]**

| | B | | | |
|---|---|---|---|---|
| A | 1 | 7 | 3 | 4 |
| | 5 | 6 | 4 | 5 |
| | 7 | 2 | 0 | 3 |

***Q8)*** a) Solve the following problem using the gradient search procedure : **[8]**

Maximize $f(X) = 4x_1x_2 - 2x_1^2 - 3x_2^2$

Take the initial trial solution $(x_1, x_2) = (1, 1)$ and tolerance error = 0.02.

b) Consider the following payoff matrix for two firms. What is the best mixed strategy for both the firms and also find out the value of the game. **[9]**

| | | *Firm II* | | |
|---|---|---|---|---|
| | | No advertising | Medium advertising | Large advertising |
| *Firm I* | No advertising | 60 | 50 | 40 |
| | Medium advertising | 70 | 70 | 50 |
| | Large advertising | 80 | 60 | 75 |

❐❐❐❐

**Total No. of Questions : 8]** **SEAT No. :**

**P4174** **[Total No. of Pages : 4**

# [4960]-25

## M.E. (Civil )

## HYDRAULIC ENGINEERING

## Closed Conduit Flow and Hydraulic Transient

## (2008 Pattern) (Elective - II)

***Time : 3 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Answer to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, slide rule and non-programmable, electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

## SECTION - I

***Q1)*** a) A centifugal pump running at 1350 r.p.m. has the characteristics as indicated below :

| Discharge Q (lps) | 12.7 | 18.9 | 25.2 | 31.5 | 37.7 | 44.00 | 50.00 |
|---|---|---|---|---|---|---|---|
| Manometric Head Hm (m) | 28.1 | 27.2 | 26.3 | 24.8 | 23.3 | 20.6 | 18.00 |
| Overall Efficiency ($\eta_0$) | 64 | 68 | 71 | 72 | 70 | 67 | 62 |

Draw the operating characteristics of the pump and determine sp. speed of pump & the power of the motor when it operates of max efficiency. **[9]**

***P.T.O.***

b) Three reservoirs A, B and C are connected by a pipe line system with a junction at point J. The relevant data of the pipe system are as follows :

| Pipe | Length (m) | Diameter (m) | Friction Factor |
|---|---|---|---|
| AJ | 500 | 0.6 | 0.024 |
| BJ | 400 | 0.5 | 0.020 |
| JC | 300 | 0.5 | 0.025 |

Water surface elevations (above the datum) in the reservoirs are : $Z_A$ = 135m; $Z_B$ = 1 20m; $Z_C$ = 100m.

Calculate the rate of flow in each of the pipes. Take at least two trials. **[9]**

***Q2)*** a) Describe the complete cycle of pressure variation due to water hammer when the valve at the downstream end of the pipe starting from reservoir is closed suddenly and rapidly. **[7]**

b) A 400 mm diameter mild steel pipe having 8mm thickness carries water at the rate of 400 lit./sec. What will be the rise in pressure if the valve at the downstream end of the pipe is closed instantaneouly. Compare the results assuming that the pipe is rigid as well as elastic. What should be the maximum closing time for the computed results to be valid? The length of the pipe is 7.5km. Take the modulus of elasticity for steel as $2.47 \times 10^{11}$ N/m$^2$ and the bulk modulus of elasticity for water as $2.075 \times 10^9$ N/m$^2$. **[9]**

***Q3)*** a) Derive the formula for the maximum rise of water level in case of a simple surge tank and the time required to attain this maximum surge. Also obtain the total time required for one complete cycle of surge oscillations. Neglect friction. **[8]**

b) A simple surge tank of 25m diameter is connected to a reservoir through a pipe of 4m diameter and 6.00 km length. If the turbine valve is suddenly closed when the pipe was carrying a discharge of 80m$^3$/sec, determine the maximum rise of water level in the surge tank and its period of oscillation. **[8]**

***Q4)*** Write short notes on : **[16]**

a) Main characteristics and operating characteristics of centrifugal pump;

b) Effect of time of closure on the rise of pressure due to water hammer.

c) Differential surge tank

d) Numerical solution of water hammer problem.

## SECTION - II

***Q5)*** a) Describe the procedure to determine the discharge distribution in a pipe network system by using Hardy-Cross method. **[6]**

b) For the pipe network shown in fig. Q.5 (b), determine the flow in each of the pipes. Assume the value of n = 2 in the formula $hf = rQ^n$. **[12]**

Take at least three trials.

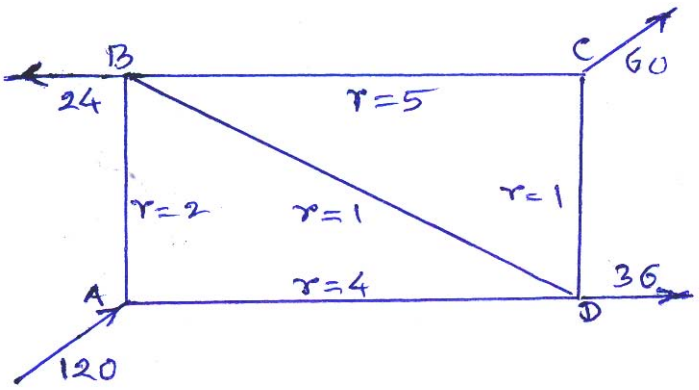



Fig. Q. 5 (b)

***Q6)*** a) Explain the use of PIPE 2000 (KYPIPE) program. **[5]**

b) Explain the classification of GVE profiles in case of open channel flow. **[6]**

c) Explain the use of HECRAS (HEC 2) program. **[5]**

***Q7)*** A rectangular channel 12.5m wide carries a discharge of 62.5$m^3$/sec. If at a certain section, due to the construction of a weir, the depth of flow is 3m, how far upstream or downstream of this section, would the depth of flow be within 10% of the normal depth of flow from NDL. The bed slope of the channel is 0.0004 and manning's roughness co-efficient is 0.015.

Use direct step method taking at least three steps. Classify and sketch the resulting GVF profile. **[16]**

***Q8)*** Write short notes on : **[16]**

a) Tree type networks

b) Transient flow in pipe systems

c) Control section in GVF computations

d) Ven Te Chow's method

Total No. of Questions : 8]

SEAT No. :

P4599

[Total No. of Pages : 2

# [4960] - 26

## M.E. (Civil - Hydraulics)

## HYDRO INFORMATICS AND SIMULATIONS

## (2008 Pattern)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Answers to the two sections should be written in separate answer booklet.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Your answer will be valued as a whole.***
6) ***Use of electronic pocket calculator is allowed.***
7) ***Assume suitable data if necessary.***

### SECTION - I

***Q1)*** Define Hydroinformatics. What are the techniques used in Hydroinformatics? Explain role of Data mining and numerical modeling in Hydroinformatics. **[16]**

***Q2)*** What is decision support system. Discuss design of decision support system for predicting stream flow in a river. **[16]**

***Q3)*** Discuss various methods of simulations. Discuss possible simulation model for passing outflow from a reservoir into a navigational channel which is connected to a harbor. **[16]**

***Q4)*** Write short notes on (any two) : **[18]**

a) JAL SHIVAR YOJANA

b) Role of internet in water resources engineering

c) Any practical Hydroinformatics tool

***P.T.O.***

## SECTION - II

***Q5)*** What are Artificial Neural Networks. Explain in detail standard back propagation algorithm. Compare standard back propagation and Feed forward networks. **[16]**

***Q6)*** Explain Conjugate Gradient algorithm and enlist the applications of ANN in rainfall-runoff modeling with two case studies. **[16]**

***Q7)*** a) What is the necessity of cross validation in ANN modeling? Explain any method of cross validation in detail. **[8]**

b) Discuss Fitness function, population, individuals, fitness value in connection with the Genetic Algorithm. **[8]**

***Q8)*** Explain the flow chart of Genetic Algorithm and write short notes on following topics in concern with GA.

a) Mutation

b) Crossover

c) reproduction

**[18]**

**Total No. of Questions : 6]** **SEAT No. :**

**P4175** **[Total No. of Pages : 2**

# [4960]-27

## M.E. (Civil / Hydraulics)

## HYDROPOWER

## (2008 Pattern) (Elective - II)

***Time : 3 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answers any two questions from each section.***
2) ***Neat diagram must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electonic pocket calculator is allowed.***
5) ***Assume Suitable data if necessary.***
6) ***Answer to the two sections should be written in separate books.***

### SECTION - I

***Q1)*** a) Discuss the advantages and limitations of hydropower against nuclear power. **[6 + 6 = 12]**

b) Write a note on : 'Service operation flexibility' of hydropower. **[8]**

c) State various objectives of planning for water power development. **[5]**

***Q2)*** a) Explain the water conductor system of storage power plant. **[10]**

b) Write a detailed note on prediction of load. **[5]**

c) Briefly explain economics of pumped storage plants. **[10]**

***Q3)*** a) Define powerhouse and explain its components with neat diagram. **[12]**

b) Write a short note on

i) Lake tapping. **[5]**

ii) Compact powerhouse with suitable example. **[8]**

***P.T.O.***

## SECTION - II

***Q4)*** a) Write a note on hydraulic design of draft tube. **[10]**

b) Explain the importance of 'Economic Diameter of a Penstock'. **[5]**

c) Write a detailed note on buried penstocks. **[10]**

***Q5)*** a) A power plant with 3 units of 60,000 kW total output, run under a head of 80 m, at 100 r.p.m. with 90% efficiency. A model of the turbine is tested on a flume of 0.3 cumec under a head of 5 m. Compute scale ratio of the model, it's speed and power. **[8]**

b) Write a note on surge tank with orifice opening. **[7]**

c) Describe governing of Francis turbine with neat sketch. **[10]**

***Q6)*** a) Explain portable micro hydro unit for non-perennial streams. **[15]**

b) Write a note on micro hydro power generation on Canals. **[10]**

**Total No. of Questions : 8]** **SEAT No. :**

**P4176** **[Total No. of Pages : 2**

# [4960]-28

## M.E. (Civil / Hydraulics)

## OPEN CHANNEL HYDRAULICS

## (2008 Pattern)

***Time : 3 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answer any three question from section one and three questions from section two.***
2) ***Answer to the two sections should be written in separate answer booklet.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Black figure to the right indicate full marks.***
5) ***Your answer will be valued as a whole.***
6) ***Use of electronic pocket calculator is allowed.***
7) ***Assume suitable data if necessary.***

## SECTION - I

***Q1)*** a) A trapezoidal channel 5 m wide and having a side slope of 1.5 horizontal to 1 vertical is laid on a slope of 0.00035. The roughness coefficient n=0.015. Find the normal depth for a discharge of 20 $m^3/s$ through this channel. **[8]**

b) Show that the continuity equation for open channel flow is given by

$$\frac{\partial}{\partial x}(AV) + T\left(\frac{\partial y}{\partial t}\right) = 0$$ **[8]**

***Q2)*** a) Write in detail about control of jump by rise in the bed level. **[8]**

b) An overflow spillway has its crest at elevation 125.4m and a horizontal apron at an elevation of 95m on the downstream side. Find the tail water elevation required to form hydraulics jump when the elevation of energy line is 127.9m. The $C_d$ for the flow can be assumed as 0.735. The energy loss for the flow over the spillway face can be neglected. **[8]**

***P.T.O.***

***Q3)*** a) A river 100m wide and 3 m deep has an average bed slope of 0.0005. **[8]**
Estimate the length of GVF profile produced by a low weir which raises the water surface just upstream of it by 1.5 m. Assume n=0.035. Use direct step method.

b) Explain $M_2$, $S_1$ and $H_2$ profile with a neat sketch. **[8]**

***Q4)*** Write short notes on (any three) : **[18]**

a) V. T. Chow's method of direct integration.

b) Types of hydraulic jump.

c) Parameters on which Manning's 'n' depends.

d) Types of channel slopes.

## SECTION - II

***Q5)*** a) Derive dynamic equation for spatially varied flow with decreasing discharge. **[8]**

b) What is a side weir? Explain with the help of definition sketch. Draw types of spatially varied flow profiles for flow over side weir. **[8]**

***Q6)*** a) Distinguish between **[6]**

i) Hydraulic and Hydrologic method of flood routing

ii) Prism storage and wedge storage

iii) Channel routing and reservoir routing

b) Explain Muskingum method of flood routing. **[10]**

***Q7)*** a) Derive dynamic equation for Monoclinal rising wave. **[8]**

b) A rectangular channel carries water at a depth of 2 m and a velocity of 1.5 m/s. Sudden opening of gate at its upstream causes surge of depth 3.5. Determine absolute velocity of surge and increased discharge. **[8]**

***Q8)*** Write short notes on (any 4) : **[18]**

a) Classification of SVF profiles

b) Method of characteristics

c) Types of rapidly varied unsteady flow

d) Solitary wave

**Total No. of Questions : 8]** **SEAT No. :**

**P4177** **[Total No. of Pages : 2**

# [4960]-29
## M.E. (Civil) (Hydraulics)
## HYDROLOGY
## (2008 Pattern)

***Time : 3 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3 ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data if necessary.***

## SECTION - I

***Q1)*** a) Write a note on instantaneous unit hydrograph. **[6]**

b) Following data pertains to an Isohyetal map generated for a specific area for a one day storm. Determine the equivalent uniform depths and plot depth- area-duration curve. **[10]**

| Isohyet mm | 42 | 40 | 38 | 36 | 34 | 32 | 30 | 28 | 26 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|
| Area enclosed between Isohyets ($km^2$) | 543 | 1345 | 2030 | 2545 | 2955 | 3280 | 3535 | 3710 | 3880 | 3915 |

***Q2)*** a) Write a note on time series. **[8]**

b) Explain in detail the effect of slope on infiltration rate and infiltration Indices. **[8]**

***P.T.O.***

***Q3)*** a) The flood analysis of 30 years at a site on river yielded mean and standard deviation of 1200 $m^3/s$ and 650 $m^3/s$ respectively. If it is expected to last for next 50 years with 95% assurance, for what discharge the structure should be designed? Use Gumbel's method. (Given, for n = 30, $\bar{y}_n = 0.53622$ and $\sigma_n = 1.11238$). **[8]**

b) Explain Log-Pearson type III distribution. **[8]**

***Q4)*** Write short notes on : **[18]**

a) Intensity duration frequency curve

b) Return period

c) Accuracy of tipping bucket rain gauge

## SECTION - II

***Q5)*** a) A recuperation test on an open well of diameter 6 m yielded following data.

i) R.L. of water table = 337.8 m

ii) R.L. of water level in the well when the pumping is just stopped = 331.2 m

iii) R.L. of water level in the well 3.5 hours after the pumping is stopped = 334.5 m

Estimate the safe yield of the well, the working head is 4 m. **[8]**

b) Write a note on interference of wells. **[8]**

***Q6)*** a) Briefly explain methods to control ground water salinity. **[8]**

b) Write a note on ground water quantamination. **[8]**

***Q7)*** a) Explain 'Basin Method' of artificial recharge of ground water. **[8]**

b) Write a note on types of strainers. **[8]**

***Q8)*** Write short note on : **[18]**

a) Perched aquifer

b) Cone of depression

c) Development of wells.

**Total No. of Questions : 8]** **SEAT No. :**

**P4160** **[Total No. of Pages : 2**

# [4960]-3

## M.E. (Civil) (Construction Management)

## CONSTRUCTION TECHNIQUES

## (2008 Pattern)

***Time : 4 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answer 3 from questions Section I and Section II, Question No 1 and Question No 5 are Compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data if necessary.***
5) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator is allowed.***

### SECTION - I

***Q1)*** a) Explain the step by step procedure of, Construction of under deep water concrete diaphragm walls. **[12]**

b) List out the construction techniques for tunneling in soft strata. Explain any one in detail with diagram. **[6]**

***Q2)*** a) What is mean by grouting? Explain the need of grouting. What are the practically precautions to be taken while grouting. **[10]**

b) Enlist the different types of grouting and explain any two in details. **[6]**

***Q3)*** a) Explain with diagram, installation and operation of, Well point system **[10]**

b) Explain following : **[6]**

i) Dewatering by electro-osmosis.

ii) Horizontal drainage

***P.T.O.***

***Q4)*** a) Explain any one method of launching of girder of bridge. **[8]**

b) What is mean by pile cap and group of pile? Explain the function. **[8]**

## SECTION - II

***Q5)*** a) Explain the step by step procedure of casting of precast member. **[9]**

b) List out the different methods of high rise construction ,and explain any one in detail with diagram. **[9]**

***Q6)*** a) Draw the tree-diagram for classification of piles and also explain the negative skin friction. **[8]**

b) Explain the factors affecting on quality of ready mix concrete. **[8]**

***Q7)*** a) Enlist the pile driving methods and also explain any one in details. **[8]**

b) Write short note on. (any two) : **[8]**

i) Shortcreting.

ii) Pumped concrete.

iii) Guniting.

***Q8)*** a) Which factors should be considered while designing the coffer-dams. **[8]**

b) What is mean by caissons? Enlist various types of caissons and explain any one in detail. **[8]**

Total No. of Questions : 12]

SEAT No. :

**P4178**

[Total No. of Pages : 3

# [4960]-30

## M.E. (Civil) (Hydraulic Engineering) (Semester - II)

## SEDIMENT TRANSPORT & RIVER MECHANICS

## (2008 Course)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 from Section - I and Q.6 or Q.7 or Q.8,Q. 9 or Q.10, Q.11 or Q.12 from Section - II.***
2) ***Answer to the two sections should be written in the separate answer books.***
3) ***The diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of calculator is allowed.***
6) ***Assume suitable data if necessary.***

### SECTION - I

***Q1)*** a) What are the significant sediment properties? Explain shied analysis for sediment motion in detail. **[10]**

b) Differentiate the variation of form resistance and grain resistance in different flow regimes? **[8]**

OR

***Q2)*** a) Write short note on Bed Formations. **[10]**

b) Explain use of remote sensing in determining the sediment load. **[8]**

***Q3)*** a) Briefly explain the various modes of sediment transport. **[8]**

b) Using Meyer-Peter and Muller method, estimate the bed load transport of sediment in an alluvial channel, 150 m wide and 4 m deep carrying a discharge of 375 $m^3/s$. The channel bed slope is 1 in 4000 and the mean size of the sediment is 0.3 mm. **[8]**

***P.T.O.***

OR

***Q4)*** a) Design an irrigation canal using Kennedy's equation from following data: (Assume any other suitable data if necessary) **[8]**

Full supply discharge = $60m^3/s$

C.V.R(m) 1.0

Kutter's N = 0.0225

Side Slope 0.5H:1V

B/DRatio = 11.7

b) Explain. **[8]**

i) Initial Regime

ii) Final Regime

iii) Sediment Load

iv) Threshold Velocity

***Q5)*** Write short notes on the following : **[16]**

a) Garde- Ranga Raju's method of resistance analysis.

b) Assumptions in Einstein's bed load function.

c) Suspended load distribution.

d) Use of remote sensing in determining the sediment load.

OR

***Q6)*** a) Explain the various for controlling the sedimentation of reservoirs. Also mention the effectiveness of each measure for sediment control. **[8]**

b) Explain microscopic and macroscopic methods for bed load measurements and suspended load measurements. **[10]**

## SECTION - II

***Q7)*** a) What is bifurcation? What is confluences? Explain their practical significance. **[10]**

b) On the basis of hydraulic aspects, explain the phenomenon of aggradation and degradation. **[8]**

OR

***Q8)*** a) Write down causes of meandering. **[10]**

b) In a wide alluvial stream, a suspended load sample taken at a height of 0.33 m above the bed indicated a concentration of 1100 ppm of sediment by weight. The stream is 5.0 m deep and has a bed slope of l/3600.The bed material can be assumed to be uniform size with a fall velocity of 2.2 cm/sec. Estimate concentration of sediment at mid depth. Assume K=0.4 **[8]**

***Q9)*** a) What is river gauging ? Explain the methods of river gauging in detail. **[8]**

b) In context with river morphology explain the terms bifurcation sand confluences. **[8]**

OR

***Q10)***a)Write short note on Cutoff & Development of Cutoff with the neat sketch.**[8]**

b) Explain: **[8]**

i) Meander Belt

ii) Meander ratio

iii) Tortusity

iv) Meander length.

***Q11)***Write short notes (any three) : **[16]**

a) Groynes-concepts-applications-types.

b) Pitched island.

c) River gauging by ultrasonic method.

d) Elements of river morphology

OR

***Q12)***a) What are the objectives of river training? Give the classification of river Training. **[8]**

b) What are the methods of river gauging & explain any one of them. **[8]**

**Total No. of Questions : 6]** **SEAT No. :**

**P4179** **[Total No. of Pages : 3**

# [4960]-31

## M.E. (Civil) (Hydraulics)

## IRRIGATION & DRAINAGE

## (2008 Pattern)

***Time : 3 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answer any two questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn whenever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume Suitable data if necessary.***
6) ***Use of logarithmic tables, Slide rule, Mollier charts, Electronic pocket calculator and stream tables is allowed.***

## SECTION - I

***Q1)*** a) Determine the consumptive use requirement for a certain crop with the climatic and other data as given below. Also calculate the field irrigation requirement if the water application efficiency is 75%. Use Blaney-Criddle formula. **[7]**

| *Month* | *Mean monthly temperature in °C* | *Monthly percent of day-time hours of the year* | *Monthly consumptive use coefficient* | *Mean effective rainfall in mm* |
|---|---|---|---|---|
| April | 25 | 8.60 | 0.60 | -- |
| May | 27 | 9.29 | 0.65 | -- |
| June | 28 | 9.18 | 0.70 | 52.3 |
| July | 29 | 9.39 | 0.75 | 74.6 |
| August | 29 | 9.04 | 0.75 | 62.8 |
| September | 27 | 8.31 | 0.65 | 31.2 |
| October | 24 | 8.10 | 0.60 | 25.3 |

***P.T.O.***

b) The following data pertains to healthy growth of a crop : **[8]**

i) Field capacity of soil = 30%

ii) Permanent wilting percentage = 11%

iii) Density of soil = 1300 kg/cu.m

iv) Effective depth of root zone = 700 mm

v) Daily consumptive use of water for give crop = 12 mm

For healthy growth moisture content must not fall below 25% of the water holding capacity between the field capacity and the permanent wilting point. Determine the watering interval in days.

c) Write short note on : **[10]**

i) Soil groups of India

ii) Classification of Soil water

***Q2)*** a) Explain how soil properties affect the irrigation requirements. **[7]**

b) What do you understand by GCA and CCA? **[8]**

c) What is consumptive use of water? Describe any two methods for determining the consumptive use of water. **[10]**

***Q3)*** a) Explain the various methods for avoiding soil erosion. **[8]**

b) Explain the effect of salinity and alkalinity in irrigation. **[7]**

c) Discuss the various sub-surface irrigation methods. Indicate their limitations. **[10]**

## SECTION - II

***Q4)*** a) Explain Drip irrigation system in detail. **[7]**

b) Explain the design consideration involved in intake well. **[8]**

c) Write short note on : **[10]**

i) Command area development

ii) Warabandi scheme

***Q5)*** a) Describe with a neat sketch a non-modular type of outlet. **[10]**

b) Describe in detail sprinkler method of irrigation. Indicate the advantages of this method of irrigation. **[7]**

c) Define sensitivity of an outlet. Find the relation between sensitivity and flexibility of an outlet. **[8]**

***Q6)*** a) In a drainage system closed drains are to be placed with their centers 2 m below the ground level to keep the highest position of the water table 17 m below the ground level. The impervious stratum is at a depth of 9.6 m below the ground level. If the average annual rainfall in the area is 850 mm, find the spacing of drains. Assume 1 % of the average annual rainfall to be drained in 24 hours and coefficient of permeability $k = 1 \times 10^{-5}$ m/s. **[10]**

b) Explain the effects of water logging. Also suggest the reclamation to be done to water logged areas. **[8]**

c) Describe with neat sketch Kennedy's gauge outlet. **[7]**

● ● ●

**Total No. of Questions : 8]** **SEAT No. :**

**P4180** **[Total No. of Pages : 2**

# [4960]-32

## M.E. (Civil) (Hydraulics Engineering)

## COASTAL ENGINEERING

### (2008 Pattern) (Elective - III)

***Time : 3 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithms tables, slide rule, Mollier charts, electronics pocket calculator is allowed.***
6) ***Assume suitable data if necessary.***

## SECTION - I

***Q1)*** a) Derive expressions for particle kinematics in linear wave theory. **[8]**

b) Define shallow water, deep water, wave length, wave number. **[8]**

***Q2)*** a) What is wave reflection? Discuss the factors on which reflection depends. Define surf similarity parameter. **[10]**

b) Derive equation for general refraction bye bathymetry. **[8]**

***Q3)*** a) Discuss the process of wave measurement. Classify the waves. **[8]**

b) Define: Draw definition sketch of propagating wave and define related terms. **[8]**

***Q4)*** Write short notes on (any four) : **[16]**

Wave shoaling, higher order theory, numerical wave modeling, Choice of wave theory, wave run up

***P.T.O.***

## SECTION - II

***Q5)*** a) List theoretical wave spectra. Write in brief on JONSWAP spectrum. **[8]**

b) Discuss the phenomenon of littoral drift. What is longshore and cross shore littoral drift? **[8]**

***Q6)*** a) What are various types of coastal protection works? Describe any two of them in detail? **[10]**

b) Discuss fall velocity, permeability for sediments. **[8]**

***Q7)*** a) Derive equation for suspended load by currents. **[8]**

b) Discuss the environmental parameters which influence the coastal region. **[8]**

***Q8)*** Write short notes on (any four) **[16]**

Uses of wave spectra, case study related to coastal erosion in India, Initiation of sediment movement, mechanism of sediment transport, beach profiles

Total No. of Questions : 8]

SEAT No. :

**P4181**

[Total No. of Pages : 2

# [4960]-33

## M.E. (Civil) (Hydraulics Engineering)

## WATER MANAGEMENT AND CONVEYANCE SYSTEMS

### (2008 Pattern) (Elective - III)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Answer to the two sections should be written in the separate answer books.***
3) ***The diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of calculator is allowed.***
6) ***Assume suitable data if necessary.***

## SECTION - I

***Q1)*** a) Discuss in detail about River flow, diffusion and dispersion regimes. **[10]**

b) Classify the difference between point and Non point sources of loading system. Give examples for each. **[8]**

***Q2)*** a) What do you mean by diffusion and dispersion regimes? Describe them in detail. **[8]**

b) Discuss in brief about eutrophication reduction. **[8]**

***Q3)*** a) Discuss in brief about toxic substances and heat management in water management. **[8]**

b) Explain the application of computer - based models, for water quality and contaminant transport. **[8]**

***Q4)*** Write short notes on any four : **[16]**

a) Reservoir analysis

b) Contaminant decay modelling

c) Various water distribution systems

d) Global and national water problems

e) Water tariff structures

***P.T.O.***

## SECTION - II

***Q5)*** a) Determine quantity of bed load transported through a trapezoidal channel, by using MPM equation with the following data. **[10]**

i) Depth of flow = 2.0m

ii) Width of channel 2.6m

iii) Bed slope = 1.5000

iv) Uniform size of bed material = 0.33mm (Ks)

v) Side slope 0.5H :1V

vi) Manning's Constant n = 0.02225

b) Write elaborately about design elements of water distribution systems and system modelling. **[8]**

***Q6)*** a) What are the challenges involved with urban drainage systems? Suggest the methods to control the urban drainage and runoff problems. **[8]**

b) Explain Technology and impacts of water conservation practices and policies on municipal service infrastructure. **[8]**

***Q7)*** a) How to forecast and estimate a flood? What are the various methods of controlling a flood? **[8]**

b) Briefly discuss the deterministic and stochastic modelling. **[8]**

***Q8)*** a) What are the major economic aspects and design making considerations related to the growth of hydro-electric plant? Discuss them in brief. **[8]**

b) Draw a neat sketch of hydro- electric power plant, label and explain all the parts. **[8]**

**Total No. of Questions : 8]** **SEAT No. :**

**P4182** **[Total No. of Pages : 3**

# [4960]-34

## M.E. (Civil-Structures)

## STRUCTURAL MATHEMATICS

## (2008 Pattern)

***Time : 4 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Attempt three questions from section I and three questions from section II.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of non programmable electronic calculator is allowed.***
6) ***Assume suitable data, if necessary.***

## SECTION - I

***Q1)*** a) What is the relation between flexibility and stiffness matrix? Explain with proper illustration. **[4]**

b) Using Flexibility method, analyze the beam shown. **[13]**

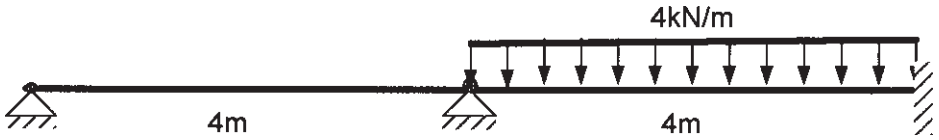



Fig.1.b

***Q2)*** a) Explain how the bandwidth and half bandwidth of stiffness matrix of a three storey double bay portal frame can be minimized. **[5]**

b) Using Flexibility or Stiffness method, analyze the truss shown in the Fig. 2.b. Find the joint displacements, support reactions, bar forces and bar elongations. Take AE = 5000 kN for all the bars. **[12]**

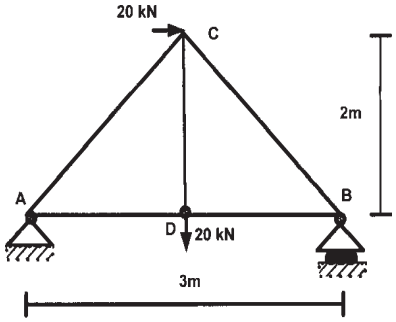



Fig. 2.b

***P.T.O.***

***Q3)*** a) Derive the transformation matrix for the grid member. **[8]**

b) Given dy/dx = x–y+2. At x = 0, y = 1. Calculate the value of y at x =0.1 and 0.2 using an interval of 0.1. Use Runga Kutta method. **[8]**

***Q4)*** a) Find an approximate value of y when x = 0.3, given that dy/dx = 3xy and y = 0.6 when x = 0. Take h = 0.1 Adopt Euler method. **[8]**

b) Derive the stiffness matrix of a typical space truss element. **[8]**

## SECTION - II

***Q5)*** a) For the fixed beam shown in Fig. 5.a, apply central difference formula dividing the beam in four equal parts and find the deflection at nodal points, and moment at fixed ends. **[8]**

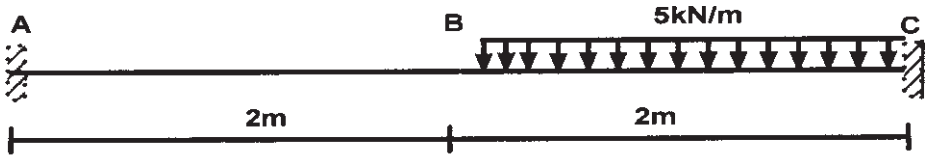



Fig. 5.a

b) A simply supported uniform plate of side length ‘2a x a’ supports a uniformly distributed load over entire plate. Estimate the deflection at the various nodal points, using a grid interval of h =a/2 using finite difference method. Comment in the changes to be employed if the plate is fixed at all edges instead of simply supported. **[8]**

***Q6)*** a) What are different interpolation techniques? Explain cubic spline interpolation? What are cubic splines? State the conditions for a spline to be cubic. **[7]**

b) Find the cubic splines for the following table of values. **[9]**

| x : | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Y : | 1 | 5 | 11 | 8 |

Hence evaluate y(1.5) and y' (3).

***Q7)*** a) Values of y are given at values of x as shown below. **[9]**

| X | 1.0 | 1.4 | 3.8 | 5.0 |
|---|---|---|---|---|
| Y | 15.0 | 20.5 | 38.0 | 34.0 |

Calculate the value of y at x = 4.6 using Lagrange interpolation technique.

b) Find a quadratic polynomial that fits the following data. **[8]**

| x | –4 | –2 | 0 | 2 | 4 |
|---|---|---|---|---|---|
| y = f(x) | 2 | 1 | 1 | 1 | 2 |

***Q8)*** a) What are the numerical methods to evaluate area under the curve? Explain the advantage of Gauss Quadrature over other methods. **[7]**

b) A beam simply supported at its ends supports uniformly distributed load of 5 kN/m over the entire length of 6 m. Find a Fourier expression for the load. Calculate the deflection and bending moment at its centre.**[10]**

**Total No. of Questions : 6]**

**P5101**

**SEAT No. :** ____

**[Total No. of Pages : 2**

# [4960]-35
# M.E. (Civil)
# STRUCTURES
# Advanced Solid Mechanics
# (2008 Pattern)

***Time : 4 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:-***

1) ***Answer any two questions from each section.***
2) ***Answers to the two sections must be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

## SECTION - I

***Q1)*** a) What is compatibility of strains? Obtain Strain compatibility equation for 2D problem in elasticity? **[10]**

b) A plane passing through point (x,y,z) in a stressed elastic body has its normal 'n' with direction cosines cos(n,x), cos(n,y), cos(n,z). Obtain expressions for the stress resultants (Tn) and its direction in terms of six independent components at that point. **[15]**

***Q2)*** a) Define Airy's stress function '$\Phi$'. Prove that the stress function satisfies the Biharmonic Governing Equation in absence of body forces. **[10]**

b) If $\Phi$ is a third degree polynomial function, obtain the stress distribution on the sides of rectangular plate of size L × 2h. Neglect body forces. Also check for static equilibrium of the plate under this stress distribution.**[15]**

***Q3)*** a) Explain the concept of stress Invariants? Hence, discuss the state of pure shear and hydrostatic state of stress? **[10]**

b) Obtain the solution for stress distribution $\sigma_r$ and $\sigma\theta$ in a hollow cylinder subjected to uniform external pressure '$P_o$' and internal pressure '$P_i$'?**[15]**

***P.T.O.***

## SECTION - II

***Q4)*** a) Derive differential equation for the elastic line of a beam resting on an elastic foundation? **[10]**

b) A semi-infinite beam is subjected to a force 'P' and a moment '$M_o$' at one end. Starting from the solution for an infinite beam, obtain the solution at a section 'z' from the beam end for **[15]**

i) Deflection 'y'

ii) Bending moment $M_x$.

***Q5)*** a) What is axi-symmetric problem? Explain its stress and strain distribution? **[10]**

b) A thick cylinder of internal radius 75mm and external radius 150 mm is subjected to an internal pressure of $10N/mm^2$. Determine variation of radial and hoop stresses in the cylinder wall? **[15]**

***Q6)*** a) Derive Poisson's equation for torsion of prismatic bars of non-circular section in terms of stress function $\Phi$ using St. Venant's Theory. Neglect body forces. **[15]**

b) A shaft of elliptical c/s having semi major axis 100 mm and semi minor axis 50 mm is subjected to a torque of 1.5 kN-m, determine maximum and minimum shear stress developed in shaft. **[10]**

Total No. of Questions : 6]

SEAT No. :

P4183

[Total No. of Pages : 2

# [4960]-36

## M.E. (Civil) (Structures)

## STRUCTURAL DYNAMICS

## (2008 Pattern)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any two questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Figures in bold to the right, indicate full marks.***
4) ***If necessary, assume suitable data and indicate clearly.***
5) ***Use of electronic pocket calculator is allowed.***

### SECTION - I

***Q1)*** a) Derive the various solutions for single degree of freedom systems subjected to damped vibrations. **[15]**

b) What are different types of damping? Explain with suitable examples. **[10]**

***Q2)*** a) Derive the expression for a single degree of freedom system subjected to forced damped vibration. **[15]**

b) Explain transmissibility with a suitable example. **[10]**

***Q3)*** a) A single degree of freedom system consists of a weight W=9.81 kN, a spring stiffness 20 kN/cm and a dashpot with coefficient 0.071 kN/cm/s. Find i) damping factor, ii) logarithmic decrement and c) ratio of any two consecutive amplitudes. **[15]**

b) A 500 N instrument is installed at a location where vertical acceleration is 0.1g and at frequency = 10 Hz. The instrument is mounted on a rubber pad of stiffness 12,800 N/m and damping such that the damping factor is 0.10. Determine the acceleration transmitted to the instrument. **[10]**

***P.T.O.***

## SECTION - II

***Q4)*** a) Explain orthogonality of modes. **[10]**

b) Find the natural frequencies and mode shapes for the system shown in Fig. 1. **[15]**

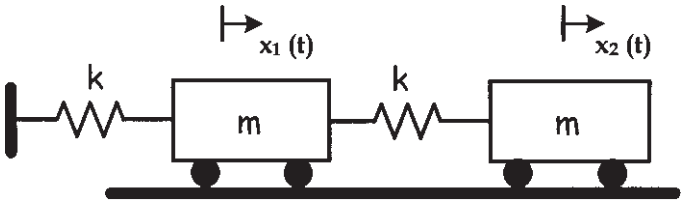



**Fig. 1**

***Q5)*** a) What are the characteristics of non-linear systems? **[15]**

b) Explain Stodola Method. **[10]**

***Q6)*** a) What is modal superposition method? **[10]**

b) Determine the natural frequencies and modes of vibrations of a uniform simply supported beam. **[15]**

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Total No. of Questions : 6]

SEAT No. :

P5111

[Total No. of Pages : 2

# [4960] - 37

## M.E. (Civil Structures)

## ADVANCED DESIGN OF CONCRETE STRUCTURES

## (2008 Pattern) (Elective - I) (Semester - I)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates :-***

1) ***Solve any two questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of calculator and relevant IS codes allowed.***
6) ***Assume suitable data, if necessary.***

### SECTION - I

***Q1)*** a) Draw yield lines for the following: **[10]**

i) Triangular slab with flxed supports on two adjacent side with one side unsupported.

ii) Circular slab with fixed support.

b) Design a RCC slab for a circular hall of diameter 5 m using Yield Line Theory. Assume the peripheral support thickness 250mm, the slab is simply supported. Use M20 Fe500 take Live load = 4 $kN/m^2$ & floor finish load = 1$kN/m^2$. Show its reinforcement details. **[15]**

***Q2)*** a) Design a flat slab for a hall with column spacing 4 m × 4 m c/c. The size of the column is 400 mm × 400 mm each use M20 Fe415 take live load = 3$kN/m^2$ & floor finish load = 1.2$kN/m^2$. Show its reinforcement details. **[10]**

b) Design a grid slab for a floor of hall 15 × 15 m having square grid of 1.5 m. Use M25 Fe415 take Live load = 4$kN/m^2$ and floor finish load = 1.2$kN/m^2$. Apply the required check & draw reinforcement details. **[15]**

***P.T.O.***

***Q3)*** Design a staging for circular type ESR for 2.5 lakh liters with staging height 10m using M25, Fe500 in earthquake zone III. Safe bearing capacity is 180 $kN/m^2$. Design of container is not required. Assume approximate dimension of container, wall, top, bottom slab thickness, beams sizes & number of columns. Design must include calculations of vertical loads and horizontal force calculations design the bracings, columns and foundations. Draw the reinforcement details. **[25]**

## SECTION -II

***Q4)*** Design post tensioned prestressed concrete slab for a floor for the following flat interior panel of 8m × 8m, live load on slab $4kN/m^2$, floor finish load on slab = 1 $kN/m^2$, concrete grade M50 HT steel is S3 cables of cross sectional area of each strand 150 $mm^2$ with fy = 1900 $N/mm^2$. design cables to serve as beams. Assume 3 panels in each direction (floor size 24m × 24m) width of the beam on periphery of floor 600 mm and column size 600mm 600mm. Design must include check for fibre stresses in concrete and deflection. Draw sketches showing cable profiles. **[25]**

***Q5)*** Design a deep beam of a hall for flexure and shear for the following: **[25]**

Clear span = 5m, width of support = 450mm, working UDL on the beam 1500 kN/m. Take the total depth of beam = 3.5 m. Use M40 & Fe500. Show all analysis and design calculations & Draw the reinforcement details.

***Q6)*** A two span prestressed concrete continuous beam ABC having cross section 300 × 600 mm simply supported at A & C and continuous over B with M45 and multistrand cables 2Nos 12T13 with Fy = 1900 $N/mm^2$ stressed to 75% of fy , each span is of 15m, superimposed load on both the spans 12 kN/m, Assume 15% loss of prestress. **[25]**

a) Determine primary, secondary moment at support at prestresses and dead load.

b) Calculate shift, and stress in extreme fibers at working load.

c) Draw the resultant line of thrust at working load.

Total No. of Questions : 6]

SEAT No. :

**P4184**

[Total No. of Pages : 2

# [4960]-39

## M.E. (Civil Structure) (Semester - I)

## DESIGN OF COMPOSITE CONSTRUCTION

## (2008 Pattern) (Elective - I)

*Time : 4 Hour]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Solve any two questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of Calculator is allowed.***
6) ***Assume Suitable data necessary***

### SECTION - I

***Q1)*** a) Explain code provisions in IS, BS &Euro code with reference to flexural behavior of composite used in Construction. **[9]**

b) Explain advantages of using composite construction and its applications. **[8]**

c) State basic design considerations of composite beam. **[8]**

***Q2)*** a) Explain types of sheeting used for composite construction; Explain its utility, applications, its material properties. **[9]**

b) How longitudinal shear, longitudinal slip, deflection, vertical shear is considered in composite construction. **[8]**

c) Explain structural failure patterns and its possible reasons, in composite beam. **[8]**

***Q3)*** a) Explain structural behavior of concrete filled tubular circular column under axial load. **[8]**

b) Explain prefilled decking system ,and its steps to structural design. **[8]**

c) How fire resistance is taken care of in composite design. Explain in brief. **[9]**

***P.T.O.***

## SECTION - II

***Q4)*** a) Explain schematically composite truss ,its structural range and application. Its advantages and disadvantages. **[13]**

b) Draw neat structural arrangement in composite truss with details of connectors. Show important ,typical details on sketch. **[12]**

***Q5)*** a) State design steps to consider fire protection in composite construction, as stated in code. **[8]**

b) What is geometric imperfections, why they are induced, How are they are eliminated in composite construction. **[8]**

c) Sketch typical composite foundation showing important connection details .**[9]**

***Q6)*** a) Sketch typical composite bridge deck slab and detail it. **[8]**

b) Write design steps of composite beam with all necessary checks as per code provisions. **[8]**

c) Design composite simply supported beam of span 10 meters to carry load 5 KN/m.Use composite constructions. Select appropriate constituents for composite construction. Assume their appropriate properties for design. Apply suitable code provisions and checks. **[9]**

**Total No. of Questions : 8]** **SEAT No. :**

**P4161** **[Total No. of Pages : 2**

# [4960]-4

## M.E. (Civil)

## CONSTRUCTION AND MANAGEMENT

## New Construction Materials

## (2008 Pattern) (Elective - I)

***Time : 4 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answer three questions from Section-I and three questions from Section-Il and 18 marks question from each section is compulsory.***
2) ***Answer to the two sections should be written in separate books.***
3) ***Figures to the right indicate full marks.***
4) ***Neat Diagram must be drawn wherever necessary.***
5) ***Electronic Pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

### SECTION - I

***Q1)*** Explain the conventional as well as the modern methods used for testing and characterization of flyash, with a case study. Discuss advantages of using modern methods; enlist the norms suggested by the Government of Maharashtra as regards effective utilization of fly ash. **[18]**

***Q2)*** Explain with a detail case study, the use of serpentine in nuclear radiation shield. **[16]**

***Q3)*** Explain in brief any 8 eco- friendly construction materials and where they are used. Explain concept of carbon credits. **[16]**

***Q4)*** Explain in brief the following : **[16]**

a) Roller compacted concrete.

b) Precaution in mass concreting works.

c) Leed Rating.

d) Nano technology and TQC.

***P.T.O.***

## SECTION - II

***Q5)*** What is SSC? What are its Advantages? Explain with sketches any 2 tests in details, Explain principles of mix design of SSC. **[18]**

***Q6)*** Explain any 4 smart materials in detail and explain their application in construction. **[16]**

***Q7)*** a) Compare and contrast between steel fibers and carbon fibers as regards their use in FRC. **[8]**

b) What is HPC? Where is it used? What are its advantages? **[8]**

***Q8)*** Draw flow diagram of silica fume production. List out 6 applications involving use of silica fume concrete. Explain the construction methodology of any one application in detail. Discuss the advantages of SFC. **[16]**

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Total No. of Questions : 6]

SEAT No. :

**P4955**

[Total No. of Pages :3

# [4960]-40
# M.E.(Civil)(Structures)
# DESIGN OF FOUNDATIONS
# (2008 Pattern)(Semester-I)(Elective-I)

*Time :4Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any two questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Your answers will be valued as a whole.***
5) ***Use of logarithmic tables electronic pocket calculator is allowed & IS codes are not allowed.***
6) ***Assume suitable data, if necessary.***

## SECTION-I

***Q1)*** a) Explain the following **[15]**

i) Proportioning of footing.

ii) IS - 1892, provisions for soil Exploration.

iii) A - line chart.

iv) Teng's correlations.

v) Soil structure Interaction

b) Explain the steps by sample calculations, for computation of consolidation settlement, for a framed structure, column footing with a pressure increment of 160 kN/m$^2$, size 2.5m×3.5m. Assume, two layers of soil, sand & clay with following properties, **[10]**

i) For sand, $\gamma$ = 19 kN/m$^3$ & $\gamma_{sat}$ = 22 kN/m$^3$

ii) For clay, $\gamma_{sat}$ = 18 kN/m$^2$, $C_c$=0.30, W =40% & G = 2.7

Consider effect of GWT.

***P.T.O.***

***Q2)*** a) Explain the design steps, with sample calculations for, **[16]**

i) Flat slab Raft

ii) Beam & Raft (slab) foundation

b) Discuss the conditions favouring the design of diff. types of raft foundations. **[9]**

***Q3)*** a) Compare in the light of IS-2974-Pt-II-1966, design of foundations for, **[15]**

i) Rotary machines

ii) Impact machines

b) A machine having a wt. of 25,000 kN has an unbalance, such that it's subjected to a force of 6000 kN at a frequency of 650 rpm. What should be the 'K' for the supporting springs if the max force transmitted to the foundation, due to the machine is 600 kN? Neglect damping. **[10]**

## SECTION-II

***Q4)*** a) Explain the following **[15]**

i) Design steps for precast & cast-in-situ piles.

ii) Converse La-barre's formula & Feld's rule.

iii) PSF & NSF

b) Compute the settlement of pile group to carry a load of 4000kN, for a 20m deep clay. Width of pile cap is 6m, length of pile 15 m with 0.6 M, $\phi$. The $q_u$=90 kN/m$^2$,clay is underlain by rock. Assume 30°, pressure distribution. **[10]**

LL is 80% & FOS for shear is 03.

***Q5)*** a) Explain the steps for 'Rees & Matlock' method. **[10]**

b) Design an RCC precast pile to sustain a working load of 900 kN, with length 12m & $\phi$ = 0.4 M. $q_u$ = 50kN/m$^2$. Design with suitable reinforcement & check for handling stresses. **[15]**

***Q6)*** a) Explain the steps for 'Design of pile cap', with the help of sample calculations. **[9]**

b) Describe diff. types of 'shell foundations', stating their suitability & IS code recommendations. **[8]**

c) Compare 'Hyperbolic & Conical RC shell foundations' with & without edge-beams. **[8]**

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Total No. of Questions : 6]

SEAT No. :

**P4185**

[Total No. of Pages : 2

# [4960]-41

## M.E. (Civil) (Structure)

## ADVANCED DESIGN OF METAL STRUCTURES

## (2008 Pattern) (Elective - II)

*Time : 4 Hour]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Solve any two questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of Calculator is allowed.***
6) ***Assume suitable data if necessary.***

### SECTION - I

***Q1)*** a) A Hording structure is to be designed supported by two built up columns as back up structure. The display board is 30 m wide and 18 m height. The board is supported on built up back up structure from ground ,the bottom edge of board being at height of 15 m from ground. Draw schematic diagram of back up structure and hoarding structure with structural parts. **[8]**

b) Give design considerations and design steps to design this hoarding. **[9]**

c) Calculate design force at foundation level. **[8]**

***Q2)*** a) Explain castellated beams with neat sketch, state its advantages and disadvantages. **[8]**

b) Calculate the sectional properties of castellated beam made from I section, web 8 mm thick, depth of web 500mm, Flange 12 mm thick ,150 mm wide. **[9]**

c) State expression of maximum shear stress in castellated beam section, with suitable free body diagram. **[8]**

***P.T.O.***

*Q3)* a) What are merits and demerits of Aluminum structural sections as compared to steel sections. **[9]**

b) Design aluminum section strut to carry axial compressive load of 150 kN. The effective length of strut is 2.3 meter. Assume factor of safety 2. **[16]**

## SECTION - II

*Q4)* a) Draw structural types of transmission tower and microwave tower. Show all main structural components and accessories to be considered for design. **[10]**

b) Explain the effect of tension cable connected to transmission cable. What is the effect when cable suddenly brakes? How design forces are affected due to braking of cable. **[15]**

*Q5)* a) Sketch the typical details at connection of tubular truss members. Consider welded joint. **[8]**

b) What are the provisions in IS code for design of scaffolding using tubular structure. **[9]**

c) Write the merits and demerits of Tubular sections as structural memebers. **[8]**

*Q6)* a) Compare the load carrying capacity of channel section in flexure (of same dimensions, channel with depth of web 100mm, flange width 75 mm) and light gauge channel section 100 mm width of web and 75 mm width of flange, stiffened section ,lip width 12mm thickness of light gauge 1.5 mm. **[15]**

b) Compare and differentiate stiffened and unstiffened section. **[6]**

c) How light gauge section is manufactured? **[4]**

Total No. of Questions : 6]

SEAT No. :

P4600

[Total No. of Pages : 2

# [4960]-42

## M.E. (Civil - Structures)

## STRUCTURAL DESIGN OF STEEL BRIDGES

## (2008 Pattern)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Attempt any two questions from Section I and Section II.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figure to the right indicate full marks.***
5) ***Assume suitable data, if necessary and clearly state.***
6) ***Use of electronic pocket calculator, steel table and IS 800 are allowed.***
7) ***Use of cell phone is prohibited in the examination hall.***

## SECTION - I

***Q1)*** a) Explain in brief classification of bridges with sketches. **[10]**

b) Explain the historical development of bridges in details. **[8]**

c) State and explain lateral forces acting on bridges. **[7]**

***Q2)*** a) Explain design criterion of horizontal truss bracings and end cross frames deck type plate girder bridge. **[10]**

b) A deck type plate girder railway bridge of span 24 m is provided for a double broad gauge track. The self weight of stock rails and check rails are 0.8 and 0.4 kN/m respectivly. The self weight of sleepers is 3.6 kN/m. Design a economical cross section of plate girder. Draws the design sketches for the bridge structures. The EUDL for B M is 2329 kN, for S F is 2548 kN and impact factor is 0.526. **[15]**

***P.T.O.***

***Q3)*** a) Explain design criterion of bracing systems for through type truss girder railway bridges. **[10]**

b) Determine the maximum forces in top and bottom chord members of the pratt truss girder through bridge for single broad gauge track of span 50 m. The spacing of main girder, cross girder and stringer are 7, 5 and 2m respectively. **[15]**

## SECTION - II

***Q4)*** The effective span of through type truss girder highway two lane bridge is 30 m. The reinforced concrete slab is 250 mm thick exclusive of the wearing coat. The foot paths are provided on either side of the carriage way. The spacing between centre to centre of truss girder is 12 m. The highway bridge is to carry IRC class A standard loading. Suggest a suitable truss girder for the bridge. Design the top and bottom chord members of the central panel. **[25]**

***Q5)*** The effective span of a deck type plate girder two lane highway bridge is 20 m. The reinforced concrete slab is 250 mm thick exclusive of the wearing coat, The foot paths are provided on either side of the carriage way. Design the maximum section of plate girder, if the bridge is to carry IRC class A loading. . **[25]**

***Q6)*** a) Explain in brief application of bearing in railway steel bridges. **[10]**

b) The effective span of truss girder through type bridge for a single broad gauge track is 24 m. Reaction due to dead load, live load and impact load is 1000 kN. Vertical reaction due to wind is 150 kN. Tractive force is 1000 kN and breaking force is 500 kN. Design the rocker bearing and draw design sketch. **[15]**

Total No. of Questions : 6]

SEAT No. :

P4186

[Total No. of Pages : 3

# [4960]-43

## M.E. (Civil Structures)

## PLASTIC METHOD FOR ANALYSIS AND DESIGN OF STEEL STRUCTURES

## (2008 Pattern) (Elective - II) (Semester - I)

*Time : 4 Hour]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any two questions from each section.***
2) ***Answer to the TWO Sections should be written in separate answer books.***
3) ***Neal sketches must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of non-programmable calculator, IS: 800-2007 and steel table is allowed.***
6) ***Assume suitable data, if necessary.***

### SECTION - I

***Q1)*** a) Explain Complete. Over complete & Partial collapse at structure. **[5]**

b) A simply supported beam of equal I - section is subjected to bending moment. Find the shape factor if permissible yield strees in compression and tension is 260 MPa and 290 N/mm$^2$ respectively. The section has following dimensions:

Top & Bottom flange = 200 mm × 25 mm

Web = 25 mm × 150 mm (excluding top flange) **[12]**

c) Explain elasto-plastic behaviour of a beam in flexure and find expression for moment of resistance. **[8]**

***P.T.O.***

***Q2)*** a) A Portal frame ABCD is fixed at A & D. Columns AB & DC are 6m in height & beam BC is 5m long. Mp for beam is twice that for columns. It is subjected to factored udl of 25 kN/m over BC & horizontal factored concentranted load of 40 kN at B in the direction BC. Sketch all possible mechanisms & obtain design moment Mp. Draw statically admissible bending moment diagram. **[12]**

b) A continuous beam ABCD is simply supported at A,B,C & D. Span AB = 5m. BC 4m & CD = 6m. Mp is uniform. It is subjected to factored loads as under,

i) Total udl value on AB & CD = W.

ii) Concentrated load 2 W at center of BC.

Find collapse load 'W' & draw statically admissible bending moment diagram. What is the type of collapse? **[13]**

***Q3)*** A symmetrical gable portal frame ABCDE has bases A & E fixed 15 m apart. Vertical columns AB & ED each equal to 5 m & apex C is 10 m above base. It is subjected to horizontal load 35 kN at B & concentrated load of 70 kN each at centre of each gable beam. Mp is uniform. **[25]**

a) Draw all basic mechanisms and obtain Mp in each case.

b) Draw (sway + Gable) mechanism & obtain Mp

c) Draw free body diagram of beam & column.

## SECTION - II

***Q4)*** a) Classify symmetrical 'I' section having width of flange 280 mm & overall depth 350 mm. Thickness of section is 20 mm uniform. $F_y$ = 280 MPa. If this section is used as a beam, find moment of resistance as per IS : 800-2007 codal provisions. **[15]**

b) How the cross sections are classified in Limit State Theory? What are their significance? **[5]**

c) Explain in brief philosophy of Limit state design. **[5]**

***Q5)*** A column between floor of a multi-storey building frame is subjected to load and moment as mentioned below: **[25]**

Ultimate axial compression = 1100 kN

Ultimate moments about major axis:

At Top = 150 kN m

At Bottom = 70 kN m

The effective length of column is 5.5m.

It is braced at its mid-height to provide local lateral restraint for buckling about y-y axis. Design the section & use specifications for interaction between moment & axial compression

***Q6)*** Design symmetrical gable portal frame for workshop shed of span 30m. Height of both columns is 12m and apex is at 15m from base. Column bases are fixed. AC sheet is used over purlins. Using (DL + LL) combination, design uniform section for bending as per IS:800-2007. **[25]**

Total No. of Questions : 6]

SEAT No. :

**P4601**

[Total No. of Pages : 2

# [4960] - 44

## M.E. (Civil - Structures)

## DESIGN OF INDUSTRIAL STRUCTURES

## (2008 Course)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Attempt any two questions from Section I and Section II.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data, if necessary and clearly state.***
6) ***Use of electronic pocket calculator, steel table and IS 800 are allowed.***
7) ***Use of cell phone is prohibited in the examination hall.***

## SECTION - I

***Q1)*** a) Analysis the industrial building bents for columns **[18]**

i) hinged at base

ii) fixed at base

iii) partially fixed at base and draw moment diagram

b) State and explain design consideration of roof column and its base.**[7]**

***Q2)*** The span of a knee roof trusses used over an industrial building 28 m long is 18 m. The pitch of roof truss is 1 in 4. The GI Sheets are used for roof covering. The basic wind pressure is 1.5 kN/m$^2$. The height of eaves above ground level is 8 m. Propose a suitable type of roof truss. Determine the loads at various panel points due to dead load, live load and wind load. Also determine the reaction. **[25]**

***Q3)*** Design of gable portal frame without gantry loads for the data given in Q.2 and draw the design sketches. **[25]**

***P.T.O.***

## SECTION - II

***Q4)*** a) Explain in details design concept of open web frames for industrial shed with suitable sketches. **[13]**

b) State the application of truss purlin and explain in brief design consideration. **[12]**

***Q5)*** a) State and explain design consideration of mobile gantry structure. **[15]**

b) State and explain design consideration of machine foundation. **[10]**

***Q6)*** Design suitable bracing systems for industrial structure of Q.2. **[25]**

❐❐❐❐

Total No. of Questions : 6]

SEAT No. :

P4187

[Total No. of Pages : 2

# [4960]-45

## M.E. (Civil / Structures)

## THEORY OF PLATES AND SHELLS

## (2008 Pattern)

*Time : 4 Hour]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Attempt any two questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of non programmable electronic calculator is allowed.***
6) ***Assume suitable data, if necessary.***

### SECTION - I

***Q1)*** a) For analysis of plates, state and explain various assumptions made in small deflection theory. **[5]**

b) Derive the governing differential equation in Cartesian coordinates for bending of rectangular thin plates. Discuss the boundary conditions. **[12]**

c) For isotropic plates, under the action of lateral loading determine the stress-strain relations and hence the moment curvature relations in Cartesian coordinate system. **[8]**

***Q2)*** a) Derive Navier's solution for deflection a simply supported rectangular plate under uniform intensity of loading q. **[16]**

b) For a simply supported isotropic plate subjected to uniform intensity of loading q, apply Ritz' s method to obtain the expression for deflected shape of the plate. **[9]**

***Q3)*** Develop from first principles, governing differential equation for circular plate under axisymmetric loading. Also obtain the expressions for radial moment at the center of clamped plate. **[25]**

***P.T.O.***

## SECTION - II

***Q4)*** a) Derive the expressions for the strains in the shell at a point due to membrane actions. **[18]**

b) Classify thin shell into various types of based on shell geometry and curvature. **[7]**

***Q5)*** a) Derive equilibrium equation and hence equation for deflection using general cylindrical shell theory(considering bending action) for axisymmetric load. **[20]**

b) State the advantages of the shell structure as compared to plates. **[5]**

***Q6)*** a) Explain the need for the bending theory for the analysis of the shell structure. **[5]**

b) Describe in brief, the Lundgren's beam theory for thin shells. **[5]**

c) For a cantilever cylindrical open shell of length L, radius a, and half angle $\varphi_o$ subjected to self weight , obtain the expression membrane stresses $N_x$, $N_\varphi$, and $N_{x\varphi}$. **[15]**

Total No. of Questions : 6]

SEAT No. :

P4188

[Total No. of Pages : 2

# [4960]-46

## M.E. (Civil Structures)

## FINITE ELEMENT METHOD

## (2008 Pattern) (Semester - II)

*Time : 4 Hour]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any two questions from each section.***
2) ***Answer to the two sections should be written in separate books.***
3) ***Figures to the right indicate full marks.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Use of non programmable calculator is allowed.***
6) ***Assume suitable data, if necessary***

### SECTION - I

***Q1)*** a) Using potential energy approach derive stiffness matrix for a beam element. **[10]**

b) A bar element, with axial displacement 'x' as degree of freedom at end nodes, derive [K] for element using Polynomial displacement function. **[10]**

c) Explain variational methods and their applications in finite element analysis. **[5]**

***Q2)*** a) Determine the shape function for the Linear Strain Triangular (LST) element. Use polynomial functions. **[16]**

b) Explain with suitable examples compatible and completeness requirements of displacement functions. **[9]**

***Q3)*** a) Using serendipity concept find shape functions for a 8 noded quadratic seredipity family element. **[10]**

b) What is derivative transformation? How is it carried out with the help of a Jacobian? Where is such a transformation required in FEM? **[15]**

***P.T.O.***

## SECTION - II

***Q4)*** a) Explain strain-displacement and stress-strain relationships for triangular problem. Hence, derive necessary matrices for formulation of stiffness matrix of triangular axisymmetric element. **[18]**

b) Explain the method of finding shape function for a hexahedral element using natural coordinates. **[7]**

***Q5)*** a) Explain Midlin's theory of plate bending? **[7]**

b) Write displacement functions for both ACM and BFS elements. Verify conformity of both the elements. **[18]**

***Q6)*** a) Explain the concept of degenerated solid elements by suitable examples. **[10]**

b) Explain membrane and bending actions in shell elements. How these two states of stresses are considered in formulating [K] for shell element. **[15]**

Total No. of Questions : 12]

SEAT No. :

**P5078**

[Total No. of Pages : 3

# [4960]-48
## M.E. (Civil) (Structures)
## EARTHQUAKE RESISTANT DESIGN OF BUILDINGS
## (2008 Pattern)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 from section I and Q.7 or Q.8, Q.9 or Q.10. and Q.11 or Q.12 from section II.***
2) ***Answers to the two sections must be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the write indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary***
7) ***Use of IS 1893-2002 (Part-1) is permitted***

## SECTION - I

***Q1)*** a) What are the causes and types of earthquake? **[6]**

b) What are the different major plates? Explain the Plate Tectonic Theory in details? **[6]**

c) Describe the approaches used to measure the size of an earthquake? **[6]**

OR

***Q2)*** a) Describe code based methods of seismic analysis? **[6]**

b) What is non-structures? Explain various approaches to deal with non-structures? **[6]**

c) Write a note on body waves and surface waves in an earthquake? **[6]**

***Q3)*** a) Explain in brief some of the earthquakes occurred in India? What lessons are learnt from them? **[8]**

b) What are the criteria or demands of seismic resistant design of structures? **[8]**

***P.T.O.***

OR

***Q4)*** a) Describe with examples the effect of different irregularities in a structure in an earthquake prone area? **[8]**

b) What is soil liquefaction? What are the measures taken to reduce it. **[8]**

***Q5)*** A plan of five storey SMRF building for T.V. Centre is as shown in figure 3.1. The Dead Load including self weight of slab etc. is 5 kN/m$^2$ and Live Load 4 kN/m$^2$ on each floor and 1.5 kN/m$^2$ on the roof. The building is situated in Zone IV .Assuming soil type II and storey height 3.5 m, determine lateral forces and shears at different storey levels. **[16]**

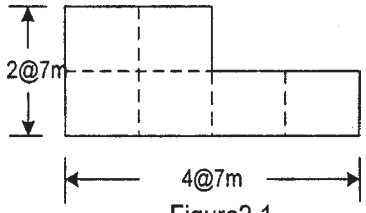

Figure2.1

OR

***Q6)*** Determine frequency and design seismic coefficient for an ordinary masonry shear wall in primary health centre at Killari, given the following data- Roof Load- 20 KN/m, Height of Wall - 3.5 m, Width of wall - 0.3 m , Unit weight of wall -20 KN/m2,Type of soil - Rocky **[16]**

## SECTION - II

***Q7)*** a) How would you carry the assessment of RC building to ascertain the requirements and level of retrofitting? **[8]**

b) Describe with suitable sketches the various methods of retrofitting. **[10]**

OR

***Q8)*** a) What are the causes of instability of steel buildings? Discuss in detail the P- $\Delta$ Effect. **[8]**

b) Explain the procedure to carry dynamic analysis of multistory structure to obtain seismic forces and distribution along the height? **[10]**

***Q9)*** a) Give reasons for poor performance of masonry buildings? How to improve the seismic performance of masonry building? **[8]**

b) Describe the restoration of masonry buildings? **[8]**

OR

***Q10)***a) Design a RC rectangular beam of span 6m supported on RC columns to carry a point load of 150kN in addition to its self weight 3kN/m. The moment due to seismic load is 6kN.m and shear force 30kN. Use M20 grade concrete and Fe 250 grade steel. **[16]**

***Q11)***a) What is necessity of ductile detailing? Explain with sketches ductile detailing of flexural member? **[8]**

b) Explain concept of base isolation? Describe different techniques of base isolations? **[8]**

OR

***Q12)***a) How would you carry the assessment of RC building to ascertain the requirement of level of retrofitting? **[8]**

b) Explain in detail the non-conventional techniques for retrofitting of RC building? **[8]**

Total No. of Questions : 6]

SEAT No. :

P4189

[Total No. of Pages : 2

# [4960]-49

## M.E. (Civil Structure) (Semester - II)

## STRUCTURAL STABILITY

## (2008 Pattern) (Elective - III)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any two questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of nonprogrammable pocket Calculator is allowed.***
6) ***Assume Suitable data if necessary.***

### SECTION - I

***Q1)*** a) Explain elastic stability and instability. **[12]**

b) Explain energy method for analysis of stability of structure. **[13]**

***Q2)*** a) Explain column with geometric imperfections, write its governing equations of equilibrium. **[12]**

b) Analyze the column with one end clamped and other hinged boundary condition. **[13]**

***Q3)*** a) Stability of structure is an eigen value problem. Discuss. **[10]**

b) Diffentiate structural stability of elastic buckling and Inelastic buckling of columns. **[15]**

### SECTION - II

***Q4)*** a) A beam column subjected to a uniformly distributed load through out its span. Obtain the expression for maximum deflection and maximum moment. **[13]**

***P.T.O.***

b) What are approximate methods of analysis Compute the critical load of the frame shown in figure 1. All the members have the same El. **[12]**

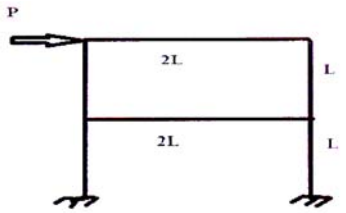


Fig 1

***Q5)*** a) Explain Galarkin's large deformation theory for thin plates. **[10]**

b) Sketch the different modes of buckling of portal frames. **[5]**

c) Draw free body diagram for elastic plate loaded in one of the directions axially. Show the elastic deformation along with boundary conditions. **[10]**

***Q6)*** a) Explain the role of finite element method in structural stability analysis. What is stress stiffness matrix? **[10]**

b) Explain discreet and continuous system. What are the governing equations for stability of each system, explain at least one. **[15]**

**Total No. of Questions : 8]** **SEAT No. :**

**P4162** **[Total No. of Pages : 3**

# [4960]-5

## M.E. (Civil Construction and Management)

## DISASTER MANAGEMENT

### (2008 Pattern) (Elective - I)

***Time : 4 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Question No. 1 and 5 are compulsory. Out of the remaining attempt any two questions from Section I and two questions from Section II.***
3) ***Answers to the two sections must be written in separate answer books.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Figures to the right indicate full marks.***
6) ***Use of logarithmic tables, slide rule, Moiller charts, electronic pocket calculator and steam tables is allowed.***
7) ***Assume suitable data wherever necessary.***

## SECTION - I

***Q1)*** a) Enlist various types of terrestrial disasters. Which of these disasters are man made and natural disasters? Discuss about preventive measures related to these disasters. **[6]**

b) Discuss about the physical, economic and environmental losses that occur on account of forest fires and volcanoes. **[6]**

c) In event of a major natural disaster it is common phenomenon of outbreak of epidemic diseases. Enlist the causes of this type of secondary disaster and suggest suitable preventive measures. **[6]**

***Q2)*** a) Write a note on Tsunami. **[6]**

b) Which type of disasters can be predicted in advance? **[6]**

Discuss the features of early warning systems.

c) Explain the term vulnerability with suitable examples. **[4]**

***P.T.O.***

***Q3)*** a) Which type of natural disasters can be mitigated so as to have minimum loss to life and property? Discuss mitigation measures for any one of these disasters. **[5]**

b) Is rapid depletion of ground water a type of disaster? To which category this belong? What are the reasons for this problem? **[5]**

c) Carry out the cause - effect analysis for following disasters : **[6]**

i) Loss of glaciers.

ii) Unseasonal and extreme precipitation.

iii) Forest Fires.

***Q4)*** a) What do you mean by Contingency Planning in case of Natural Disasters? Explain this concept with respect to cyclone disaster clearly detailing the steps involved. **[8]**

b) Enlist and explain various terms and concepts with respect to earthquakes. **[4]**

c) Explain the different methods for awareness creation in community with respect to disaster preparedness. **[4]**

## SECTION - II

***Q5)*** a) As a planning engineer being a part of Disaster response team, plan a relief camp for a village with population of 10000 people affected by flood disaster. The planning and design thumb rules should be clearly stated and in conformance with SPHERE GUIDELINES. Undertake the design process for: **[10]**

i) Water supply and sanitation.

ii) Solid waste management.

b) What are the different sources of drinking water? Enlist and explain the various technical criteria considered for short listing an appropriate source in case of emergency response. **[4]**

c) Discuss importance of sanitation in emergencies. Explain in detail link of Sanitation with water supply and hygiene promotion. **[4]**

***Q6)*** a) It is often said the Disasters know no boundaries and religions. How will you manage cross border natural disasters affecting multiple countries? What will be the issues involved: **[8]**

i) If the countries are friendly.

ii) If the countries are hostile.

b) It is said the nature provides effective protection against disastrous impact of natural disasters. Explain this statement with suitable examples. **[8]**

***Q7)*** a) Explain Disaster Response Mechanism in India. Discuss the organization structure for Response mechanism from Central Government level to District level administration clearly explaining the roles and responsibilities of all concerned involved. **[8]**

b) Enlist various water treatment processes available in case of water supply in emergency response. Explain in detail with appropriate sketches any two methods. **[8]**

***Q8)*** Write short notes on : **[16]**

a) Emergency Response process

b) Civil Engineering interventions in Emergencies.

c) Ground water sources and their yield.

d) Water quality standards in Emergencies.

**Total No. of Questions : 8]** **SEAT No. :**

**P5109** **[Total No. of Pages : 3**

# [4960]-50

## M. E. (Civil) (Structure)

## STRUCTURAL RELIABILITY

### (2008 Pattern) (Elective - III) (Semester - II)

***Time : 4 Hours]*** ***[Max. Marks : 100***

***Instructions to the candidates:***

1) ***Answers to the two sections should be written in separate answer book.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of Calculator is allowed.***
6) ***Assume suitable data if necessary.***

## SECTION - I

***Q1)*** a) Compare 'Discrete Variables' and 'Continuous Variables' in pretext of their probability laws and simple illustrative examples. **[6]**

b) The cube strength of concrete, X, follows the normal distribution with the mean and the standard deviation values as 25 $N/mm^2$ and 5 $N/mm^2$ respectively. Calculate the probability of getting a value for strength less than 20 $N/mm^2$. **[6]**

c) Derive an expression for probability of failure for the case of load (S) and resistance (R) following the log normal distribution. **[5]**

***Q2)*** a) Compare critically the conventional methods of structural design with respect to evaluation of safety. **[6]**

b) The test results of the cube strength and cylinder strength of seven batches of concrete laid in footings in a day on a construction site are given below : **[5]**

| Sr. No. of Batch | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Cube Strength ($N/mm^2$) | 22.07 | 19.07 | 24.55 | 22.39 | 19.97 | 18.02 | 15.75 |
| Cylinder Strength ($N/mm^2$) | 14.25 | 12.02 | 15.30 | 14.55 | 12.25 | 11.47 | 10.05 |

Determine the sample covariance and correlation coefficient between cube strength and cylinder strength of concrete.

***P.T.O.***

c) What is meant by 'Structural Reliability'? Explain every important term in the definition. **[5]**

***Q3)*** a) Write short note on application of "Chi-Square Test". **[6]**

b) Derive the expression for 'Reliability Index' for the case of load (S) and resistance (R) following normal distribution. **[6]**

c) Derive the expressions for the reliability of a series system and a parallel redundant system. **[5]**

***Q4)*** a) Explain the formulation of probability model for wind load along with the various variables involved. **[6]**

b) The axial load carrying capacity of a column, R, in normally distributed with mean valve and standard deviation of R being 100KN and 200KN respectively. The column is subjected to an axial load, S, which is normally distributed with mean valve and standard deviation of S being 700KN and 300KN respectively. **[5]**

c) Explain the term "Lifetime Maximum Sustained Load"? Enlist the underlying assumptions in its stochastic analysis. **[5]**

## SECTION - II

***Q5)*** a) Write short note on Monte Carlo Method with respect to its objective and procedural steps? **[6]**

b) How to generate normal variates from the distribution of Y following the normal distribution. **[6]**

c) Write a short note on decision models with designed risk level. **[5]**

***Q6)*** a) Derive the expression for generating log normal variates from the distribution of Y following the lognormal distribution with median of Y (i.e. $\hat{Y}$) and standard deviation of lognormal Y (i.e.$\sigma_{lny}$). **[6]**

b) Explain Safety Checking Formats used for a design code? **[5]**

c) Explain how the system reliability concept can be extended for decision making with design risk. **[5]**

***Q7)*** a) Derive the expression for partial safety factors specified with respect to the mean values of random variables in the reliability based design of Civil Engineering Structures. **[6]**

b) Short note on the development of reliability based design criteria. **[6]**

c) Explain Reliability based design criteria for RCC Structures. **[5]**

***Q8)*** a) Explain how to analyze the risk associated with a decision. **[6]**

b) Explain the steps in the development of a reliability based design criteria, to determine the revised partial safety factors for RCC design, as an improvement over the provisions specified in IS : 456. **[5]**

c) Write short note on decision tree analysis. **[5]**

Total No. of Questions : 6]

SEAT No. :

**P4190**

[Total No. of Pages : 2

# [4960]-51

## M.E. (Civil Structures)

## NON-LINEAR ANALYSIS OF STRUCTURE

## (2008 Pattern) (Semester - II) (Elective - III)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any two questions from each section.***
2) ***Answer to the two sections should be written in separate books.***
3) ***Figures to the right indicate full marks.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Use of non programmable calculator is allowed.***
6) ***Assume suitable data, if necessary***

### SECTION - I

***Q1)*** a) State and explain techniques of non-linear analysis. **[6]**

b) State and explain types of nonlinearities, with examples, in the analysis of structure. **[6]**

c) Find the solution for a moment curvature by non linear analysis of a simply supported beam subjected to concentrated load at midspan. **[13]**

***Q2)*** a) Explain 'Displacement Equations Approach' of nonlinear analysis of plates. **[8]**

b) Using Hamilton's principal, derive a system of 13 governing equations of geometrically non linear behaviour of plate in terms of membrane forces, moment resultants, transverse shear forces, displacement components and slope functions. **[17]**

***Q3)*** a) Derive the simplified nonlinear governing equation using Berger approximation for plates with immovable boundaries. **[13]**

b) State and explain different boundary conditions for the nonlinear analysis of plates obtained from variational technique. **[12]**

***P.T.O.***

## SECTION - II

***Q4)*** Obtain approximate solutions for the tip deflection components of cantilever column at post-buckling stage due non linear behaviour considering moment curvature relationship. **[25]**

***Q5)*** a) Explain with diagrams and derivation, the deformation of square pinned-fixed frame for compressive loading. **[15]**

b) For a two-node truss element, develop the tangent stiffness matrix and force vector corresponding to the configuration at time t. Consider large displacement and large strain conditions. **[10]**

***Q6)*** a) Write steps involved in elastic plastic analysis of frames. **[12]**

b) Obtain statics matrices by Elastic-Plastic Analysis for a member with **[13]**

i) a plastic hinge at end l

ii) a plastic hinge at end 2

iii) hinges at both the ends

Total No. of Questions : 6]

SEAT No. :

P4191

[Total No. of Pages : 2

# [4960]-52

## M.E. (Civil) (Structures)

## BIOMECHANICS AND BIOMATERIALS

## (2008 Pattern) (Semester - II) (Elective - IV)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Solve any two questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of non programmable Calculator is allowed.***
6) ***Assume suitable data if necessary.***

### SECTION - I

***Q1)*** a) Explain Bone tissue structure with suitable sketch. Explain engineering material properties as applicable to hard tissue. **[8]**

b) Explain various elasticity models applicable to tissue. Draw suitable line diagram to illustrate the same. **[9]**

c) Define Biomechanics, advantages of its study and applications. **[8]**

***Q2)*** a) Explain Biomaterial. Compatibility of biomaterial. Enlist at least five bio compatible materials and its suitable use in treatment of biomechanics related problem. **[8]**

b) Explain various non metallic materials used as bio compatible materials with its Advantages and application. **[9]**

c) What are articulating surfaces? Explain any one of it with suitable sketch and free body diagram. **[8]**

***Q3)*** a) Explain bone cement as biomaterial. What are its limitations. **[8]**

b) Explain properties of UHMWPE as prosthesis material. **[9]**

c) Explain properties of stainless steel, cobalt base alloys, Titanium base alloys when used as prosthesis material. **[8]**

***P.T.O.***

## SECTION - II

***Q4)*** a) Explain in brief anisotropy, transverse isotropy, orthotropy for bone tissue. **[9]**

b) Sketch geometry Knee joint, Show joint forces acting, contact surfaces area possible for different positions. Write the joint equilibrium equation. **[9]**

c) Explain device to measure wear of cartilage on cartilage material. **[7]**

***Q5)*** a) Explain human gait with suitable sketches, importance of gait study. **[8]**

b) Enlist and explain various measurement techniques for body motion. **[9]**

c) In which situation correction of gait is inevitable, What are ways to correct the human gait. **[8]**

***Q6)*** a) What are the fundamental design consideration for engineering design of Prosthesis. **[8]**

b) Explain step by step structural analysis and design steps of Hip joint, stem part. **[9]**

c) What is the classification of prosthetics devices? Enlist prosthetics widely used and the situations in which they are required to be used. **[8]**

Total No. of Questions : 6]

SEAT No. :

P4192

[Total No. of Pages : 2

# [4960]-53

## M.E. (Civil Structure)

## MECHANICS OF MODERN MATERIALS

## (2008 Pattern) (Semester - II) (Elective - IV)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any two questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of nonprogrammable pocket Calculator is allowed.***
6) ***Assume Suitable data if necessary.***

### SECTION - I

***Q1)*** a) Explain and enlist various fiber matrices used in FRP. **[8]**

b) What is piezoelectric material. What are its effect and applications. **[5]**

c) What is direct and converse effect. **[4]**

d) Explain classification of materials used in FRC and situations where these class of materials are advantageous. **[8]**

***Q2)*** a) Write short note on shape memory alloys( SMA) and Functionally graded materials(FGM). **[10]**

b) Explain Generalized Hookes Law for orthotropic material in 1-2-3 coordinates. **[8]**

c) Write compliance and stiffness matrices for plane stress for cross ply laminate material. **[7]**

***Q3)*** a) Explain Tsai-Hill theory of failure applicable for FRC. **[12]**

b) Explain stress strain behavior of FRC. **[13]**

***P.T.O.***

## SECTION - II

***Q4)*** a) Explain force moment resultant with neat diagram for a typical laminate. **[10]**

b) Explain and sketch : **[15]**

i) Unidirectional laminate

ii) Symmetric Laminate

iii) Symmetric Cross-ply Laminate

iv) Symmetric Angle - Ply laminate

v) Antisymmetric Laminate

***Q5)*** a) Write constitutive relation of a lamina subjected to hydrothermal expansion in plane stress condition. **[10]**

b) The lamina of size 60mm × 60 mm in direction 1-2-3 material direction are: **[15]**

$\alpha_1 = -0.018 \times 10^{-6} \ / c^0, \ \ \alpha_2 = 24.3 \times 10^{-6} \ / c^0$

Find transformed thermal expansion coefficient $\alpha_x$, $\alpha_y$, $\alpha_{xy}$, and free thermal strains along 45° relative to x- axis.

***Q6)*** a) Explain manufacturing of composite. **[8]**

b) List tests carried out for determination of properties of composite, Explain Biaxial testing and inter laminar fracture toughness of composite material. **[17]**

Total No. of Questions : 6]

SEAT No. :

**P4193**

[Total No. of Pages : 2

# [4960]-54
# M.E. (Civil Structures)
# THEORY OF PLASTICITY
# (2008 Pattern) (Elective - IV)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any two questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***All questions carry equal marks.***
6) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
7) ***Assume Suitable data if necessary.***

## SECTION - I

***Q1)*** a) A beam of narrow rectangular cross section of unit width simply supported at the ends loaded by its own weight. Find expressions for displacement component *u* and *v*. **[15]**

b) Derive equations of equilibrium for two dimensional elasticity problems in polar coordinates. **[10]**

***Q2)*** a) The state of stress at a point is given by $\sigma_x$ = 60 MPa; $\sigma_y$ = 125 MPa; $\tau_{xy}$ = 35 MPa. If the yield strength of the material is 120 MPa in a uniaxial tensile test, determine whether yielding will occur according to Tresca's and Von-Mises yield condition or not. **[15]**

b) Write short note on yield surfaces. **[10]**

***Q3)*** a) A thick cylinder of internal radius 20 cm and external radius 30 cm is subjected to an internal pressure '*p*' MPa. If the yield stress for the cylinder material is 230 N/mm$^2$, determine (a) the pressure at which the cylinder will start yielding just at the inner radius (b) the stresses when the cylinder has a plastic front radius of 25 cm. Assume Von-Mises yield condition and state of plane strain. **[15]**

b) The state of stress at a point is given by, $\sigma_x = 0.60 \times 10^3$ kg/cm$^2$; $\sigma_y$ = 1.25 kg/cm$^2$ and $\tau_{xy}$ = 0.3 kg/cm$^2$. If the yield strength of the material is 1.25 kg/cm$^2$ in a uniaxial tensile test, determine whether yielding will occur according to Tresca's and Von-Mises yield condition or not. **[10]**

***P.T.O.***

## SECTION - II

***Q4)*** a) Write short note on : **[15]**

i) Isotropic hardening model

ii) Kinematic hardening model

b) Explain initial and subsequent yield surfaces in tension. **[10]**

***Q5)*** a) Determine the plastic deformation of the bar if the whole elongation $\Delta l = 0.02m$, the original length of the bar was $l = 3.0m$, assumption is elasto-plastic behaviour of material. E = 210 GPa and $f_y$ = 275 MPa. **[15]**

b) State and explain uniqueness theorems. **[10]**

***Q6)*** a) Explain Tressca's yield condition in plane stress and plane strain. **[10]**

b) Explain the finite element models for plasticity problems. **[15]**

Total No. of Questions : 6]

SEAT No. :

**P4194**

[Total No. of Pages : 2

# [4960]-55
# M.E. (Civil Engg. Structures)
# OPTIMIZATION TECHNIQUES
# (2008 Pattern) (Elective - IV)

*Time : 4 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any two questions from section - I and two questions from section - II.***
2) ***Figures to the right indicate full marks.***

## SECTION - I

***Q1)*** a) State the broad classification of optimization problems and techniques. **[13]**

b) Elaborate single variable optimization and multivariable optimization with equality and inequality constraints. **[12]**

***Q2)*** a) Explain revised simplex method with suitable examples. **[13]**

b) Elaborate Decomposition principle, and Post-optimality analysis in Linear Programming. **[12]**

***Q3)*** Draw the flowchart and algorithm of following: **[25]**

Non-Linear Programming Problem.

a) Fibonacci Method.
b) Golden Section Method.
c) Quadratic Interpolation Method.
d) Cubic Interpolation Method.
e) Direct Root Method.

## SECTION - II

***Q4)*** a) What is unconstrained optimization and what are the engineering applications? **[10]**

b) Explain : **[15]**

i) Indirect search method and Direct search method.
ii) Random search method and Steepest Descent (Cauchy) method.
iii) Univariate and pattern search method.

***P.T.O.***

***Q5)*** a) What is constrained optimization and what are the engineering applications? **[10]**

b) Explain : **[15]**

i) Interior Penalty function method.

ii) Convex Programming.

iii) Reduced Gradient method.

***Q6)*** a) Develop the Artificial Neural Network Model for Civil Engineering Application. **[13]**

b) Explain with suitable sketch and examples selection operator, crossover operator and mutation operator in genetic algorithm. **[12]**

Total No. of Questions : 6]

SEAT No. :

**P4195**

[Total No. of Pages : 4

# [4960]-56

# M.E. (Civil) (Environmental Engg.)

# NUMERICAL METHODS AND APPLIED STATISTICS

*Time : 3 Hour]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any two question from each section.***
2) ***Figures to the right side indicate full marks.***

## SECTION - I

***Q1)*** a) Find the inverse of Matrix $\begin{bmatrix} 1 & 1 & 1 \\ 2 & -3 & 4 \\ 3 & 4 & 5 \end{bmatrix}$ using Gauss Jordan method and hence solve the system $x + y + z = 9$ **[9]**

$$2x - 3y + 4z = 13$$

$$3x + 4y + 5z = 40$$

b) Determine the roots of the equation $x^2 + xy = 6,\ x^2 - y^2 = 3$ using Newton-Raphson method. **[8]**

c) Find $f(22)$ from the Gauss forward formula for the following observations: **[8]**

| $x$: | 0 | 1 | 2 | 5 |
|---|---|---|---|---|
| $f(x)$: | 2 | 3 | 12 | 147 |

***Q2)*** a) The following data give the number of finished articles per day by different number of workers in a factory

| No.of articles : | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|---|---|---|---|---|---|---|---|---|---|---|
| No.of worker : | 3 | 7 | 11 | 14 | 18 | 17 | 13 | 8 | 5 | 4 |

Find mean, standard deviation and coefficient of variation of daily output of finished articles. **[8]**

***P.T.O.***

b) A company producing cold drinks has two bottling plant located at $T_1$ and $T_2$. Each plant produces three drinks A,B,C and their production capacity per day is as below: **[8]**

| Cold drink | Plant | |
|---|---|---|
| | $T_1$ | $T_2$ |
| A | 6,000 | 2,000 |
| B | 1,000 | 2,500 |
| C | 3,000 | 3,000 |

The market demands 80,000 bottles of A and 22,000 bottles of B and 40,000 bottels of C during month of June. The operating cost per day of plant $T_1$ and $T_2$ are Rs. 6000 and 4000 respectively. Find graphically the number of days for which each plant must run in June So as to minimize the operating costs while meeting the market demand.

c) A firm produces three products which are processed on three machines. The relevant data is as below:

| Machine | Time per unit | | | Mach. Capacity |
|---|---|---|---|---|
| | A | B | C | min/day |
| $M_1$ | 2 | 3 | 2 | 440 |
| $M_2$ | 4 | - | 3 | 470 |
| $M_3$ | 2 | 5 | - | 480 |

The profit per unit products A, B, C is Rs 4, 3, 6 respectively Determine the daily no. of units to be manufactured for each product assuming that all the units of product are consumed in the market. **[9]**

***Q3)*** a) For the following distribution, find the first four moments about mean, coefficient of skewness and kurtosis: **[9]**

| x : | 50-70 | 70-90 | 90-110 | 110-130 | 130-150 | 150-170 | 170-190 |
|---|---|---|---|---|---|---|---|
| f : | 4 | 8 | 12 | 20 | 6 | 7 | 3 |

b) State and prove theorem of compound probability. **[8]**

c) The probabilites of three events A, B, C are 0.25, 0.45 and 0.2 respectively. The conditional probability of event x occur are as $p(x|A)=0.8$, $p(x|B)=0.65$ & $p(x|C)=0.3$. Find probability of $p(A|x)$, $p(B|x)$ and $p(C|x)$ **[8]**

## SECTION - II

***Q4)*** a) Find the density function of product of two independent random variables. **[8]**

b) Find the mean, variance with standard deviation of binomial distribution with parameter n and p. **[8]**

c) As a result of test on 20,000 electric fans manufactured by a company. If was observed that lifetime of the fan was normally distributed with an average life of 2040 hours and standard deviation of 60 hours. Estimate the number of fans that is expected to run fan: **[9]**

i) more that 2150 hours.

ii) less than 1960 hours.

***Q5)*** a) Write short notes: (any two) **[10]**

i) Cofidence Interval

ii) Good Estimater

iii) Testing of Hypothesis

b) 400 labours were selected at random from a certain city. Their mean income was 1700 per month. with standard deviation of Rs. 140, set up 95% level of cofidence limits within which the income of the labour community of the district is expected to lie. **[8]**

c) Two groups A and B consists of 100 people each who have a disease. A serum is given to group A but note to group B. It was found that in group A and B, 75 and 65 people respectively recover from the disease. Test the hypothesis that serum helps to cure disease. **[7]**

***Q6)*** a) Calculate Pearson's coefficient of correlation between advertisement cost and sales as per data given below: **[8]**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Adv.cost.in Rs : | 39 | 65 | 62 | 90 | 82 | 75 | 25 | 98 | 36 | 78 |
| Sales in lakhs: | 47 | 53 | 58 | 86 | 62 | 68 | 60 | 91 | 51 | 84 |

b) Obtain the two regression equations between purchase and sales by least square method and obtain the likely sales when the purchases equal 100. **[8]**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Purchase : | 62 | 72 | 98 | 76 | 81 | 56 | 76 | 92 | 88 | 49 |
| Sale : | 112 | 124 | 131 | 117 | 132 | 96 | 120 | 136 | 97 | 85 |

c) Following table shows sales of four salesman A, B, C, D in three seasons. Carry out analysis of variance. **[9]**

| Season | Salesman | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | Total |
| Summer | 36 | 36 | 21 | 35 | 128 |
| Winter | 28 | 29 | 31 | 32 | 120 |
| Monsoon | 26 | 28 | 29 | 29 | 112 |
| Total | 90 | 93 | 81 | 96 | 360 |

Total No. of Questions : 10]

SEAT No. :

P4196

[Total No. of Pages : 2

# [4960]-57
# M.E. (Civil Environmental Engg.)
# AIR POLLUTION AND CONTROL
# (2010 Pattern)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any 3 questions from each section.***
2) ***Figures to the right indicate full marks.***
3) ***Your answers will be valued as a whole.***
4) ***Assume suitable data, if necessary.***
5) ***Use of electronic pocket calculator and steam table is allowed.***

## SECTION - I

***Q1)*** Answer the followings :

a) What are the sources and classification of air pollutants? **[8]**

b) Global effects of air pollution with suitable example. **[8]**

***Q2)*** Discuss the following in detail : **[18]**

a) Photochemical smog

b) Effects of air pollution on Human health

c) Effects of air pollution vegetation

***Q3)*** a) What is lapse rate? Discuss its relation with temperature variation. **[8]**

b) Draw and explain the plume behavior of different heights which are seen in industrial area. **[8]**

***Q4)*** a) Write features of Gaussian plume model and give the limitations of Gaussian-plume models. **[12]**

b) What is Air Pollution Index ? Explain. **[4]**

***Q5)*** A thermal power plant bums 100 tonnes of coal with 5.5% sulphur content. Calculate the minimum stack height required. The particulate concentration in flue gases is 8000mg/$m^3$ and the gas flow rate is 20$m^3$/sec. **[16]**

***P.T.O.***

## SECTION - II

***Q6)*** a) Give the Indian Air Quality Standards (SPM, $SO_2$, NOx, CO) for Residential, Industrial and Sensitive areas. **[10]**

b) Write short notes on various kinds of Air Quality Standards. **[8]**

***Q7)*** a) Explain the Venturi scrubber with a neat sketch. **[8]**

b) A cylindrical electrostatic precipitator of diameter 0.3m is used for separating pulverized coal fly-ash particles from a furnace gas stream. If the volumetric flow rate of the gas is 0.05 $m^3$/sec, what will be the length of precipitator for obtaining a collection efficiency of 99.9%. What percent change in electrode collection area is required to increase the collection efficiency from 99.9 to 99.95%? **[8]**

***Q8)*** a) Describe the scenario of air pollutants generated in automobiles and Industrial processes. **[8]**

b) India's one of the most widely used fossil fuels is coal. How does it affect our environment from air pollution point of view? **[8]**

***Q9)*** a) What is the minimum size of the particulates removed though the following control equipments : **[8]**

i) Settling chambers

ii) Cyclones

iii) Fabric filters

iv) ESP's

b) Explain about Absorption, Adsorption processes of pollution control. **[8]**

***Q10)*** a) Discuss the effects of particulates on earth-atmosphere heat balance. **[6]**

b) Describe the effects of air pollution on historical monument with suitable example within India. **[10]**

Total No. of Questions : 8]

SEAT No. :

**P4956**

[Total No. of Pages : 2

# [4960]-58

# M.E. (Civil) (Environmental Engg.)

# PHYSICO-CHEMICAL PROCESS FOR WATER AND WASTE WATER TREATMENT

## (2010 Pattern) (Semester - I)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Use of non-programmable calculators are allowed.***
3) ***Neat sketches to be drawn wherever necessary.***
4) ***Make suitable Assumptions if necessary.***
5) ***Figures to the right indicate full marks.***

## SECTION - I

***Q1)*** Explain water quality index. Discuss the significance of drinking water quality criteria and its importance in the design of water quality standards. **[18]**

***Q2)*** A Modern society discharges 50 MLD of domestic sewage. Draw the flow diagram for treating this sewage. Discuss the concept on which the design of the proposed treatment units is based. **[16]**

***Q3)*** a) Discuss the importance of Langlier index? Explain how to calculate it. **[8]**

b) Discuss the double layer theory of particle destabilization. **[8]**

***Q4)*** Answer the following with respect to filters **[4×4=16]**

a) Mechanism of purification.

b) Modes of operation of RSF.

c) Operational problems of filters.

d) Negative head and Air binding in filters.

***P.T.O.***

## SECTION - II

***Q5)*** Discuss the working principle of pressure sand filter with neat sketch Discuss its advantages and limitations over Gravity filters. **[16]**

***Q6)*** a) Compare the disinfection by chlorination and by uv radiation. **[8]**

b) Discuss the factors affecting disinfection. **[8]**

***Q7)*** Discuss the process of ION Exchange and nano filtration. **[16]**

***Q8)*** Write a short note on following (All) **[3×6=18]**

a) Disinfection by chlorine dioxide.

b) Ultrafiltration.

c) Comparision between slow sand and Rapid Gravity filter.

x x x

Total No. of Questions : 8]

SEAT No. :

P4602

[Total No. of Pages : 2

# [4960] - 59

## M.E. (Civil) (Environmental Engineering)

## AIR AND WATER QUALITY MODELLING

## (2010 Pattern)

*Time : 3 Hours]* *[Max. Marks :100*

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Use of non programmable calculators are allowed.***
3) ***Neat sketches to be drawn wherever necessary.***
4) ***Make suitable assumptions if necessary.***
5) ***Figures to the right indicates full marks.***

## SECTION - I

***Q1)*** a) Discuss the importance of model building and write the steps in the model development. **[8]**

b) Explain the importance of calibration and verification of models. **[10]**

***Q2)*** a) Discuss the simple transport models. **[8]**

b) Discuss the historical development of water Quality Model. **[8]**

***Q3)*** a) Discuss the modifications of streeter phelps equation. **[8]**

b) Discuss the lake water quality models with assumptions and Reliability. **[8]**

***Q4)*** a) Discuss the importance of atmospheric stability in air Quality Modelling. **[8]**

b) Discuss the various atmospheric conditions for transport and duffision of stack emissions. **[8]**

***P.T.O.***

## SECTION - II

***Q5)*** a) Write a short note on "Stack Plume Characteristics". **[8]**

b) Discuss the air modelling techniques for non-reactive pollutants. **[8]**

***Q6)*** a) Discuss the modification of Gaussian Plume equation. **[8]**

b) Discuss the feature of fixed box model. **[8]**

***Q7)*** a) Discuss the Industrial effluent index. **[8]**

b) Discuss the importance of water and air quality index in the modelling studies. **[8]**

***Q8)*** Write a short note on following : **[3 × 6 = 18]**

a) Determination of WQI.

b) NAAQS, 2009.

c) Determination of Air Quality Index.

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Total No. of Questions : 8]

SEAT No. :

**P4413**

[Total No. of Pages : 2

# [4960]-6

## M.E. (Civil) (Construction & Management)

## REPAIRS, REHABILITATION, RETRO FITTING OF STRUCTURES

## (2008 Pattern) (Elective-I)

*Time : 4 Hours]* *[Maximum Marks : 100*

***Instructions to the candidates:***

1) ***Question No 1 and 5 are Compulsory. Out of the remaining attempt any two questions from Section I and two questions from Section II.***
2) ***Answers to the two Sections must be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data whenever necessary.***

### SECTION - I

***Q1)*** Explain holistic model of corrosion of RCC and discuss the method of retrofitting of sewage structure? **[18]**

***Q2)*** Explain the essential parameters for repairs and the Explain materials for repairs? **[16]**

***Q3)*** Discus performance requirements of repairs system and elaborate in details different repairs stage with fig.? **[16]**

***Q4)*** Rational approach to any Repairs and rehabilitation works also describe step by step of repairs management? **[16]**

### SECTION - II

***Q5)*** What are the factors related to building damages due to earthquake and how structure response to earthquake motion? **[18]**

***P.T.O.***

***Q6)*** Describe foundation rehabilitation also explains general methods of repairs? **[16]**

***Q7)*** Application of new material in repairs and rehabilitation and explain retrofit of structure using innovative materials. **[16]**

***Q8)*** Elaborate the seismic rehabilitation method of RCC building in India. **[16]**

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Total No. of Questions : 10]

SEAT No. :

P4197

[Total No. of Pages : 2

# [4960]-61

## M.E. (Civil-Environmental Engg.)

## ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT

## (2010 Pattern) (Elective - I) (Semester - I)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any 3 questions from each section.***
2) ***Figures to the right indicate full marks.***
3) ***Your answers will be valued as a whole.***
4) ***Assume suitable data, if necessary.***

### SECTION - I

***Q1)*** Answer the followings :

a) Explain the concept of EIA and its methodologies. **[10]**

b) Discuss in detail about Base line studies. **[8]**

***Q2)*** Give note on : **[16]**

a) Documentation and selection process for EIA.

b) Explain about Background information.

***Q3)*** Write in details for : **[16]**

a) Screening.

b) Interaction Matrix.

***Q4)*** a) What do you mean by noise pollution? Discuss about identification of type of noise and its sources? **[9]**

b) With suitable example, discuss how you will collect noise data in industry. **[7]**

***Q5)*** Briefly discuss about existing air pollution levels & standards, assessment of impact & practice for air pollution control. **[16]**

***P.T.O.***

## SECTION - II

***Q6)*** a) How you will Predict and assess of impact of water due to manufacturing industries. **[9]**

b) Give the general methodologies for the assessment of impacts on ground water. **[9]**

***Q7)*** Explain in brief about : **[16]**

a) Assessment of Soil pollution.

b) Soil Standards.

***Q8)*** What you understand by prediction and assessment of impacts on cultural and socio-economic environment. Explain with example. **[16]**

***Q9)*** Give note on : **[16]**

a) Environmental Clearance.

b) Environmental management plan (EMP).

***Q10)*** Discuss the followings:

a) Categorization of industries. **[8]**

b) Rapid and Comprehensive EIA. **[8]**

Total No. of Questions : 8]

SEAT No. :

**P4198**

[Total No. of Pages : 2

# [4960]-62

# M.E. (Civil) (Environmental Engg.)

# OCCUPATIONAL SAFETY & HEALTH

## (2008 Pattern) (Elective - II)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any three questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

## SECTION - I

***Q1)*** a) Comment in detail on occupational safety and health administration. **[8]**

b) What are the OHSHAS 18001 Health & Safety Standards? **[8]**

***Q2)*** a) What is Task Analysis in Ergonomics? Explain. **[8]**

b) What is a need of ergonomics program? Explain. **[8]**

***Q3)*** a) Explain Human error and fault tree analysis. **[8]**

b) How to control hazards in automobile industry. **[8]**

***Q4)*** Write short notes on following. **[18]**

a) Occupational safety and health act.

b) Hazards in Paper and pulp mill.

c) Right to know laws.

***P.T.O.***

## SECTION - II

***Q5)*** a) Explain Electrical Safety with respect to fire prevention & protection. **[8]**

b) Explain fire development and its severity. **[8]**

***Q6)*** a) Comment on occupational health. Enlist personal safety equipments and explain uses of any two. **[8]**

b) Discuss investigation methods & different models with respect to accidents in an industrial working environment. **[8]**

***Q7)*** a) What are the health problems in construction industries? Explain. **[8]**

b) How to tackle health problems in pharmaceutical industry? Explain. **[8]**

***Q8)*** Write short notes on following. **[18]**

a) Types of fires.

b) Occupational health measures in operating anaerobic digester.

c) Hazard control in manufacturing & processing industries.

Total No. of Questions : 8]

SEAT No. :

P4199

[Total No. of Pages : 2

# [4960]-63

## M.E. (Civil - Environmental Engg.)

## PRINCIPLES AND DESIGN OF BIOLOGICAL TREATMENT SYSTEM

## (2010 Pattern) (Elective - II) (Semester - I)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any 3 questions from each section.***
2) ***Figures to the right indicate full marks.***
3) ***Your answers will be valued as a whole.***
4) ***Assume suitable data, f necessary.***
5) ***Use of electronic pocket calculator and steam table is-allowed.***

### SECTION - I

***Q1)*** a) Explain Objectives of biological treatment. **[9]**

b) Explain attached and suspended growth process. **[9]**

***Q2)*** Give note on : **[16]**

a) TOC, BOD5, AOX and COD.

b) Batch type and continuous type reactor.

***Q3)*** a) Design a horizontal flow grit chamber with rectangular cross section for treating maximum sewage flow of 10 MLD at maximum temperature of 34 °C during summer and minimum temperature of 15 ° C in winter. **[10]**

b) Write about Biological characteristics of wastewater. **[6]**

***Q4)*** a) A suspension contains particles of grit with a diameter of 0.2 mm and specific gravity of 2.65. For particles of this size $C_D$= 10, f = 0.03, and $\beta$ = 0.06. The suspension also contains organic solids of same size for which the specific gravity is 1.10 v and f are unchanged. Determine the settling velocity of the grit and the scour velocity of grit and organic material. Where $C_D$= Drag Coefficient, f = Darcy-weisbach friction factor, $\beta$ = Friction factor of particles. **[10]**

b) Explain Flow equalization. **[6]**

***P.T.O.***

## SECTION - II

***Q5)*** Give notes on : **[18]**

a) Activated Sludge Process

b) Trickling Filters

c) R.B.C.

d) Aerated Lagoons

***Q6)*** a) What are the mechanism of sewage treatment by septic tank? Explain. **[6]**

b) Design an out fall circular sewer of the separate system running 0.7 times full for a town with a population of 80,000 persons with water supply at 200 lpcd. The sewer can be laid at a slope of 1 in 1000 with n = 0.0 12. A self-cleansing velocity of 0.75 m/sec is to be developed. The dry weather flow may be taken as 1/3 of the maximum discharge and 85% of the water supplied. **[10]**

***Q7)*** a) What is the objectives and methods of a sludge treatment? **[8]**

b) Explain anaerobic ponds. **[8]**

***Q8)*** a) Discuss operational problems in treatment plant.

b) What is Trouble Shooting?

c) Sludge management facilities.

**[16]**

Total No. of Questions : 8]

SEAT No. :

P5113

[Total No. of Pages : 2

# [4960] - 64

## M.E. (Civil) (Environmental)

## ENVIRONMENTAL RISK ASSESSMENT & MANAGEMENT

## (2010 Pattern) (Elective - II)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates :-***

1) ***Answer any THREE questions from each section. [Section I & II]***
2) ***Answers to the two sections should be written in separate answer book.***
3) ***Neat diagram must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic non - programmable calculator is allowed.***
6) ***Assume suitable data if necessary.***

### SECTION - I

***Q1)*** a) Explain the following : **[3 × 3 = 9]**

i) Sources of Environmental hazards

ii) Environmental & Ecological risks

iii) Risk Assessment framework

b) What do you understand by risk Assessment and Risk management? Explain the difference between Total Risk & Incremental Risk. **[9]**

***Q2)*** Explain the Hazard identification system in details. Discuss the problems associated with exposure risk Assessment. **[16]**

***Q3)*** Discuss the Risk characterization and consequence determination. **[16]**

***Q4)*** Discuss the estimation of carcinogenic and non - carcinogenic risks to human health. **[18]**

***P.T.O.***

## SECTION -II

***Q5)*** Discuss & in details the HOZOP and FEMA methods for Risk Assessment. **[18]**

***Q6)*** a) Discuss the Emergency Preparedness plans for Risk management. **[8]**

b) Discuss the Risk based environmental standard settings. **[8]**

***Q7)*** Discuss the risk Assessment and Management for hazardous chemical storage in a synthetic organic chemical industry. **[16]**

***Q8)*** Discuss the Risk management :

a) Hazardous waste disposal facilities. **[9]**

b) Nuclear Power Plants. **[9]**

Total No. of Questions : 8]

SEAT No. :

P4603

[Total No. of Pages : 2

# [4960]-65

## M.E. (Civil) (Environmental Engineering)

## INDUSTRIAL WASTE WATER MANAGEMENT

## (2010 Pattern)

*Time : 3 Hours]* *[Max. Marks :100*

***Instructions to the candidates:***

1) ***Answer any THREE questions from each section.***
2) ***Use of non-programmable calculators are allowed.***
3) ***Neat sketches to be drawn wherever necessary.***
4) ***Make suitable assumptions if necessary.***
5) ***Figures to the right indicates full marks.***

## SECTION - I

***Q1)*** a) Differentiate between Industrial effluent and Muncipal Sewage. **[9]**

b) Discuss the effect of mixing of Industrial effluents with domestic sewage on the design of Sewage Treatment Plant. **[9]**

***Q2)*** a) Discuss the flotation techniques for oil seperation. **[8]**

b) Discuss the volume & strength reduction approch for Industrial Waste Water Management. **[8]**

***Q3)*** a) Discuss the Nitrification & Denitrification process. **[8]**

b) Explain the Adsorption Process for the treatment of Industrial Waste Water. **[8]**

***Q4)*** a) Discuss the Membrane Seperation process for Industrial Waste Water Treatment. **[8]**

b) Discuss the importance of equalization and Neutralization in Waste Water Treatment. **[8]**

***P.T.O.***

## SECTION - II

***Q5)*** Explain with the help of manufacturing process, the sources of Waste Water generations from

a) Textiles Industries. **[8]**

b) Tannery Industries. **[8]**

***Q6)*** a) Discuss the characteristics of effluent generated from petroleum refineries and the treatment options for the same. **[8]**

b) Discuss the characteristics of effluent generated from Tannery Industry and the treatment options for the same. **[8]**

***Q7)*** a) Discuss the manufacturing process and sources of effluent generations from sugar factory. **[8]**

b) Discuss the water requirements for Dairy Industry. **[8]**

***Q8)*** Discuss the concept of CETP. Discuss the general design considerations for the same. Also Explain the O & M problems associated with CETP operations for heterogeneous Industrial estates. **[18]**

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Total No. of Questions : 10]

SEAT No. :

**P4200**

[Total No. of Pages : 2

# [4960]-66
# M.E. (Civil Engg.)
# ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY
# (2010 Pattern)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answers questions from each section.***
2) ***Answer to the two sections should writtern in separate answer books.***
3) ***Assume suitable data, if necessary.***

## SECTION - I

***Q1)*** a) Explain Atomic Absorption Spectrophotometer (AAS) with it's principle, neat sketch, working and give its merits & demertis? **[8]**

b) Explain briefly High performance Liquid Chromatography (HPLC) with it's limitations. Explain how this limitations been overcome by Gas chromatography? **[8]**

***Q2)*** Explain the principle of Ion chromatography? Write a short note on types of various electrode employed in ion chromatography? **[16]**

***Q3)*** a) Explain the optical methods with their principle & mechanism for the pollutant removal in the industrial effluent? Give their Advantages & disadvantages. **[8]**

b) Explain the nature of nuclear radiation, its impact of human health & uses of isotopes and tracers widely used in environmental engineering? **[8]**

***Q4)*** a) Explain the importance of following in the wastewater treatment & management with suitable example. **[10]**

i) Electrical conductivity

ii) Different types of solids and

iii) pH of the waste water.

b) How knowledge of colloidal chemistry and nuclear chemistry applied to the measurement of pollution parameters. **[8]**

***P.T.O.***

***Q5)*** Write in brief, the selectivity of mobile phase in GC as well as HPLC in the waste water treatment and analysis? Explain the limitations of HPLC. **[16]**

## SECTION - II

***Q6)*** Explain in details principles, design parameters & drawbacks of sequencing Batch Reactor (SBR) process along with proper sketch to treat the waste water? **[16]**

***Q7)*** a) Enlist the various emymes and metabolic reactions and Explain their role in the field of environmental microbiology? Comment on the facultative respiration in wastewater treatment. **[10]**

b) Explain the role of microorganism, its cell structure, metabolism and nutrient required for its growth in wastewater treatment & in various biological processes. **[6]**

***Q8)*** a) What is 'Soil Bioremediation', Explain it with suitable example? Explain phenomenon of 'Self purification of natural water body'? **[5]**

b) Explain in details biological process (aerobic, anaerobic and natural system) of wastewater and how treatment can be done. **[6]**

c) Explain industrial microbiology & how this knowledge used in the treatment of various types of industrial wastewater. **[5]**

***Q9)*** a) Explain media & techniques of staining & Enumeration of microorganism in water & wastewater? **[10]**

b) Explain isolation of microorganisms & it's importance in environmental engineering? **[6]**

***Q10)*** a) Explain the compound microscopy and Micrometry? Give their applications in the environmental engineering? **[10]**

b) Explain principle & application of Microscopy & Micrometry used in environmental engineering? Explain the isolation of microorganism. **[6]**

Total No. of Questions : 8]

SEAT No. :

**P4604**

[Total No. of Pages : 2

# [4960]-67
# M.E. (Civil-Environmental Engg.)
## SOLID AND HAZARDOUS WASTE MANAGEMENT
## (2010 Pattern)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates :***

1) ***Answer any three questions from each section.***
2) ***Use of Non programmable calculators are allowed.***
3) ***Neat sketches to be drawn wherever necessary.***
4) ***Make suitable assumptions if necessary.***
5) ***Figures to the right indicates full marks***

## SECTION - I

***Q1)*** Discuss the problems and Issues of MSW in India. Also Discuss the Environmental Impact of mismanagement of MSW. **[18]**

***Q2)*** Discuss the Indian legislation on management & handling of MSW, Hazardous waste & Biomedical waste **[16]**

***Q3)*** Write a short notes on : **[4 × 4 = 16]**

a) Labelling & Handling of hazardous waste

b) Need for transfer station

c) Waste reduction at source

d) Recycling and Reuse of waste

***Q4)*** For a multispeciality hospital located in rural areas, how will you manage the solid waste including Biomedical waste from the hospital. **[16]**

***P.T.O.***

## SECTION - II

***Q5)*** Discuss the site selection criteria for sanitary land fills. Discuss the landfill closure and environmental monitoring of land fills. **[18]**

***Q6)*** Explain the leachate treatment and land fill gas management. **[16]**

***Q7)*** What are Nuclear and Radioactive waste? Discuss the various treatment and disposal options for the same. **[16]**

***Q8)*** Write a short notes on :

a) Thermal conversion technology for waste processing. **[8]**

b) Composting for MSW. **[8]**

Total No. of Questions : 8]

SEAT No. :

**P4957**

[Total No. of Pages : 3

**[4960]-68**

# M.E. Civil (Environmental Engineering)

## GROUND WATER CONTAMINATION AND POLLUTION TRANSPORT

## (2010 Course) (Semester - II) (Elective - III)

*Time : 3 Hours]* *[Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answer any 03 questions from each section.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary, clearly mentioning the same.***
4) ***Use of non-programmable scientific calculator is allowed.***

## SECTION - I

***Q1)*** a) Explain in detail the relationship between geotechnical properties and ground water potential of an area. **[8]**

b) Explain in detail dispersion phenomenon. Support your answer with an appropriate equation applicable for homogeneous and isotropic two dimensional media. **[8]**

***Q2)*** a) Explain following terms wrt variation in ground water levels: **[9]**

i) Diurnal Variations.

ii) Seasonal Variations.

iii) Short term variations.

b) Assume that three piezometers are installed very close to each other but penetrate up to the different depths as given below: **[7]**

| Piezometer | a | b | c |
|---|---|---|---|
| Elevation at surface(m) | 300 | 300 | 300 |
| Depth of piezometer (m) | 90 | 65 | 40 |
| Depth of water | 15 | 35 | 30 |

***P.T.O.***

***Q3)*** a) Explain in detail seismic refraction and gravity & magnetic methods for predicting ground water potential. **[8]**

b) Explain following terms: **[8]**

i) Aquifer.

ii) Tracer study.

iii) Physical qualities of ground water.

iv) Zone of diffusion.

***Q4)*** Write Short Notes (Any three): **[18]**

a) Vertical distribution of ground water.

b) Darcy's law for ground water studies.

c) Flow nets.

d) Multiple well systems.

## SECTION - II

***Q5)*** a) Explain in detail ground water pollution wrt. **[9]**

i) Mining activities.

ii) Tank & pipeline leakage.

iii) Agricultural sources.

b) Explain in detail: sea water intrusion. Explain remedial measures to overcome it. **[7]**

***Q6)*** a) Tracer injected into a well took 6 hours to travel up to another well 70m apart. The difference in water surface elevation was found to be 1.5m. the aquifer samples indicated a porosity of 30%. Determine the following: **[8]**

i) Permeability.

ii) Seepage velocity.

iii) Reynold's no.

b) Compare physical models v/s computer models for ground water studies. **[8]**

***Q7)*** a) Enlist any four methods of artificial recharge. Explain any 02 in detail. **[8]**

b) Explain in detail with a neat sketch: well interference. **[8]**

***Q8)*** a) Explain in detail ground water development and management. **[9]**

b) Explain in detail water logging and remedial measures to overcome it. **[9]**