Total No. of Questions : 6] **[Total No. of Pages : 2**

P1641 **[3765]-36**

M.E. (Civil - Structures)

ADVANCED DESIGN OF STEEL STRUCTURE

(2002 Course)

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) ***Use of electronic non programmable calculator, I.S.800, 80', 875, 1915, 1161 is allowed.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Draw neat sketch showing different types of bridge bearings. **[10]**

b) Show structural arrangement of deck type & through type railway plate girder bridge. Also indicate various bracing systems. **[5]**

c) In a deck plate girder railway bridge with broad gauge main line. The max B.M is 200 KNm & S.F is 2000 kN. from all forces. Design the section of plate girder at maximum B.M. **[10]**

Q2) A deck type 'N' truss bridge has 10 equal panels of 4m each with depth of truss 4m. The dead load & live load intensities are 24 KN/m & 40 KN/m respectively.
Draw influence line diagram for members at top panel point from left end of truss. Using impact factor 0.40 design top chord section. **[25]**

Q3) a) Define stiffned, unstiffned & multiple stiffened element of light gauge element. **[5]**

b) Explain concept of effective width for simply supported plate in case of small moments acting on it. **[10]**

c) A hat section 100mm × 80mm × 4mm as lip of 25mm dimension.
Find the allowable compressive load if it is to be used as column of 3m effective length. **[10]**

P.T.O.

SECTION - II

Q4) a) State advantages & disadvantages of tubular sections in steel structure. **[8]**

b) Write note on design considerations as per I.S. code for tubular structure used as scafoulding. **[8]**

c) Compare the hollow circular & hollow square section as thin' thin tubular sections, for its strength with respect to use as compression member.**[9]**

Q5) a) Suggest & design beam-column welded connection for ISMB500 & ISSC200 to carry 120 KNm. B.M. & 100KN shear. **[15]**

b) Sketch various lateral load resisting systems & state its applications.**[10]**

Q6) a) Find shape factor for 'T' section with flange width 100mm, Depth 100mm & thickness of flange & web 10mm. **[5]**

b) Explain upper bound, lower bound and uniqueness theorem. **[5]**

c) Analyse the beam ABC of length 5m. propped cantilever at end C & fixed at end A. The cantilever is loaded by load w at B. which is 2m from C. for AB portion the plastic moment of resistance is 2 Mp while for BC it is Mp.
Determine collapse load. **[15]**

Total No. of Questions : 8] [Total No. of Pages : 2

P1718 **[3765]-486**

M.E. (Mechanical Engg. - Heat Power Engg.)
ADVANCED FLUID MECHANICS
(2008 Course)

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

Instructions to the candidates:

1) ***Answer any 03 questions from each section.***
2) ***Answer 03 questions from Section - I and 03 questions from Section - II.***
3) ***Answers to the two sections should be written in separate books.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Figures to the right indicate full 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) Derive the governing equation for conservation of mass using Divergence theorem. **[10]**

b) Consider the following steady three dimensional velocity field in Cartesian co-ordinates : $\overline{V} = (u, v, w)$

$= (axy^2 - b)i + cy^3j + dxy\overline{u}$, where a, b, c are constants.

Under what conditions this flow field is in compressible. **[6]**

Q2) a) Explain the concept of stress tensor. **[6]**

b) Consider steady incompressible, laminar flow of a Newtonian fluid in the narrow gap between two infinite parallel plates. The top plate is moving at speed V, and the bottom plate is stationary. The distance between the two plates is 'h', and gravity acts in negative z-direction. There is no applied pressure other than hydrostatic pressure due to gravity. Calculate the velocity and pressure fields and estimate shear force per unit area acting on the bottom plate. **[12]**

Q3) a) Derive Navier stokes equation for incompressible, isothermal flow. **[10]**

b) Consider the steady two dimensional, incompressible velocity field,

$\overline{V} = (u, v) = (ax + b)\,\overline{i} + (-ay + c)\,\overline{j}$, where a, b, c are constants. Calculate the pressure as a function of x and y. **[6]**

P.T.O.

Q4) a) Air moves over a flat plate with a uniform free stream velocity of 10m/s. At a position 15 cm. away from the front edge of the plate, what is the boundary layer thickness? Use a parabolic profile in the boundary layer. For air $v = 1.5 \times 10^{-5}$ m²/s and Rho = 1.23 kg/m³. **[10]**

b) Air moves over a 10m long flat plate. The transition from laminar to turbulent flow takes place between Reynolds numbers of 2.5×10^6 and 3.6×10^6. What are the minimum and maximum distance from the front edge of the plate along which one expect laminar flow in the boundary layer? The free stream velocity is 30 m/s and $v = 1.5 \times 10^{-5}$ m²/s. **[6]**

SECTION - II

Q5) a) Explain Prandtl's mixing length hypothesis. **[10]**

b) Air flows over a smooth flat plate at a velocity of 4.4 m/s. The density of air is 1.029 kg/m³ and $v = 1.35 \times 10^{-5}$ m²/s. The length of the plate is 12m in the direction of flow. Calculate i) the boundary layer thickness at 16cm and 12m respectively, from the leading edge and ii) the drag co-efficients for the entire plate surface (one-side) considering turbulent flow. **[8]**

Q6) a) Explain the meaning of skin friction co-efficient for boundary layers.**[8]**

b) Water at 15°C flows over a flat plate at a speed of 1.2 m/s. The plate is 0.3m long and 2m wide. The boundary layer on each surface of the plate is laminar. Assume velocity profile is approximated by a linear expression for which

$$\frac{\delta}{x} = \frac{3.46}{\sqrt{\mathrm{Re}_x}}$$

Determine the drag force on the plate. Take for water $v = 1.1 \times 10^{-6}$ m²/s, $\rho = 1000$kg/m³. **[8]**

Q7) a) How the fluid velocity varies with flow area in a isentropic flow. Explain. **[8]**

b) What are the property relations for isentropic flow of ideal gases? Explain their significance. **[8]**

Q8) a) Air enters a converging-diverging nozzle of a supersonic wind tunnel at 1MPa and 300K. with a low velocity. If normal shockwave occurs at the exit plane of nozzle at Ma = 2, determine the pressure, temperature. Mach number, velocity and stagnation pressure after the shockwave.**[8]**

b) Show that the point of maximum entropy on the Fanno line for the adiabatic steady flow of a fluid in duct corresponds to sonic velocity Ma = 1. **[8]**

Total No. of Questions : 8] [Total No. of Pages : 3

P1962 **[3765]-418**

M.E. (Civil - Construction & Management)
THRUST AREAS IN PROJECT MANAGEMENT
(Open Elective) (2008 Course)

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

Instructions to the candidates:

1) ***Answer any 3 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 logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What is pre-project planning?

What are its advantages?

Draw a sequential diagram explaining the various steps involved in it. **[1+2+5]**

b) Explain how the Covey habits are very instrumental in providing an effective leadership in the Indian Construction sector, with proper examples. Which are the various skills required by construction leaders? Explain with examples. **[6+4]**

Q2) a) Explain the concept diagrams related to quality, quality measurement, defects and non-conformities used by ISO 9001:2000 with proper examples. **[8]**

b) Explain ISO 9001:2000 quality audit process from concept to completion with an example. **[8]**

Q3) a) Explain importance of idea generation in entrepreneurship? By what ways can the ideas be generated? Explain. Detail out the John Mullions test for ideas evaluation with proper examples. **[1+2+7]**

b) Perform SWOT analysis if you intend to set-up a fly-ash industry in India as Dirk (India) has already set-up. **[6]**

Q4) a) With any detail case study, explain the process and benefits of the project partnering concept application in the construction sector. **[8]**

b) Explain utility of PDRI in project pre-planning with an example. **[4]**

c) Explain the concept of labour-stabilized matrix and its use in development of human resources at the grass-root level. **[4]**

SECTION - II

Q5) a) Elaborate with examples, each term in SCM (Supply Chain Management). Detail out its application in the procurement and use of resources necessary to construct PQC and DLC in a concrete pavement. **[3+5]**

b) Diagrammatically, explain the clear-cut difference between Fast track construction and conventional construction. Explain concept of GMP with an example.
Discuss the limitations of fast track construction. **[4+2+4]**

Q6) a) As a project manager, explain how you will motivate your **[6]**

i) managerial staff

ii) workers on project site

[3 independant measures for each]

b) Explain transformational leadership and transactional leadership with an example each. Which style is better? Why? **[2+2+1]**

c) "Mivan" is a very versatile formwork. Explain with proper examples.**[5]**

Q7) a) Discuss the process and importance of performing competency mapping in an organisation with a proper example. **[6]**

b) What is gap analysis? How is it done? How are the gaps closed? Can new gaps be created? How? **[6]**

c) What is strategic management? Why is it essential in the global era? Explain, giving examples. **[4]**

Q8) As a result of conducting the training needs assessment of site engineers executing nuclear power projects, on behalf of the contractor, the following findings emerged **[16]**

a) 70% of the personnel were not proficient in understanding the intricacies associated with such projects and 40% of theses personnel did not have any field experience associated with such execution.

b) 30% personnel were unable to interprete the working drawings properly.

c) The execution required preparation of "Mockups" for very special items and getting them approved by the client, but no engineer was exposed to such a system, in their previous work experience.

d) 80% engineers were very good in execution of a specified work through use of a method control statement, nevertheless they lacked the co-ordination skills with various agencies involved.

e) 50% personnel were very poor in reporting systematically and promptly and hence the planning department was frequently under pressure.

f) 25% staff were not conversant with the use of latest construction materials, technique and machineries.

g) Site documentation was proper in general, but was not in accordance with the ISO 9001:2000 procedures.

h) 15% engineers were unable to use existing soft wares related to procurement, billing and MIS.

i) 65% of the staff faced a linguistic communication problem while dealing with the sub-contractors, labours and vendors because of multi-linguistic communications required.

j) Safety policies, procedures and techniques were not being implemented effectively on the site.

The client-Contractor relationships were strained due to the above scenario. Also the progress of the site was very slow. As a result, the interim billing of the contractor was drastically affected.

The total number of site engineers associated were 20. The average yearly package of each engineer was Rs. 4 lakhs. The project packages, together value Rs. 3000 crores, expected to be completed within a period of 36 calendar months.

You are the HR manager of the contracting firm.

Design and develop a cost effective, training programme, taking due consideration of the various requirement of the training programs, traines and the trainees, in order to generate profit and credit worthiness from the site execution team. Make relevant, necessary assumptions.

Also prepare a feedback form for evaluating the training given.

Total No. of Questions :10] [Total No. of Pages :5

P1648

[3765] - 65

M.E. (Mechanical / Design Engineering)

MECHANICAL VIBRATIONS

(2002 Revised Course) (502202)

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 books.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Assume suitable data, if necessary.*
6) *Use of pocket non programmable electronic calculator is allowed.*

SECTION - I

Q1) a) What is frequency response function. **[5]**

b) A spring mass-dashpot system of mass m stiffness k and damping ratio is 0.25 is exited by a force **[12]**

$F(t)= \Sigma\ Fo\ Cos\ (m\omega_n t)$ where m = 1/2, 1, 3/2

Determine the mean square response and compare the output spectrum with that of input.

Q2) The system in the figure 1 is subjected to a random input base motion which can be considered as a white noise of spectral density ∂o find the spectral density of motion of mass m_2 **[16]**

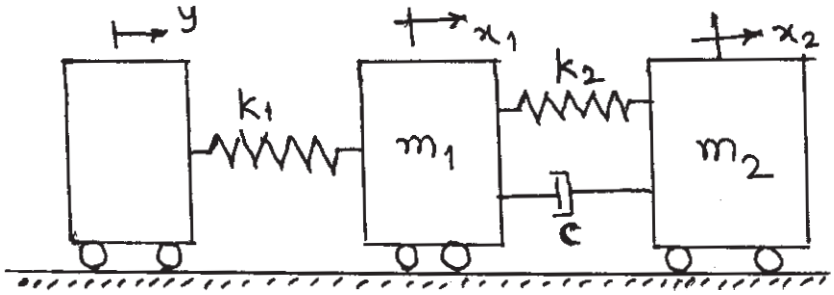

FIG-1

P.T.O.

Q3) An eccentric cam of eccentricity e rotating with uniform angular velocity ω operated a roller follower of mass m with push rod of length L, cross sectional area A and Young's modulus of material E. The push rod, which acts as a spring, has been compressed by an amount Xo before assembly, Determine. **[17]**

a) Equation of motion of the follower, including the gravitational force.

b) The Force exerted on the follower by cam.

c) Condition under which the follower loses contact with cam.

Q4) If the system shown in figure 2 is displaced so as to strike one side plate (through X max > c) and released, Find the frequency of the ensuring free vibrations. Comment on the result. **[16]**

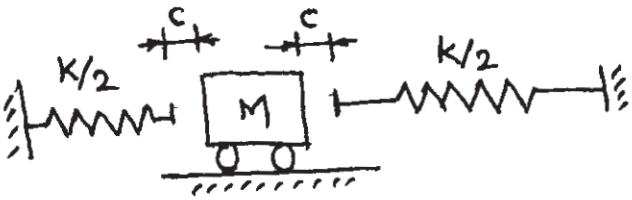

FIG-2

OR

a) Explain wide band and narrow band random vibrations. **[6]**

b) By actual test, an aircraft instrument package has been damaged by sinusoidal vibration that exceeded the limits of 2.5 kg. Determine the necessary static deflection of isolator that could protect the package from damage from a random vibration of $0.12g^2$/Hz from 5 to 2000 Hz. Assume that the isolators are made of synthetic rubber for which $\xi = 0.05$. **[10]**

Q5) Discuss briefly any two of the following: **[16]**

a) Phase plane technique.

b) Duffling Equation.

c) Self exited vibration.

d) Tool Chatter.

SECTION - II

Q6) A three degree of freedom system has parameters m, k & c. It is subjected to a force $e^{-\alpha t}$. Find the response & sketch the same. **[17]**

Q7) For the double pendulum system shown in the figure 3, formulate the equations of motion applying Langrage's equations. Formulate the equations in matrix form. Hence find the natural frequency and mode shapes through the method of matrix iterations. **[16]**

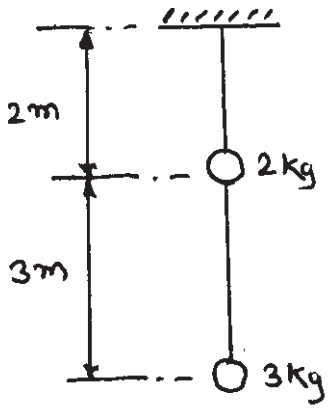

FIG-3

OR

For the two mass systems shown in the figure 4 find the natural frequencies and mode shapes. Normalize the modal vectors with respect to the mass matrix. Hence find the response of the system through modal analysis using principal coordinates and generalized forces. m_1 = 5kg, m_2 = 2kg, $k_1 = k_3$ = 500N/m, k_2 = 1000N/m F = 20sin(10t) N **[16]**

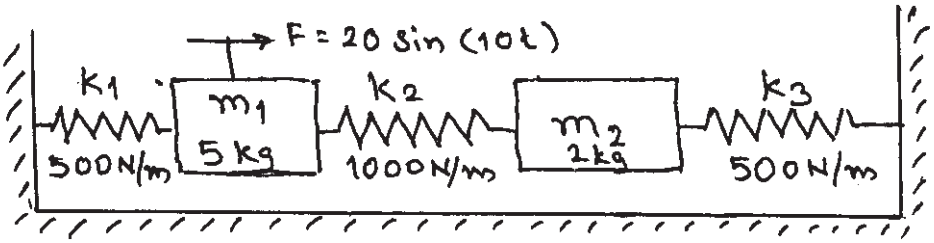

FIG-4

Q8) A uniform string of mass m length L is fixed at both ends. It is under a large tension T which does not change in vibrations. Find response of the string to a force $F_0 \sin(\omega t)$ at the centre in the transverse direction. Comment on the result. **[16]**

OR

A beam of mass m per unit length L and area of cross section A is fixed at both ends. A force P in the sense left to right acts at a length L/4 from the left end. Find the vibrations of the beam if this force is suddenly removed. Modulus of elasticity is E. **[16]**

Q9) An undamped machine of 90 kg mass is supported so that its natural frequency is 35Hz. The machine rotates at 1800 rpm. To avoid resonance it is suggested that a dynamic vibration absorber be used. Design a vibration absorber so that a speed fluctuation of ± 1 % can be tolerated. Also find the amplitudes of vibrations at limiting speed for a rotating unbalance of 5kg-mm. **[17]**

Q10) Write short notes on Any two: **[16]**

a) Influence Coefficients.
b) Duhamels Integration.
c) Eigen Values and Eigen Vectors.
d) Rayleigh-Ritz method.

Laplace Transform Pairs

	$f(t)$	$L[f(t)]$
1.	$f(t)$	$\int_0^\infty e^{-st} f(t)\,dt = F(s)$
2.	$x(t) \pm y(t)$	$X(s) + Y(s)$
3.	$K\,f(t)$	$KF(s)$
4.	$u(t)$ or 1	$1/s$
5.	$\delta(t)$	1
6.	t	$1/s^2$
7.	t^n	$n!/s^{n+1}$
8.	$\sin \omega t$	$\dfrac{\omega}{s^2+\omega^2}$
9.	$\cos \omega t$	$s/s^2 + \omega^2$
10.	e^{-at}	$1/s + a$
11.	$e^{-at} \sin \omega t$	$\dfrac{\omega}{(s+a)^2+\omega^2}$
12.	$e^{-at} \cos \omega t$	$\dfrac{s+a}{(s+a)^2+\omega^2}$
13.	$e^{-at} f(t)$	$F(s + a)$
14.	$u(t - a)$	$\dfrac{e^{-as}}{s}$
15.	$\delta(t-a)$	e^{-as}
16.	$\begin{bmatrix} 0 \text{ when } t < a \\ f(t-a) \text{when } t > a \end{bmatrix} = f(t-a)u(t-a)$	$e^{-as} F(s)$
17.	$\dfrac{d\,f(t)}{dt}$	$sF(s) - f(0)$
18	$\dfrac{d^2 f(t)}{dt}$	$s^2F(s) - s\,f(0) - \dfrac{d\,f(0)}{dt}$
19.	$\int_0^t f(t)\,dt$	$\dfrac{F(s)}{s}$

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Total No. of Questions :8] [Total No. of Pages :2

P1655

[3765] - 134

M.E. (Electronics) (Digital Systems)

IMAGE PROCESSING AND PATTERN RECOGNITION

(Revised 2002 Course) (Elective - I)

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

Instructions to the candidates:

1) *Answer any three questions from each section.*
2) *Answers to the two sections must be written in separate answer books.*
3) *Figures to the right indicate full marks.*
4) *Use of scientific calculator is allowed.*
5) *Assume suitable data, if required.*

SECTION - I

Q1) a) Consider any spatial filtering mask and explain how it will be used for filtering an image. **[8]**

b) Draw a pixel brightness transformation function that will enhance the brightness values between 100 and 200. Explain its operation. Draw a transformation function that will smooth the information between intensity values 100 and 200. **[8]**

c) Explain what is champering. **[2]**

Q2) a) Why image is required to be preprossed? **[2]**

b) What is local preprocessing? How it is advantageous than global preprocessing? **[6]**

c) Explain what is contrast stretching, gray level slicing and bit plane slicing? **[8]**

Q3) a) Draw sobel edge operator for horizontal and vertical edge detection. Explain how the magnitude and direction of the edge can be calculated. **[8]**

b) Explain the steps involved in canny edge detector. Why a smoothing filter is used as a first step? **[8]**

P.T.O.

Q4) a) Explain A-algorithm graph search method for boarder detection. **[8]**

b) Explain how the edge is followed using dynamic programming. **[8]**

SECTION - II

Q5) a) Explain single pass split and merge algorithm for region based segmentation. **[8]**

b) Explain chain coding method. What are signatures? How they are used for shape representation. **[8]**

Q6) a) What is a convex hull? Explain shape representation using convex hull. **[8]**

b) Explain the use of hough transforms for line detection. **[8]**

Q7) a) Explain K-means cluster analysis. Explain the use of cluster analysis for object recognition. **[10]**

b) Explain the object recognition using a Hopfield net. **[8]**

Q8) a) What is syntactic analysis? Explain the use of syntactic classifier for object recognition. **[8]**

b) What are Fuggy set operators? Explain Fuggy reasoning for object recognition. **[8]**

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Total No. of Questions :6] [Total No. of Pages :3

P1660

[3765] - 157

M.E. (Electrical) (Control System)

DIGITAL CONTROL SYSTEMS

(2002 Course) (503101)

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) *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) State and explain sampling theorem. **[8]**

b) A system is defined by input output relationship **[10]**

$$y(n) = ne^{x(n)}$$

Justify whether this system is i) static or dynamic, ii) linear or nonlinear iii) time invarient or time varient, iv) causal or non causal and v) stable or unstable.

c) Obtain the pulse transfer function of the system shown in Figure No. 1 by first principle: **[7]**

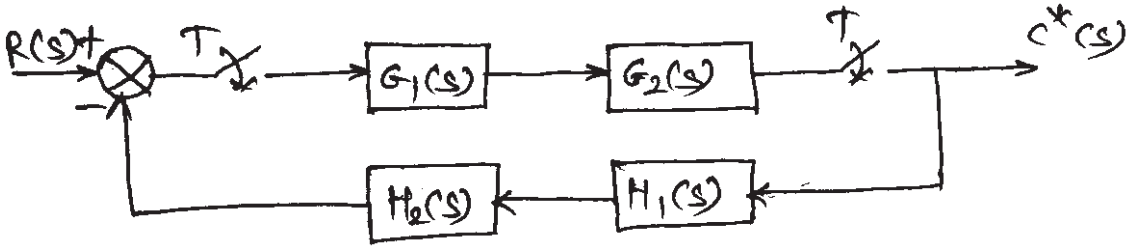

Figure No. 1

P.T.O.

Q2) a) Obtain the z transform of the following functions: **[8]**

i) $G(s) = \dfrac{5}{s(s+3)}$ ii) $G(s) = \dfrac{2}{(s+1)(s+2)}$

b) Obtain the inverse z transform of the following functions: **[8]**

i) $X(z) = \dfrac{3z}{(z-1)(z+2)}$ ii) $X(z) = \dfrac{5}{(z+1)(z-0.5)}$

c) Determine discrete fourier transform of $x(n) = \{1, 1, 1, 1, 0, 0, 0, 0\}$. **[9]**

Q3) a) Using Jury stability test obtain the limits of k such that the system shown in Figure No. 2 is stable. **[16]**

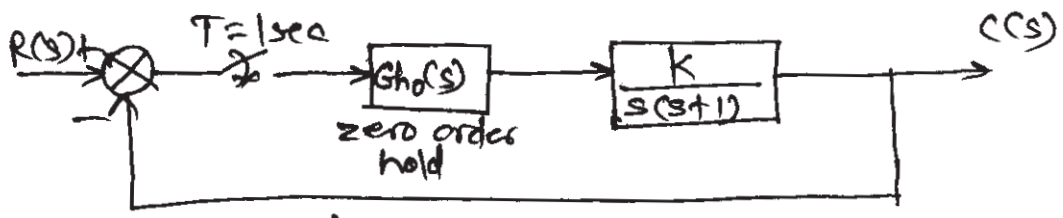

Figure No. 2

b) Obtain the state transition matrix of the system **[9]**

$$x(k+1) = \begin{bmatrix} 0 & 1 \\ -0.16 & -0.8 \end{bmatrix} x(k).$$

SECTION - II

Q4) a) Obtain the state model of the pulse transfer function G(z) in **[18]**

i) Controllable canonical form.

ii) Observable canonical form.

iii) Jordon canonical form.

$$G(z) = \frac{(z+1)(z+3)}{(z-1)(z-2)(z-3)}$$

b) Derive the formula to obtain pulse transfer function from the state model. **[7]**

$x(k+1) = Gx(k) + Hu(k)$

$y(k) = Cx(k) + Du(k)$

Q5) a) Discretize the following continuous time state equation **[10]**

$x' = Ax + Bu$ with $A = \begin{bmatrix} 0 & 2 \\ 0 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$. Take T = 1 sec.

b) Using direct Liapunov method, derive the following relation for the system with state model $x(k+1) = Gx(k)$ $[G^T PG - P] = -Q$ **[7]**

c) Using direct Liapunov method, determine the stability of the system

$x(k+1) = \begin{bmatrix} 1 & -1.2 \\ 0.5 & 0 \end{bmatrix} x(k)$. Also determine Liapunov function. **[8]**

Q6) a) Draw and explain the block schematic of digital temperature control system. **[9]**

b) Define the terms controllability and observability. Derive the necessary and sufficiency conditions for controllability and observability of a discrete time system. **[16]**

$x(k+1) = Gx(k) + Hu(k)$

$y(k) = Cx(k)$.

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Total No. of Questions :6] [Total No. of Pages :2

P1661

[3765] - 160

M.E. (Electrical Engg.) (Control System)

PROCESS CONTROL

(2002 Old Course)

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 wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Assume suitable data, if necessary.*

SECTION - I

Q1) Explain proportional, integral, derivative control actions in details. Also explain Electronic PID controller with neat circuit diagram. **[25]**

Q2) a) What is process identification? Give types of process identification in details. **[10]**

b) Explain Reset windup and anti Reset windup technique with example. **[15]**

Q3) a) Write short note on: **[10]**

i) Ratio control system.

ii) Split range control system.

b) Explain cascade control scheme for heat exchanger with neat block diagram in details. **[15]**

P.T.O.

SECTION - II

Q4) a) Explain process lags with respect to liquid flow, vapor flow and concentrations. **[10]**

b) Explain flow control, liquid level control, pressure control in chemical reactor with neat diagram. **[15]**

Q5) Explain programmable logic controller with architecture, block diagram, programming languages and typical applications. Write specifications of any one Industrial PLC. **[25]**

Q6) Develop a process control scheme for steam boiler plant. Explain temperature control, flow control system in details with respect to steam boiler plant. **[25]**

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Total No. of Questions :10] [Total No. of Pages :4

P1670

[3765] - 187

M.E. (Production Engineering)

RELIABILITY ENGINEERING

(Old & Revised Course 2002) (511110) (Elective - II)

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

Instructions to the candidates:

1) *Answer any three questions from each section.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Assume suitable data, if necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of non-programmable electronic calculator is allowed.*

SECTION - I

Q1) a) Three identical motors are operating in an active parallel configuration. Failure rates for motor are 0.0005 and statistically independent. If all three starts at t = 0, Find the Reliability at 500 hrs and Mean time to Failure (MTTF). **[8]**

b) Calculate the reliability of the system shown in Fig. 1. The values in the block show the reliability of individual components in the system. **[8]**

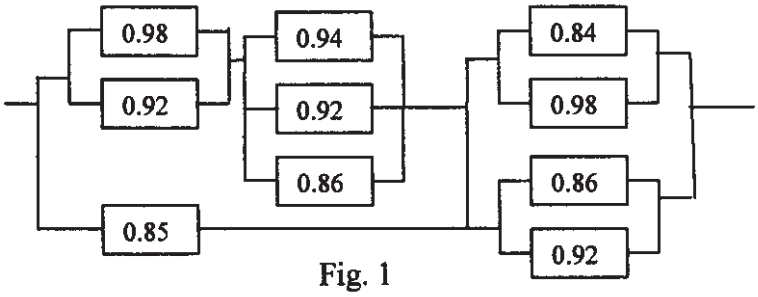

Fig. 1

Q2) a) Following data refer to the problem of allocation of Reliability to each component in the system. **[8]**

Sr. No. i	No.of Components (n_i)	Operating time, Hrs (t_i)	Weighting Factor of (i^{th}) subsystem (W_i)
1	9	15	0.9
2	10	10	0.95
3	8	25	0.85
4	15	20	1

P.T.O.

Find out the failure rates of the components, so that the system reliability becomes 0.98, using AGREE method.

b) An aircraft consists of Four engines-independent, active and identical. At least Two engines must operate successfully for the aircraft to fly successfully. The average failure rate of each engine is 0.0008 failures/ hour. Compute reliability of the aircraft for 10-hour flying mission. **[8]**

Q3) a) In a Parallel system if we need at least one out of 4 units to operate for the successful working of the system determine the expression for reliability in terms of λ and t. If λ is considered as 0.005 and mission time 100 hrs find the reliability . **[8]**

b) The following data refer to predicted reliability of Eight components in series. In case the desired reliability of the system is not fall below 0.92 find the reliability goal for individual components. **[8]**

Components	1	2	3	4	5	6	7	8
Predicted reliability	0.996	0.999	0.990	0.996	0.991	0.980	0.95	0.98

Q4) a) Find the reliability of system shown in Fig 2 using conditional probability method. The values in the blocks show reliabilities of each element. **[8]**

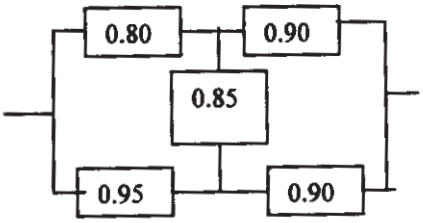

Fig 2

b) A system consists of Four subsystems A,B, C & D having failure rates 0.005, 0.002, 0.004 and 0.008 respectively per hour. If the mission time is 50 hours and the system reliability required is 0.95, find the failure rate as well as reliability of each subsystem for the entire mission period, using ARINC method. State any assumptions used. **[8]**

Q5) Write short notes on following (Any three): **[18]**

a) Maintainability & Availability.
b) Reliability effort function.
c) Conditional Probability Method.
d) Distributions in Probability analysis.
e) Life Cycle Costing.

SECTION - II

Q6) a) Explain the systematic procedure to be followed for Failure Modes, Effects and Criticality Analysis. **[8]**

b) A Logic gate diagram for FTA study has been shown in Fig.3. The failure probabilities of a, b, c, d and e are 0.01, 0.003, 0.005 , 0.007 and 0.09 resp. Find system Reliability. **[8]**

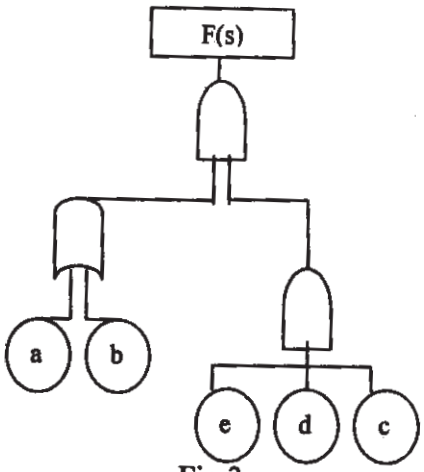

Fig.3

Q7) a) The following data refers to a short sample reliability test of an engineering instruments: **[8]**

Failure No.	1	2	3	4	5	6	7	8
MTTF (Hrs)	12	20	18	10	16	29	28	32

Calculate the reliability using mean and median ranking method. Also plot the reliability Vs Time.

b) Construct a fault tree for the system failure shown in Fig. 4 and find reliability of system using fault tree analysis. **[8]**

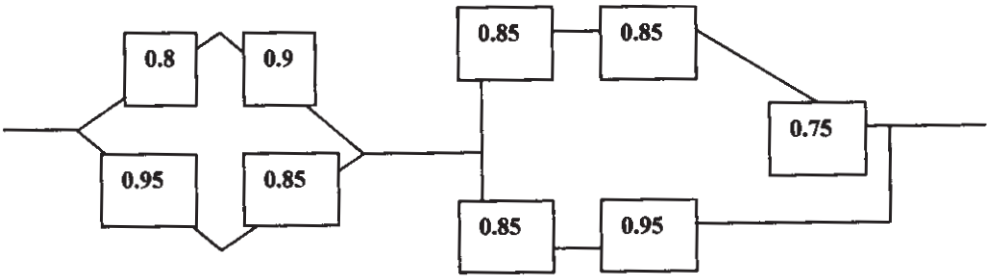

Fig. 4

Q8) a) What is meant by accelerated test in evaluating reliability? Explain sudden death testing method for reliability evaluation. **[8]**

b) Define Tie-sets and Cut-sets. State various tie-sets and cut-sets from the Fig.5. Give optimal tie sets and optimal cut sets. **[8]**

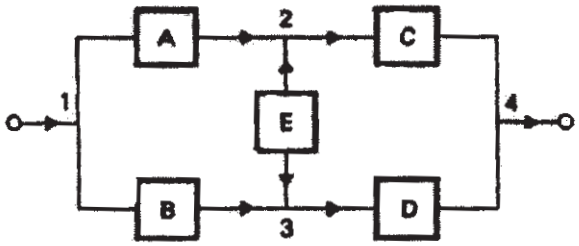

Fig. 5

Q9) a) Give the classification of redundancy and explain each with suitable example. **[8]**

b) Define availability and maintainability for the system from the following data collected at a plant : **[8]**

Mean time before failure: 65 Hrs

Mean time to repair : 20 Hrs

Administrative logistic time: 125 % of MTTR

Calculate operational availability and inherent availability of the plant.

Q10) a) The mean strength and the standard deviation of a bolted joint are 3000 Kg/cm^2 and 280 Kg/cm^2 respectively. The joint is loaded such that stress induced has a mean value of 2500 Kg/cm^2 with a standard deviation of 40 Kg/cm^2. Assuming that shear strength and the induced stresses are independent and normally distributed, find out the probability of survival of the bolted joint. Extract of data from statistical table is given below: **[8]**

Z	1.2	1.3	1.4	1.5	1.6	1.7	1.8
$\phi(z)$	0.8849	0.9032	0.9192	0.9331	0.9452	0.9550	0.9640

b) Calculate the system reliability for the system shown in Fig. 6 **[10]**

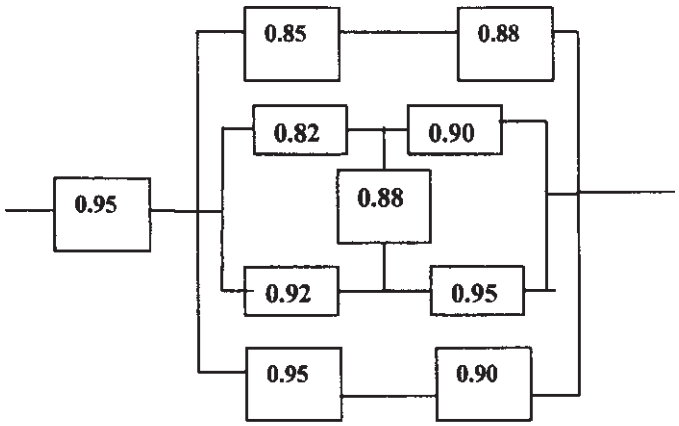

Fig. 6

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Total No. of Questions :8] [Total No. of Pages :2

P1674

[3765] - 194

M.E. (Computer Engg.)

GEOMETRIC & SOLID MODELING

(2002 Course)

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

Instructions to the candidates:

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

SECTION - I

Q1) a) Define and briefly explain topological space. **[4]**

b) With the help of an example show that ordinary Boolean intersection of two cubes may produce i) Solid ii) Plane iii) Pint iv) Line **[8]**

c) Explain various Euler's operator to create and modify the close surfaces. **[6]**

Q2) a) Comment on the statement "Generic design cannot be displayed or converted to boundary representation". **[4]**

b) Why the mathematics of sweeping is said to be more delicate and demanding? **[4]**

c) Explain the winged edge representation technique for representing the boundary of polyhedron. **[8]**

Q3) a) What is range tree? What is its use in modeling? Explain in brief. **[6]**

b) Consider the following intervals: **[6]**

L1 = [-1,6], L2 = [-2,3]. L3=[0,4], L4=[2,7] , L5 =[3,4], L6 = [-2,-1]

Construct the range tree for the above set of intervals showing all the intermediate steps and calculation

c) Define the term **[4]**

i) Static interval tree.

ii) Spatial decomposition for solid representation.

P.T.O.

Q4) a) How do you perform the topological validation of manifold B-rep solid? **[8]**

b) Briefly explain the sweep technique. **[8]**

SECTION - II

Q5) a) Find the explicit representation for linear (degree 1) B-splines in case of uniformly spaced knots (i.e. $t_{i+1} - t_i = L$) **[8]**

b) For the knot set $t_1 = 1$, $t_2 = 2$ ....., $t_i = 1$ calculate $B_{i,3}$ (5.5). **[8]**

Q6) a) What property of raster displays makes the technique of the ray tracing possible? **[6]**

b) Prove the geometric example theorem: "if two lines AB and CD are congruent, then so are their halves". **[8]**

c) How a mathematical surface is rendered as a wire frame model? **[4]**

Q7) a) Compare and contrast between graph based model, Boolean model, boundary model and space partitioning model. **[8]**

b) Find the approximation equation for the plane $3.2x + 4.5y + 12.3z + 30 = 0$ when the coefficient x,y,z should be bounded by 3 and the constant term by 9. **[8]**

Q8) a) A ray is represented by $r(t) = s + td$ where $s = 2i + j$ and $d = i + 2k$, find the coordinate on the ray that correspond to t = 0, 1,2.5 and 3 respectively. **[10]**

b) Explain the various representation conventions for face representation, edge representation and vertex representation. **[6]**

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Total No. of Questions :8] [Total No. of Pages :2

P1677

[3765] - 201
M.E. (Computer Engineering)
BIOINFORMATICS
(2002 Revised Course) (Sem. - II) (Elective - II)

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

Instructions to the candidates:

1) ***Question Nos. 4 and 8 are compulsory. Out of remaining attempt two questions from section I and two 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.***

SECTION - I

Q1) a) Draw a neat labelled diagram of a eukaryotic cell and explain the function of each component of cell. **[8]**

b) Explain the structure and function of following biomolecules (Any Two): **[4]**

i) Carbohydrates
ii) Proteins
iii) Fatty acids

c) What are the various types of cells found in human body. **[4]**

Q2) a) State the different types of RNA and explain their function. **[6]**

b) What are enzymes? How are they classified? **[4]**

c) Describe the structure of DNA and comment on the types of DNA. **[6]**

Q3) a) Write in detail on various types of amino acids and its structures. **[8]**

b) Describe a plant cell with help of diagram. **[4]**

c) Explain the mechanism of genetic sketch. **[4]**

Q4) Write short notes on (Any Six) : **[18]**

a) Process of transcription and translation in eukaryotic cell.
b) DNA replication.
c) Ramchandran Plot significance.
d) Codon Usage Table.
e) Types of mutation.
f) Promoters and Enhancers in gene expression.
g) Prokaryotic cell.

P.T.O.

SECTION - II

Q5) a) Explain neural network method for protein structure production. **[4]**

b) Write a short note on the information content in Protein Databank. (PDB) **[4]**

c) Write a computer program to convert 3 letter amino acid (DNA sequence) sequence code to a single letter protein code. **[8]**

Q6) a) Distinguish between Needleman Wunsch and Smith Waterman algorithm. **[6]**

b) Describe any one algorithm for protein secondary structure prediction. **[5]**

c) Describe the types of secondary structure of proteins. **[5]**

Q7) a) Comment on various DNA databanks available on internet. **[4]**

b) Write in detail on a method for protein tertiary structure prediction. **[4]**

c) Write a computer program to calculate % of bases 'a', 't', 'g' and 'c'. **[8]**

Q8) Write short notes on (Any Six): **[18]**

a) Hidden Markov model for gene prediction

b) Dot matrix method for sequence alignment

c) Significance of pairwise and multiple alignment

d) Importance of Bioinformatics and its emerging areas

e) FASTA algorithm

f) Information in EMBL databank

g) Two internet sites which predict protein structure in detail.

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Total No. of Questions :10] [Total No. of Pages :3

P1724

[3765] - 496

M.E. (Mechanical - Design Engineering)

OPTIMIZATION TECHNIQUES

(Revised 2008 Course) (502204 - C) (Elective - I)

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

Instructions to the candidates:

1) *Answer any three questions from each section.*
2) *Answers to each section 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 pocket calculator is allowed.*
6) *Assume suitable data wherever necessary.*

SECTION - I

Q1) a) How to identify the given problem requires optimization or not? What are the methods to classify the problems of optimization? **[6]**

b) A retail store stocks & sells three different models of TV sets. The store cannot afford to have an inventory worth more than $45,000 at any time. The TV sets are ordered in lots. It costs $aj for the store whenever a lot of TV model j is ordered. The cost of one TV set of model j is cj. The demand rate of TV model j is dj unit per year. The rate at which the inventory costs accumulate is known to be proportional to the investment in inventory at any time, with dj = 0.5, denoting the constant of proportionality for TV model j. Each TV set occupies an area of sj = 0.40 m^2 and the maximum storage space available is 90 m^2. The data known from past experience are given below.

	TV model j		
	1	2	3
Ordering cost aj ($)	50	80	100
Unit cost cj ($)	40	120	80
Demand rate, dj	800	400	1200

Formulate the problem of minimizing the average annual cost of ordering and storing the TV sets. **[10]**

P.T.O.

Q2) a) State the necessary and sufficient conditions for the maximum of a multivariable function $f(x)$. **[6]**

b) Find the dimensions of a box of largest volume that can be inscribed in a sphere of unit radius. **[10]**

Q3) a) How do you detect an unbounded solution in the simplex procedure? **[6]**

b) Minimize the following function with simplex method. **[10]**

$f = 2x_1 + 3x_2 + 2x_3 - x_4 + x_5$

subject to the constraints,

$3x_1 - 3x_2 + 4x_3 + 2x_4 - x_5 = 0$

$x_1 + x_2 + x_3 + 3x_4 + x_5 = 2$

$x_i \geq 0$; $i = 1$ to 5.

Q4) a) What is the difference between the simplex algorithm and the simplex method. **[6]**

b) Find all the basic solutions corresponding to the system of equations by pivotal reduction system. **[10]**

$2x_1 + 3x_2 - 2x_3 - 7x_4 = 1$

$x_1 + x_2 + x_3 + 3x_4 = 6$

$x_1 - x_2 + x_3 + 5x_4 = 4.$

Q5) Write short note on any THREE: **[18]**

a) Multivariable optimization with no constraint.

b) Decomposition principle.

c) Classification of optimization problem.

d) Langrange Multipler Method.

SECTION - II

Q6) a) What is difference between elimination and interpolation methods? **[6]**

b) Minimize the function, **[10]**

$f(x) = 0.65 - [0.75 / (1 + x^2)] - 0.65x \tan^{-1}(1/x)$ using the Golden section method with n = 6.

Q7) a) State the iterative approach used in unconstrained optimization. **[6]**

b) Minimize the function, **[10]**

$f(x) = (100 - x^2)$ over the interval of $60 \le x \le 150$ by half interval method.

Q8) Minimize $f(x_1, x_2, x_3) = (x_1 - x_2)^2 + (x_2 - x_3)^4$ **[16]**

subject to:

$$g_1(X) = x_1 (1 + x_2^2) + x_3^4 - 3 = 0$$

$$-3 \le x_i \le 3 \; ; \; i = 1, 2, 3$$

using Generalized Reduced Gradient Method.

Q9) a) What are the characteristics of a direct search method. **[6]**

b) Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1 x_2 + x_2^2$ from the starting point $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ using Powell's method. **[10]**

Q10) Write short note on any THREE: **[18]**

a) Exhaustive search method.

b) Interpolation method.

c) Conjugate gradient method.

d) Golden section method.

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Total No. of Questions :12] [Total No. of Pages :4

P1737 **[3765] - 527**

M.E. (Electrical) (Control System)
AUTOMATION AND ROBOTICS
(2008 Course)

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 indicate full marks.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What are the key features that distinguish Robots from other form of 'Automation' such as CNC milling machines. **[6]**

b) Briefly define each of the following terms: **[10]**

Forward kinematics, Inverse kinematics, Trajectory planning, workspace, Accuracy, repatability, resolution, joint variable, spherical wrist, end effectors.

OR

Q2) a) Suppose we could close every factory in India today and reopen them tomorrow fully automated with robots. What would be some of the economic and social consequences of such development? **[5]**

b) Why is accuracy generally less than repeatability? **[5]**

c) What is degree of freedom? Explain 6DOF with neat sketch. **[6]**

Q3) a) List five applications that contineous path robot could do that a point to point robot could not do? **[5]**

b) Explain point to point robot with example and discuss its importance in the indian industry. Specify at least one application. **[8]**

c) Give the concept of Yaw, Pitch and Roll **[5]**

OR

P.T.O.

Q4) a) Explain contineous path robot with application related to automobile industry. **[5]**

b) What are selection criteria required while designing contineous path robot. **[5]**

c) Discuss the basic component of a robot system with neat sketch. **[8]**

Q5) Pick a 8086 processor and investigate what commercially available bus architecture, operating systems and programming languages are available. Based on common Indian industrial robotic considerations. What combinations provide the most support for the desired functionality at the least cost? **[16]**

OR

Q6) a) Give the brief description of each of the following robot languages. **[10]**

i) AL

ii) AML

iii) RAIL

iv) RPL

v) VAL

b) In case of spray painting discuss following points. **[6]**

– Methods of control required.

– Selection of drive.

– Type of robot as per configuration.

SECTION - II

Q7) a) Find the rotation matrix corresponding to the set of Euler angles $\left\{\frac{\pi}{2}, 0, \frac{\pi}{4}\right\}$. What is the direction of the x_1 axis relative to the base frame? **[8]**

b) Compute the homogeneous transformation representing a translation of 3 units along the fixed y axis. Sketch the frame. What are the co-ordinates of the origin O, with respect to the original frame in each case? **[10]**

OR

Q8) a) Find the rotation matrix representing a roll of $\frac{\pi}{4}$ followed by a Yaw of $\frac{\pi}{2}$ followed by pitch of $\frac{\pi}{2}$. **[8]**

b) Robot manipulator at a location $[0.5 - 0.5\ 1]^T$ is **[10]**

i) Allowed to rotate by 30° in x direction.

ii) Allowed to rotate by 45° in y direction.

iii) Allowed to rotate by 60° in z direction.

Find the coordinates of final point P of robot manipulator after all the three rotation.

Q9) a) Consider the two link cartesian manipulator shown in figure. Derive the Forward kinematic equation using the DH conversion. **[8]**

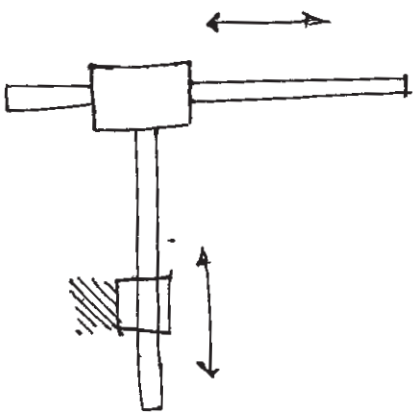


Fig: Two link cartesian robot

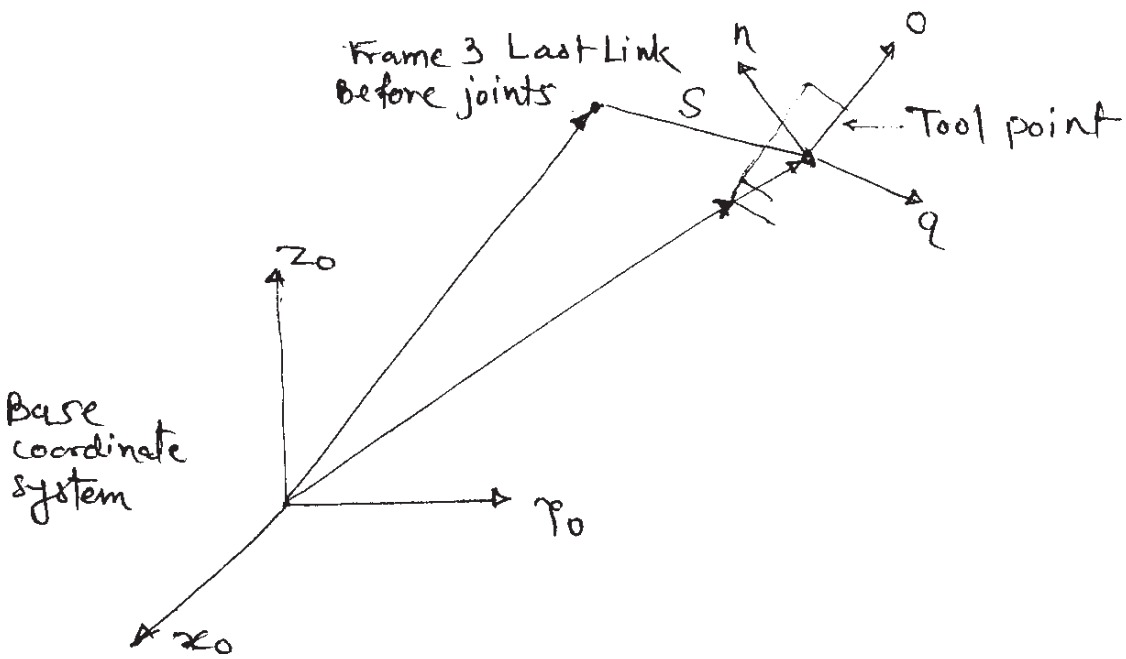
b) Explain frame to frame transformation also discuss the multiple reference frames. **[8]**

OR

Q10) a) Give and explain some properties of transformation matrices. **[7]**

b) Explain in detail DH matrix and give comments on forming the Forward Solution. **[9]**

Q11)



Block out a control strategy using Joint Position Control (JPC) and Resolved Motion Position Control (RMPC) for the manipulator shown in figure. **[16]**

OR

Q12) Define all the relationships needed along with the control structure to implement Resolved Motion Rate Control (RMRC) for the manipulator shown in fig of question 11. **[16]**

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Total No. of Questions :8] [Total No. of Pages :2

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[3765] - 534

M.E. (Electrical) (Control Systems)

ADVANCED DIGITAL CONTROL TECHNIQUES

(2008 Course) (Sem. - II) (503110)

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

Instructions to the candidates:

1) *Answer any three questions from each section.*
2) *Question Nos. 2 and 5 are compulsory.*
3) *Answers to the two sections should be written in separate books.*
4) *Neat diagrams must be drawn wherever necessary.*
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) Elaborate digital modeling with sample-and-hold devices. What are the important considerations while selecting the value of sampling period? **[8]**

b) Explain digital simulation with numerical integration. Explain each method briefly. **[8]**

Q2) Given the Transfer function **[18]**

$$D(z) = \frac{(z^{-5})}{(1+z^{-1}+z^{-2})^2}$$

a) Draw the block diagram of a direct digital program of D(z) using a minimum number of data storage units.

b) Draw the block diagram of a cascade digital program of D(z).

c) Draw the block diagram of a parallel digital program of D(z) using minimum number of data storage units.

P.T.O.

Q3) a) What are the necessary and sufficient conditions for Arbitrary Pole-Placement. **[8]**

b) Design Compensator by separation principal. **[8]**

Q4) a) Explain Pole zero cancellation design. **[8]**

b) What are the advantages and disadvantages offered by Digital Control System over Analog Control System. **[8]**

SECTION - II

Q5) a) Explain the term: **[10]**

i) Design of practical Sampling.

ii) Rate Conversion.

b) Explain Finite Word Length effect in Digital Filters. **[8]**

Q6) a) Give the applications of TMS 320 typical DSP processors. **[8]**

b) What are the key features of TMS 320C5X. **[8]**

Q7) a) What are the advantages of TMS 320C54X. **[8]**

b) Give functional block diagram of TMS 320C54X. **[8]**

Q8) a) What is fixed and floating point DSP. **[8]**

b) What is Discrete Wavelet Transform? Explain in detail. **[8]**

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Total No. of Questions :6] [Total No. of Pages :3

P1741

[3765] - 543

M.E. (Elect.) (Power System)

DIGITAL SIGNAL PROCESSING & ITS APPLICATIONS

(2008 Course) (DSP - ME 101)

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 wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Your answers will be valued as a whole.*
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) Explain the following methods of finding inverse Z transform **[8]**

i) Partial fraction method.

ii) Long division method.

b) Explain how discrete systems are classified as **[8]**

i) Time variant and time invariant systems

ii) IIR and FIR systems, giving suitable examples.

c) The impulse response of a linear time invariant system is $h(n) = \{3, \underset{\uparrow}{2}, 1, 2\}$.

Determine the response of the system to the input signal $x(n) = \{\underset{\uparrow}{1}, 2, 1, 2\}$ using convolution by graphical method. **[6]**

d) Prove **[3]**

i) $Z[Kf(K)] = -Z \dfrac{d}{dz} F(Z)$

ii) $Z[e^{\pm at} f(t)] = F(Ze^{\mp at})$

P.T.O.

Q2) a) Determine 8 point DFT of the sequence $x(n) = \{1, 1, 1, 1, 1, 1, 0, 0\}$. **[8]**

b) Explain Radix - 2 dIF (decimation in frequency) FFT algorithm. **[8]**

c) Prove the following DFT properties **[9]**

i) If $x_3(n) = ax_1(n) + bx_2(n)$

Then $X_3(K) = aX_1(K) + bX_2(K)$

ii) If $x(n) \xrightarrow[N]{DFT} x(k)$

Then $x((-n))_N = x(N-n) \xrightarrow[N]{DFT} X((-k)) = X(N-k)$.

iii) If the sequence $x(n)$ is real then $X(N-K) = X^*(k) = X(-k)$.

Q3) a) Obtain direct form and cascade form realization of the following FIR filter. **[10]**

$y(n) = 0.25x(n) + x(n-1) + 0.25\,x(n-2)$.

b) Write a short note on 'Alteration Theorem **[5]**

c) Explain the frequency sampling method of designing FIR filters. **[10]**

SECTION - II

Q4) a) Using the method of impulse invariance, obtain the IIR filter for the analog filter structure. **[9]**

$$H(s) = \frac{1}{(s+2)(s+3)}.$$

b) Explain the following structures of IIR filters. **[16]**

i) Direct form I ii) Direct form II

iii) Parallel form iv) Cascade form

Q5) a) Write a note on 'Coefficient quantization and its effect on digital filters'? **[8]**

b) Explain the concept of pipelining and its implementation. **[10]**

c) With the help of neat diagrams explain DSP based speech recognition system. **[7]**

Q6) Explain the following concepts as applied to DSP processor. TMS320C54XX (Any Five) **[25]**

a) Memory mapped register addressing.

b) Multiply and accumulate instruction.

c) Circular addressing.

d) Harward Architecture.

e) Multiported memory.

f) Bus structure.

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Total No. of Questions :8] [Total No. of Pages :2

P1750

[3765] - 565

M.E. (E & TC) (Microwave)

MOBILE COMMUNICATION GSM AND CDMA

(2008 Course) (504230)

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

Instructions to the candidates:

1) ***Q4 and Q8 are compulsory.***
2) ***Solve any two questions from the remaining in each section.***
3) ***Assume suitable data, if necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Compare cellular communication over conventional communication systems. **[6]**

b) Explain TDMA and FDMA from capacity, performance and spectral efficiency point of view. State the mobile communication systems where they are deployed. **[10]**

Q2) a) Define the terms: **[8]**

i) Calling rate

ii) Erlangs

iii) Holding time

iv) Grade of service

b) In a voice network each subscriber generates two calls / hr on average and a typical call holding time is 120 sec. What is traffic intensity in Erlangs, CCS and in seconds. **[4]**

c) During a period of 90 min, ten calls were made for 60, 74, 80, 90, 92, 70, 96, 48, 64 and 126 seconds respectively. Calculate the traffic intensity in Erlangs and CCS. **[4]**

Q3) a) Explain the interferences in a cellular system. State & explain atleast one technique to get rid of each of them. **[8]**

b) Consider a GSM system with a one- way spectrum of 12.5 MHz and channel spacing of 200 KHz. There are 3 control channels per cell and the reuse factor is 4. Assuming an omnidirectional antenna with 6 interferers in the first tier and $\gamma = 4$, calculate the number of calls per hour with 2% blocking, an average call holding time of 120 seconds & mean S/I. Given Traffic load is 110 Erlangs. **[8]**

Q4) a) Draw and explain GSM architecture in detail. **[8]**

b) Explain GSM logical channels along with GSM frame structure. **[10]**

SECTION - II

Q5) a) What are the types of hand off strategies used in IS - 95 CDMA. Explain. **[8]**

b) Draw and explain the flow diagram for CDMA call origination. **[8]**

Q6) a) Explain the forward and reverse channel structures of the IS - 95 CDMA air interface. **[10]**

b) Draw & explain the flow diagram for CDMA call termination. **[6]**

Q7) a) Explain QPSK. **[8]**

b) Explain OFDM and its advantages. **[8]**

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

a) Spread spectrum technology.

b) Wireless standards.

c) Security algorithms for GSM.

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Total No. of Questions :12] [Total No. of Pages :4

P1821 **[3765] - 768**

M.E. (Polymer Engg.)

PROCESSING AND MECHANICS OF COMPOSITES

(2008 Course)

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

Instructions to the candidates:

1) *Attempt question number 1 or 2, 3 or 4, 5 or 6, from section I.*
   Attempt question number 7 or 8, 9 or 10, 11 or 12, from section II.
2) *Figures to the right indicate full marks.*
3) *Use of electronic calculator, log paper and log - log paper is allowed.*
4) *Assume suitable design data, wherever required.*
5) *Answers to the two sections must be written in separate answer books.*
6) *Draw neat sketches wherever required.*

SECTION - I

Q1) a) Discuss the rate of change of viscosity in pultrusion die with reference to die temperature setting and exotherm during curing. **[8]**

b) Discuss the effect of pulling rate and pulling force on process conditions of pultrusion process. **[8]**

Q2) a) Draw a sketch of pultrusion line and describe the process and process variables. **[10]**

b) Discuss fiber wet out and resin penetration models for pultrusion process. **[6]**

Q3) a) Derive and obtain expression for lower band on apparent young's modulus of the composite material. **[8]**

b) A unidirectional lamina of glass epoxy composite shows following strength properties. **[8]**

P.T.O.

i) Ultimate tensile failure strength in longitudinal direction 6_{LU}= 500 MPa.

ii) Ultimate compressive failure strength in longitudinal direction $6'_{LU}$ = 350 MPa.

iii) Ultimate tensile failure strength in transverse direction 6_{TU}= 5 MPa.

iv) Ultimate compressive failure strength in transverse direction $6'_{TU}$= 75 MPa.

v) Shear strength τ_{LTU} = 35 MPa.

Estimate off axis shear strength of lamina for fiber orientation of 60º. Use Tsai - Hill failure criteria.

Q4) a) Calculate the ratio of logitudinal modulus of composite (EC) to matrix modulus for 50% of fibers by volume. Modulus of fiber is 350 GPa and of matrix is 3.5 GPa. Using Halpin - Tsai equations, find ratio of transverse modulus of composite to the matrix modulus. Assume Σ which is measure of reinforcement as 2. **[8]**

b) Discuss Halpin – Tsai equations. Analyse the equations for various values of η and Σ. **[8]**

Q5) a) Give statement of Tsai-Wu tensor theory. Reduce it to orthotropic lamina under plane stress condition. Describe uniaxial tests to determine second order tensors. Discuss also biaxial test to determine tensor of the forth order. **[9]**

b) Determine and draw the failure envelope using Azzi - Tsai - Hill theory for a general orthotropic lamina. Why stress envelope is not continuous in space? **[9]**

Q6) a) State assumptions and obtain expressions for determination of E_{11} and E_{22} by mechanics of materials approach. Comment on derived expressions and assumptions made. **[9]**

b) Prove that reduced transformed stiffness matrix is given by $\left[\overline{Q}\right] = [T]^{-1}\,[Q]\,[T]^{-T}$ Where [T] is transformation matrix. **[6]**

c) Give expressions for young's modulus, shear modulus and poisson's ratio of randomly oriented discontinuous fiber lamina. **[3]**

SECTION - II

Q7) a) A 5 mm thick symmetric cross ply laminate is constructed from 15 identical laminae having following stiffness matrix. **[14]**

$$[Q]=\begin{bmatrix} 56 & 4.6 & 0 \\ 4.6 & 18.7 & 0 \\ 0 & 0 & 8.9 \end{bmatrix} \text{GPa}$$

A uniaxial load is applied and the laminate construction is such that 9 laminae are in load direction ie. thickness of 0° plies,9 in number, is 3 mm. Using maximum strain theory, calculate load at which 90° plies fail. Calculate total load carrying capacity of the laminate.

b) Code for lamunate is given below, give correct stacking sequence. **[4]**

i) $[\pm 45 / \mp 30 / 0]$

ii) $[0 / 45 / \overline{90}]s$

iii) $[90 / 0_2 / 45]\ s$

iv) $[0 / 90_2]\ s$

Q8) Determine [A], [B] and [D] matrices for **[18]**

a) [+45 / –45] angle ply laminate

b) [+45 / –45]s Symmetric laminate, and

c) a [+45 / 0 / –45] unsymmetric laminate. each lamina is 6 mm thick. The stiffness matrices are given below.

$$[\overline{Q}]_{0^\circ}=[Q]_{0^\circ}=\begin{bmatrix} 134 & 2.3 & 0 \\ 2.3 & 8.8 & 0 \\ 0 & 0 & 3.2 \end{bmatrix} \text{GPa}$$

$$[\overline{Q}]_{+45}=\begin{bmatrix} 40.1 & 33.6 & 31.3 \\ 33.6 & 40.1 & 31.3 \\ 31.3 & 31.3 & 34.5 \end{bmatrix} \text{GPa}$$

$$[\overline{Q}]_{-45}=\begin{bmatrix} 40.1 & 33.6 & -31.3 \\ 33.6 & 40.1 & -31.3 \\ -31.3 & -31.3 & 34.5 \end{bmatrix} \text{GPa}$$

Comment on individual elements of [A], [B] and [D] matrices. Compare the three laminates.

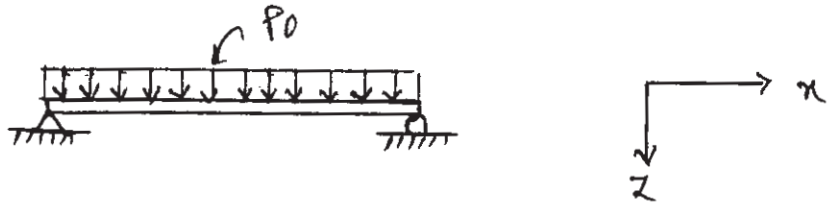
Q9) a) With suitable example, explain regular anti-symmetric cross ply laminate. Give Force per unit - width and moment per unit width equations as per classical lamination theory. Comment on individual elements of [A], [B] and [D] elements. **[8]**

b) Give basic restrictions and assumptions of laminated plate theory. Define equilibrium equations in terms of force and moment resultants. **[8]**

Q10) a) Describe $\pm 45^{\circ}$ shear testing clearly showing strain gauge arrengement & test procedure. **[8]**

b) With suitable example, explain symmetric laminate with multiple specially orthotropic layers. Give conditions for regular symmetric cross ply laminates. Comment on [A], [B] & [D] matrices. **[8]**

Q11) a) Obtain the deflections of a beam simply supported at both the ends as shown below: **[8]**



Assume that the beam carries uniformly distributed load P_o and has symmetric lay-up.

b) Show that for a simply supported symmetric laminate beam, the fundamental frequency or lowest natural frequency occures at **[8]**

$$\omega = \frac{\Pi^2}{L^2}\sqrt{\frac{b D_{11}}{\rho A}} \text{ where .}$$

L = length

ρ = mass per unit volume

A = cross - sectional area

D_{11} = 1st element in bending stiffness matrix.

b = width of beam.

Q12) a) Discuss the significance of invariant properties of the orthotropic lamina. Explain the significance of invariants U_1 and U_5 in laminate design. **[8]**

b) Explain the flow chart for laminate strength analysis for laminate design. Give stepwise design procedure. **[8]**

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Total No. of Questions :8] [Total No. of Pages :3

P1861

[3765] - 109
M.E. (E & TC) (Instru. & Microwave)
COMMUNICATION NETWORKS
(2002 Course)

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) Messages independently arrive to a system at the rate of 10 per minute. Their lengths are exponentially distributed with an average of 3600 characters. They are transmitted on a 9600 bps channel. A character is 8 bits long. **[8]**

Calculate i) Average service time Ts.
ii) What is arrival rate A.
iii) What is Service rate D.
iv) What is utilization of server U.

b) Explain M/M/1 queue system. **[4]**

c) Explain Erlang-B function. **[4]**

Q2) a) List and Explain six main goals of Routing algorithm. **[9]**

b) An organization has a class C network 200.1.1 and wants to form subnets for four departments, with hosts as follows: **[9]**

A 72 hosts
B 35 hosts
C 20 hosts
D 18 hosts

There are 145 hosts in all.

i) Give a possible arrangement of subnet masks to make this possible.
ii) Suggest what the organization might do if department D grows to 34 hosts.

P.T.O.

Q3) a) Describe socket structure and explain TCP/IP socket programming. **[8]**

b) Suppose you are doing RSA encryption with $p = 13$, $q = 7$, and $e = 5$. **[8]**

i) Find the decryption exponent d. (Hint: Use the Euclidean dividing algorithm.)

ii) Encrypt the message $m = 7$.

iii) Decrypt the cypher $c = 2$.

Q4) a) Describe different approaches to network design and explain structure of a network design tool. **[8]**

b) Suppose TCP operates over a 40-Gbps STS-768 link. **[8]**

i) Assuming TCP could utilize the full bandwidth continuously, how long would it take the sequence numbers to wrap around completely?

ii) Suppose an added 32-bit timestamp field increments 1000 times during the wraparound time you found above. How long would it take for the timestamp to wrap around?

SECTION - II

Q5) a) Explain the applications of ICMP, ARP and RARP protocols. **[8]**

b) There are two kinds of connection requests arriving at a base station of a mobile telephone network: connection requests generated by new calls (that originate from the same cell as the base station) or handovers (that originate from a different cell, but are transferred to the cell of the base station). The handovers are supposed not to experience blocking. Therefore, the base station has to reject some of the new call connection requests. Every accepted Connection request occupies one of the M available channels. During a busy hour, the average measured channel occupation time of a call is 1.64 minutes irrespective of the type of call. Furthermore, the average number of active calls is 52 and the measured blocking is 2% of the number of all the connection requests. The average interarrival time between two consecutive new call connection requests in the cell is 3 seconds. **[10]**

i) Calculate the arrival rate (in calls/minute) for the handover calls.

ii) What is the percentage of new calls that are blocked?

Q6) a) Discuss essential features of VOIP. **[8]**

b) In a TCP session from A to B, IP data packets and IP acknowledgement packets travel a distance of 2000 km over precisely the same bi-directional path. In case of congestion, the average speed is 40000 km/s and without congestion the speed is three times higher. Congestion only occurs in 20% of the travels. What is the average speed of IP packets in the TCP session? **[8]**

Q7) a) Discuss the use of Protocal analyzer in Network Troubleshooting. **[6]**

b) Suppose that a site has two communication lines connecting it to a central site. One line has a speed of 64 kbps, and the other line has a speed of 384 kbps. Suppose each line is modeled by an M/M/1 queueing system with average packet delay given by $E[D] = E[X]/(1 - \rho)$ where E[X] is the average time required to transmit a packet. λ is the arrival rate in packets/ second, and $\rho = \lambda E[X]$ is the load. Assume packets have an average length of 8000 bits. Suppose that a fraction α of the packets are routed to the first line and the remaining $1 - \alpha$ are routed to the second line. **[10]**

i) Find the value of α that minimizes the total average delay.

ii) Compare the average delay in part (a) to the average delay in a single multiplexer that combines the two transmission lines into a single transmission line.

Q8) a) Write short note on Wireless Networking, its connecting components and transmission techniques. **[8]**

b) There are two LAN bridges both connected to a pair of 802.4 networks. The first bridge is faced with 1000 numbers of 512- byte packets per second that must be Forwarded. The second is faced with 200 numbers 4096 bytes packets per second. State which Bridge will need the faster CPU. Discuss your answer. **[8]**

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Total No. of Questions :8] [Total No. of Pages :3

P1862

[3765] - 111

M.E. (E & TC) (Microwaves)

RF AND MICROWAVE CIRCUIT DESIGN

(Revised 2004 Course)

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 the separate books.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of electronic pocket calculator and smith chart is allowed.*
6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) The current flowing in a micro strip line (assumed to be infinite and loss less) is specified to be $i(t) = 0.6 \cos (9 \times 10^9 t - 500 z)$ A. Find the Phase Velocity, Frequency, Wavelength and Phasor expression of the current. **[4]**

b) Draw an electrical equivalent circuit for a high frequency capacitor and inductor. Explain their impedance response. A manufacturer data sheet records the series loss tangent of a capacitor to be 10^{-4} at 5 GHz. For a total plate dimension of 10^{-2} cm^2 and plate separation of 0.01 mm and relative dielectric constant of 10, find the conductance. **[8]**

c) Explain the practical realization of Chip Resistors with suitable example. **[4]**

Q2) a) A particular RF circuit requires that a line impedance of 50 Ω is to be maintained. The selected PCB board material is FR-4 with relative dielectric constant 4.6 and thickness of 40 mils. What are the widths of trace, phase velocity and wavelength at 2 GHz. (Given: w/h = 1.85). **[8]**

b) Derive a formula for input impedance $Z_{in}(d)$ of a terminated loss less line at a distance 'd' away from the load. Find the expressions of $Z_{in}(d)$ for special termination conditions such as short circuit and open circuit. **[8]**

P.T.O.

Q3) a) With the help of suitable example define and explain the terms Reflection coefficient, Transmission coefficient, Return loss, and Insertion loss. Give their Formulas. **[8]**

b) A load impedance of (Z_L = 150 – j50) Ω is connected to a 5cm long transmission line with characteristic line impedance Z_O = 75 Ω. For a wavelength of 6cm, compute. **[8]**

i) The input impedance.

ii) The operating frequency if phase velocity is 77% of the speed of light.

iii) The SWR.

Q4) Write Short note on: **[18]**

a) Smith Chart and its utilization for design of matching networks.

b) ABCD Network Representation.

c) Measurement of S-Parameters.

SECTION - II

Q5) a) Design and realize the fifth order Chebyshev low pass filter whose input and output are matched to a 50 Ω impedance and cut off frequency is 3.5 GHz. Assume a dielectric material that results in a phase velocity of 60% of the speed of light. **[12]**

(Given: Filter coefficients for N = 5; $g_1 = g_5 = 1.70$, $g_2 = g_4 = 1.23$, $g_3 = 2.54$, $g_6 = 1.0$)

b) Compare the attenuation versus frequency behavior of third order low pass filter for a standard 3dB Butterworth, linear phase Butterworth and 3dB Chebyshev design. **[4]**

Q6) a) Explain with the help of structure and equivalent circuit working of the following RF diodes. Explain their anyone application. **[12]**

i) PIN diode.

ii) Tunnel diode.

b) How a Varactor diode works as an RF oscillator? Explain with suitable circuit diagram. **[4]**

Q7) a) Draw an equivalent circuit of a transistor and explain the significance of each component. **[12]**

An npn transistor is operated under a DC bias of I_{CQ} = 6 mA, I_{BQ} = 4μA, and the Early voltage is recorded to be V_{AN} = 30V. Through a network analyzer measurement transition frequency is determined to be 37 GHz at room temperature. It is required to determine the hybrid –π parameters: β_0, r_π , C_π, r_o, g_m.

b) Explain the working of IMP A TT diode. **[4]**

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

a) RF amplifier Power Relations.

b) RF amplifier Stability considerations.

c) Small Signal MESFET Model.

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Total No. of Questions :8] [Total No. of Pages :2

P1867

[3765] - 181

M.E. (Production)

CIM AND ADVANCED MANUFACTURING PROCESSES

(Revised 2002 Course)

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

Instructions to the candidates:

1) *Solve any three questions from each section.*
2) *Answers to the two sections should be written in separate books.*
3) *Figures to the right indicate full marks.*
4) *Draw neat sketches wherever required.*

SECTION - I

Q1) a) Explain the concept of MRP-I along with different input and out reports. **[8]**

b) Explain any two module related to manufacturing for MRP-II? **[8]**

Q2) a) Explain the importance of flexibility in modern manufacturing era? Also explain selection of layout in FMS. **[8]**

b) Describe with suitable example the implementation of CIM? **[8]**

Q3) a) Explain the importance of computer aided process planning? Compare generative process planning with traditional process planning. **[8]**

b) Explain the different component to be considered in designing of an automated system? **[8]**

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

a) CIM Data files.

b) Selection of AGV system.

c) Computer aided testing.

d) Network topology in CIMS.

P.T.O.

SECTION - II

Q5) a) What machining center? Explain the role of ATC in it? Explain working of ATC with figure? **[8]**

b) What are the requirements of machine tool for High speed machining? Explain factors affecting on High speed machining. **[8]**

Q6) a) Explain different process parameters that affect on material removal rate in Electrochemical process? **[8]**

b) What is micromachining? Explain any one method to achieved it. **[8]**

Q7) a) Explain steriolithography process of rapid prototyping along with advantages, limitations. **[8]**

b) Discuss the factors influencing the selection of dielectric medium in EDM and explain methods of flushing? **[8]**

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

a) Wire cut EDM.

b) Fused deposition method of Rapid prototyping.

c) Water jet machining.

d) Lean manufacturing.

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Total No. of Questions :6] [Total No. of Pages :2

P1873

[3765] - 453
M.E. (Civil) (Structure)
STRUCTURAL DYNAMICS
(2008 Course)

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 indicate full marks.*
5) *Your answers will be valued as a whole.*
6) *Use of electronic pocket calculator is allowed.*
7) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) Define and explain with example : **[6]**

i) Types of vibration.

ii) Modeling of structure.

iii) Types of loadings.

b) For the SDOF (free damped system), derive the expression for- **[9]**

i) Damped frequency.

ii) Critical dampening.

c) A damper offers resistance of 0.05 N at velocity of 0.04 m/s. The damper is used with spring of stiffness 9N/m. Determine damping frequency of system when mass of the system is 0.10 kg. **[10]**

Q2) a) Explain with neat sketches the characteristics curves for viscous damped forced vibrating system. What inferences can be drawn from them? **[7]**

b) Define frequency ratio. Derive the expression for transmissibility ratio in terms of frequency ratio and damping factor. **[8]**

c) A damped natural frequency of a system as obtained from free vibration test is 9.8 cycles/sec. During a forced vibration test with constant exciting force on same system, the maximum amplitude 'A' of vibration is found to be at 9.6 cycle/sec. Find damping factor and the natural frequency of the system. **[10]**

P.T.O.

Q3) a) Show that maximum dynamic deflection of an un-damped system subjected to suddenly applied load is twice the static deflection of the system. **[10]**

b) Write notes on any three:- **[15]**

i) Response analysis using half cycle sine pulse wave.

ii) Duhamal's Integral for response of un-damped system.

iii) Logarithmic decrement

iv) Wilson theta method.

SECTION - II

Q4) a) Compute the fundamental frequency of the system shown in figure 4.1. **[10]**

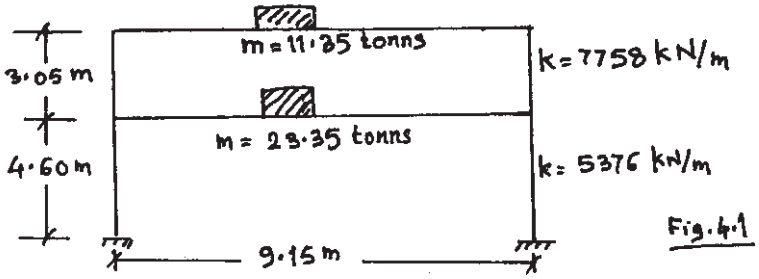

Fig. 4.1

b) Explain the Stodola Method of obtaining natural frequency of m.d.o.f. system. **[8]**

c) State and prove "Orthogonality of Modes" **[7]**

Q5) a) Write a note on " Superposition of Modes" and explain how it can be used to transform the coupled equation into uncoupled equations. **[10]**

b) Explain Non-Linear analysis by Wilson- Theta Method. **[7]**

c) Formulate the equation of motion for two degree undamped system of masses M_1 and M_2 subjected to forces $F_1(t)$ and $F_2(t)$ respectively. **[8]**

Q6) a) Explain Rayleigh's Method of free vibration analysis of beams having distributed masses. **[10]**

b) Compute fundamental frequency of freely vibrating cantilever beam of span 'L' m and subjected to point mass' M' kg along with u.d.l. of intensity 'w' N/m all over the span. Assume deflected shape given by $y = \dfrac{yb(3Lx^2 - x^3)}{2L^3}$. **[15]**

where y_b = static deflection at free tip due to 'M'.

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Total No. of Questions :8] [Total No. of Pages :3

P1891

[3765] - 679

M.E. (Petroleum)

HORIZONTAL, MULTILATERAL AND INTELLIGENT WELLS

(New Course 2008)(512103)

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) *Q.1 and Q.5 are compulsory. Out of the remaining attempt any two questions from section I and two questions from section II.*
4) *Use of cm scale graph paper is allowed.*
5) *Figures to the right indicate full marks.*
6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) Discuss radial tangential stress verses depth, when casing string is subjected to various loading condition. Show stress diagrams. **[9]**

b) Find tentative 9-5/8 inch casing shoe depth, using following well data. **[9]**

Depth-(metre)	Formation pressure in M.W.E.	Formation fracture gradient in M.W.E.
500	1.05	1.2
1300	1.05	1.3
2250	1.15	1.72
2500	1.30	1.9
2900	1.52	2.16
3000	1.60	2.20
3150	1.80	2.22
3400	1.90	2.23
4000	1.91	2.30

P.T.O.

Q2) a) Write the different types of directional wells and explain geometrical planning of Type - II, directional profile. **[8]**

b) Find the measured depth for the following directional well data: **[8]**

horizontal displacement = 6000 ft, Target depth TVD = 12000 ft.

TVD kop = 1500 ft., Build up rate = 2° per 100 ft.

Drop off rate = 1.5° per 100ft, TVD at end of drop off = 11000 ft .

Final inc lination = 20° .

Q3) a) Write function and working of different sensors used in LWD tool. **[8]**

b) A drill string consists of 600 ft of 8.25" × 2-13/16' drill collar & rest is 5" dril pipe, 19.5 ppf, grade X95 drill pipe. If required MOP is, 100,000 Ib and mud weight is 10 ppg . Calculate maximum depth of hole that can be drilled using,

i) New drill pipe P_t = 501,090 lb.

ii) Class 2 drill pipe having yield strength P_t = 394,000 Ib, steel density = 489.5 ppf. Buoyancy factor = 0.847. **[8]**

Q4) a) Discuss different types of horizontal wells and their completion technique. **[8]**

b) Write short notes on: **[8]**

i) Deflection tools

ii) Formation damage of vertical and horizontal wells

SECTION - II

Q5) Discuss in detail energy balance in hydraulics system and determine the pressure at the bottom of the drill string if, frictional pressure loss in the drill string is 1450 psi. the flow rate is 400 gpm, the mud density is 12 ppg and well depth is 10,000 ft. The internal diameter of the drill collar at the bottom of the drill string is 2.5" and the pressure increased by the pump is 3,000 psi. **[18]**

Q6) a) Calculate number of sacks of cement required, water required for gel slurry & tail slurry for 13 - 3/8" casing cementation job, if rise of cement is 600 meter from bottom, height of gel slurry = 200 meter and tail slurry 400 meter. Distance between float shoe and float collar is 25 meter.

Data given:

Capacity 17.5"hole × 13-3/8" casing = 0.1237 bbls/ft.

Capacity of 13-3/8" casing = 0.1521 bbls/ft. Gel slurry yield = 1.66 cuft/sack

Water requirement 8.77 gal/sack. Tail slurry = 1.15 cuft /sack,

Water requirement = 5 gal/sack **[8]**

b) Explain commercial speed, cycle speed and per meter cost of a drilling rig in detail. **[8]**

Q7) Write short notes on: **[16]**

a) Under balance drilling.

b) Coiled tubing drilling.

Q8) a) Discuss radius of curvature method in detail. **[8]**

b) Write short note on: **[8]**

i) Intelligent wells.

ii) Bottom hole assemblies for directional well.

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Total No. of Questions :8] [Total No. of Pages :2

P1894

[3765] - 705

M.E. (Computer Science Engg.) (IT)

GEOGRAPHICAL INFORMATION SYSTEMS

(2008 Course) (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) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) What is Map Projection? Discuss the commonly used Map Projections and compare. **[8]**

b) What is significance of a Grid system? Describe the Lambert Grid of India and UTM Grid. **[10]**

Q2) a) What are the factors that affect microwave measurements? **[6]**

b) How SAR images are interpreted? Discuss why and how the interpretation of radar images depends on geometrical characteristics? **[10]**

Q3) a) Explain in brief the edge enhancement using filtering **[6]**

b) Discuss various methods that are used to preprocess the remotely sensed raw data. **[10]**

Q4) a) With a neat block diagram, explain the four Ms. **[8]**

b) Explain the GIS workflow. **[8]**

P.T.O.

SECTION - II

Q5) a) Why it is important for the user to be aware of the database structure when using a GIS? **[6]**

b) Discuss various methods used for speed up data access and comparison. **[10]**

Q6) a) What are the components of data quality? What factors that affect the reliability of spatial data? **[10]**

b) Compare raster and vector data models. **[8]**

Q7) a) With a neat block diagram explain the architecture of a GIS. **[8]**

b) Discuss various components of a GIS. **[8]**

Q8) a) List various GIS applications from different domains. Also comment on Change in technology, users and changes in data supply. **[8]**

b) Discuss the use of GPS in GIS data capture. **[8]**

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Total No. of Questions :8] [Total No. of Pages :3

P1906 **[3765] - 46**

M.E. (Mechanical Engineering) (Design and Heat Power)
NUMERICAL METHODS AND COMPUTATIONAL TECHNIQUES
(2002 Course)

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

Instructions to the candidates:

1) *Answer three questions from each section.*
2) *Assume suitable data, if required.*
3) *Figures to the right (in square brackets) indicate full marks.*
4) *Use of a non-programmable calculator is allowed.*

SECTION - I

Q1) The deflection curve of a beam subjected to a linearly increasing load can be given as $y = C(-x^5 + 2L^2x^3 - L^4x)$,

where $C = 4 \times 10^{-5}/m^4$ and L(beam length) = 5m.

a) Use Newton Raphson method to determine the point of maximum deflection. **[12]**

b) Compute the maximum deflection. **[4]**

Q2) Solve the following system using Gaussian elemination (or any other direct method): **[16]**

$$5x_1 + x_2 + 2x_3 = 3.5$$
$$3x_1 - 2x_2 + 2x_3 = 5.5$$
$$x_1 + 2x_2 + x_3 = -0.5$$

Q3) Consider the following data on the variation of tensile strength of a plastic as a function of time it is heat treated.

Time (min)	10	15	20	25	40	50	55
Tensile Str	5	20	18	40	33	54	70

a) Fit a straight line to the data. **[12]**

b) Use the same to determine the tensile strength at a time of 32 min. **[4]**

P.T.O.

Q4) Consider one dimensional transient conduction in a rod of 1m length, given by

$$\frac{\partial T}{\partial t}=\alpha\frac{\partial^2 T}{\partial x^2}.$$

The boundary and initial conditions are

- T = 0 at $t = 0$ (initial condition)
- T = 0 at $x = 0$ (boundary condition)
- T = 120 at $x = 1$.(boundary condition)

Choose $\delta x = 0.25$m and $\delta t = 0.01$s. Take $\alpha = 1\text{m}^2/\text{s}$.

a) Using the explicit method, advance by two time steps and determine the temperature field at $t = 0.02$s. **[12]**

b) Form the equations for the implicit scheme for one time step. The solution is not required. **[6]**

SECTION - II

Q5) Consider the function

$$f(x)=x^2+\frac{2}{x}$$

Integrate this function from $x = 1.2$ to $x = 2.4$ with a step size $h = 0.2$.

a) Using Trapezoidal rule. **[6]**

b) Using Simpson's one-third rule. **[6]**

c) Compare both methods against the exact solution. **[4]**

Q6) a) Derive the forward and central difference approximations to the first derivative, along with the leading error term. **[7]**

b) Derive the approximation for the second derivative along with the leading error term. **[4]**

c) Consider $f(x) = \cos(x)$. Taking $\delta x = 0.05$, determine the forward and central difference approximations to the derivative at $x = 1$ radian. Compare against the exact solution. **[5]**

Q7) For the case of water draining out from the bottom of a tank, the water level in the tank can be given as:

$$\frac{dy}{dt} = -k\sqrt{y},$$

where $k = 0.2\text{m}^{1/2}$ / min.

The initial condition is $y = 2.5$ m at $t = 0$.

Integrate this from $t = 0$ to $t = 2$min.

a) Using Forward Euler with $\delta t = 0.5$min. **[6]**

b) Using Fourth Order Runge Kutta with $\delta t = 1$min. **[12]**

Q8) Consider steady state conduction given by the Laplace equation in a square of 1m length. The boundary conditions are as follows.

- T = 110 for $y = 0$, $0 \le x \le 1$
- T = 170 for $y = 1$, $0 \le x \le 1$
- T = 90 for $x = 0$, $0 \le y \le 1$
- T = 250 for $x = 1$, $0 \le y \le 1$

With $\delta x = \delta y = \frac{1}{3}$,

a) Form the equations at the interior nodes. **[8]**

b) Carry out 2 cycles of iteration. **[8]**

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Total No. of Questions :8] [Total No. of Pages :3

P2004 **[3765] - 480**

M.E. (Mechanical) (Heat Power)
INTERNAL COMBUSTION ENGINES
(2008 Course) (Elective - II) (502105 - A)

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 books.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of log tables, electronic pocket calculators and steam tables is allowed.*
6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) What is the general material selection criteria for the components of an I.C. engine? **[8]**

b) Enlist the materials used for the following components with their properties: **[8]**

i) Cylinder head ii) Piston rings

iii) Crank shaft iv) Connecting rod.

Q2) a) Write a note on Dynamometer. **[6]**

b) When a three cylinder four stroke cycle S.I. engine operating at 4000 rpm is connected to an eddy current dynamometer and 70.4 kW of power is dissipated by the dynamometer. Engine has a total displacement volume of 2.4 liters and a mechanical efficiency of 82% at 4000 rpm. Dynamometer has an efficiency of 93% (because of heat & mech. losses). **[10]**

Calculate:
i) Power lost in friction.
ii) BMEP
iii) Engine torque at 4000 rpm &
iv) Engine specific volume.

P.T.O.

Q3) a) A 1500 cm^3 four stroke cycle, four cylinder C.I. engine, operating at 3000 rpm, produced 48 kW of B.P. Volumetric efficiency is 92% & air fuel ratio is 21:1. **[9]**

Calculate:
- i) Rate of air flowing to engine (kg/sec.)
- ii) BSFC
- iii) Mass flow rate of exhaust flow (kg/hr)
- iv) Brake output per displacement (kW/L).

b) What are the Ideal and actual indicator diagrams? Explain. **[7]**

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

a) Combustion chamber in S.I. Engine.

b) Knocking in C.I. Engine.

c) Recent trends in I.C. Engines.

d) MPFI system.

SECTION - II

Q5) a) Explain the concept of Exhaust Gas Recirculation in Diesel Engines. How does it reduce NO_x emissions? **[6]**

b) Dry exhaust gas from a C.I. engine had the following composition by volume: CO_2 = 8.89 %, CO = 1.2 %, O_2 = 6.8 %. N_2 = 83.15 %. The fuel has 84 % carbon, 14% hydrogen and 2 % oxygen content. Determine the Air to Fuel ratio for the fuel and mass of carbon per kg of dry flue gas. **[10]**

Q6) a) Discuss the construction of a three way catalytic converter with a neat sketch and explain its working. **[8]**

b) Discuss the operation of a dual fuel engine with a neat sketch. What are its advantages over conventional diesel engine? **[8]**

Q7) a) Discuss various controls and sensors used in modern engines. **[6]**

b) Explain the terms squish, swirl and tumble in relation to I.C. engines. **[6]**

c) What are the health effects of air pollution from I.C. engines? **[4]**

Q8) Write a short note on (any three): **[18]**

a) Hybrid vehicle.

b) Diesel particulate filter.

c) Hartridge smoke meter.

d) Crankcase blowby.

e) Simulation of I.C. engine combustion.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1803

[3765]-724

M.E. (Chemical) (Environmental Engg.)

MEMBRANE TECHNOLOGY IN ENVIRONMENTAL ENGINEERING

(2008 Pattern)

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

Instructions to the candidates:

1) ***Question one is compulsory and any two from the remaining questions.***
2) ***Question five is compulsory and solve any two from the remaining questions.***

SECTION - I

Q1) a) Give a classification of membrane processes and discuss major industrial applications. **[6]**

b) Distinguish between different types of membranes which are used for industrial application. **[6]**

c) Discuss a membrane process used for desalination of sea water. **[6]**

Q2) a) Define a module and its type used in membrane processes. **[8]**

b) Discuss the parameters which control state of the polymer substance. **[4]**

c) Explain the difference between symmetric and asymmetric membranes. **[4]**

Q3) a) Explain the importance of glass transition temperature for the polymeric substance. **[8]**

b) Discuss the role of ion exchange membranes in the separation process. **[4]**

c) Explain how membranes are useful in chemical reactors. **[4]**

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

a) Osmosis and Reverse Osmosis.

b) Membrane Distillation.

c) Zeolite Membranes.

d) Retention and Selectivity.

P.T.O.

SECTION - II

Q5) a) State reasons for membrane fouling and explain the methods used for its control. **[6]**

b) What types of flow patterns are practiced in membrane processes? How transmembrane pressure is expressed? **[6]**

c) Explain modes of membrane operation with respect to flux and transmembrane pressure. **[6]**

Q6) a) Explain properties for the inorganic membrane and give its classification. **[8]**

b) Explain the structure and functionality of biological membrane. **[4]**

c) Explain why zeolite membranes are considered? **[4]**

Q7) a) Explain different techniques adopted for the membrane preparation. **[8]**

b) Which polymer substances are used for membrane preparation? **[4]**

c) Describe important structural properties of the membrane. **[4]**

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

a) Ion exchange membranes.

b) Membrane Dialysis.

c) Pressure driven Membrane Processes.

d) Membrane reactors.

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Total No. of Questions : 8] [Total No. of Pages :2

P1804

[3765] - 729

M.E. (Chemical) (Environmental Engg.)

WASTEWATER TREATMENT AND DESIGN

(2008 Pattern)

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

Instructions to the candidates:

1) *Question one is compulsory and any two from the remaining questions.*
2) *Question five is compulsory and solve any two from remaining questions.*

SECTION - I

Q1) a) Discuss the effect of the incoming and outgoing fluid flow on the performance of a reactor. **[6]**

b) Explain good qualities of a tracer and the methods of tracer experiment. **[6]**

c) How out going concentration of a nonideal reactor is determined? **[6]**

Q2) a) Explain dispersion number (d) and give significance of the Peclet number (Pe). **[8]**

b) Discuss various models used to express non ideal behavior of a reactor. **[4]**

c) Describe various flow regimes commonly used in the wastewater treatment. **[4]**

Q3) a) Give principals of unit operations and explain how mass transfer resistance is recognized? **[8]**

b) Explain the terms COD and BOD, how absorption of oxygen in a pond is obtained. **[4]**

c) How Mass Transfer Zone is developed in the adsorption column? **[4]**

Q4) Give significance of the following : **[16]**

a) F and E curve.

b) Terminal velocity of settling.

c) Plug Flow reactor and Mixed flow reactor.

d) Aeration systems.

P.T.O.

SECTION - II

Q5) a) Explain the term 'Phase'. Give applications of mass transfer operations in wastewater treatment. **[6]**

b) Describe characteristic of the solid adsorbent and explain how adsorption isotherms are developed? **[6]**

c) Explain how mass transfer is effective over a solid porous surface. **[6]**

Q6) a) Why rapid mixing is required in wastewater treatment? Which equipments are used? **[8]**

b) Explain the principal of flocculation and settling. **[4]**

c) Explain mixing action of a turbine and paddle mixer used in wastewater treatment. **[4]**

Q7) a) Give characteristic of wastewater. How bioprocesses are classified. **[8]**

b) What is a biomass? Describe functions of a microbial cell. **[4]**

c) Explain bacterial growth pattern in a batch reactor. **[4]**

Q8) Explain : **[16]**

a) Suspended and Attached growth process.

b) Perikinetic and Orthokinetic flocculation.

c) SRT of a Bioreactor.

d) Breakthrough curve in packed column.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1806

[3765] - 731

M.E. (Environmental Engineering)

INDUSTRIAL WASTE TREATMENT

(2008 Course)

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.***

SECTION - I

Q1) a) Discuss about the industrial water quality requirements. **[8]**

b) Explain the reuse and recycling concept in water management. **[8]**

Q2) Explain the treatment techniques for removal of the following pollutants from Industrial waste : **[18]**

a) Heavy Metal.

b) Oil & Grease.

c) Calcium.

Q3) a) Give the distinction between clean up and cleaner technologies. **[8]**

b) Focus on water budgeting. **[8]**

Q4) The BOD results given below are observed on a sample of wastewater.**[16]**

t, days	1	2	4	6	8	10
BOD, mg/lit	6.5	11	18	22	24	26

a) Plot BOD curve.

b) Calculate parameters K_1 & Lu.

P.T.O.

SECTION - II

Q5) A wastewater is to be treated by conventional activated sludge process. The design loading is 0.1 m^3/s and 250 mg/lit BOD. The design criteria and Operating values for conventional process are as follows :

BOD removal% = 90

Organic loading = 0.5 kg BOD/day per kg MLVSS.

The target for MLSS in aeration tank = 2000 mg/lit

Excess sludge production 0.5 kg sludge solid per kg BOD destroyed.

Air flow rate = 100 m^3/day per kg BOD per day

Final settling tank per overflow rate = 30 m^3/day per m^3 surface

Solid concentration in recycle sludge = 10,000 mg/lit

Solid concentration in effluent leaving the system = 25 mg/lit.

Calculate the following : **[16]**

a) Aeration period.

b) Amount of solid leaving the system.

c) Amount of BOD destroyed.

d) Air flow requirement.

e) Surface area of settling tank.

Q6) Explain the concept, objective, design and cost-benefit analysis of common effluent treatment plant. **[16]**

Q7) Draw the flow sheet for treatment of sugar waste and focus on its cost-benefit analysis with all details. **[16]**

Q8) Suggest the design for treatment of Industrial waste of the following : **[18]**

a) Dairy Industry.

b) Pulp & Paper Industry.

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Total No. of Questions : 8] [Total No. of Pages :2

P1808

[3765] - 736

M.E. (Instrumentation and Control) (Bio & Instru. Process)

TRANSDUCER DESIGN

(2008)

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

Instructions to the candidates:

1) *Answer any 3 questions from Section I and 3 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 logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
6) *Assume suitable data if necessary.*

SECTION - I

Q1) Design a Force transducer based instrumentation to monitor the forces acting on the platform of a petroleum tank The total weight of an empty tank is 10 Tons and when filled completely it increases by 20 Tons. Suggest a scheme of transducer and signal conditioning for display of various status of tank filling, in percentage of its capacity. Explain why strain gage transducer would be better in this case and what transducer material is preferable while weighing corrosive liquid like petrol. **[18]**

Q2) Suggest discharge measurement scheme with a device to monitor discharge of water, flowing through penstocks in a Large head Hydro Power Project, in Western Ghats of Maharashtra. The control panel needs to display water head in the dam and actual flow through penstock in Liters per Hour. Sketch one such scheme and give specifications of each component device suggested.**[16]**

Q3) Describe with neat sketch a piezoelectric accelerometer to monitor the vibrations of moving vehicle. Suggest a complete instrumentation to monitor the tri axial vibrations for one hour of a run, at a speed of 80 miles per hour, on national highway in India **[16]**

P.T.O.

Q4) Describe with neat sketch a six component accelerometer. Propose a scheme to install it in a vehicle test rig in a Laboratory. It is preferred that a device be inductive accelerometer. Describe specifications of such device and elaborate a scheme to measure and display rms values of Six components. Display should also indicate a single predominant frequency of each component under a test condition. **[16]**

SECTION - II

Q5) Write a short note on : **[18]**

a) Sagnac Gyroscope to measure rotation of a giant ship using optical fiber sensing system and DFB LASER

b) LASER DOPPLER VELOCIMETER to measure velocity of air flow around aero dynamic body in a test flume. Describe back scatter mode of measurement.

Q6) Discuss the selection criteria for Gas Sensors required for monitoring the pollution in the crowded locality. Suggest the suitable sensors and their ranges. A compact Data Acquisition System is to be proposed. **[16]**

Q7) In the instrumentation department of a fertilizer plant, pressure gauges are tested and calibrated. For calibration Dead Weight Tester is used. Explain the calibration procedure and comment on validity of results. **[16]**

Q8) It is required to design a platform weigh scale to measure 40 ton load. Compare design approach using proving ring type LVDT and cantilever beam using strain gauge sensor. **[16]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1809

[3765] - 738

M.E. (Instrumentation & Control)

COMMUNICATION PROTOCOLS FOR INSTRUMENTATION

(2008 Course) (5061103)

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

Instructions to the candidates:

1) ***Answer any 3 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) Explain the following Industry open Protocols: **[16]**

a) MODBUS Plus.

b) Data Highway plus.

Q2) With neat diagrams, explain the hybrid method used for regulating media access in Profibus DP systems. Also explain the essential technical data for Profibus DP. **[16]**

Q3) How is the Commissioning done of Fieldbus devices? Explain the following test procedures done during commissioning: **[16]**

a) Segment testing.

b) Field Device testing.

c) Operational testing.

Q4) Write short notes on the following Industry open standards: **[18]**

a) RS 232.

b) RS 422.

c) RS 485.

P.T.O.

SECTION - II

Q5) Explain the following with neat diagrams/waveforms: **[16]**

a) NRZ.

b) Manchester Data Encoding.

Q6) Explain the steps involved in commissioning of HART networks. **[16]**

Q7) Explain the ISO-OSI seven layer model. Also map the following protocols on the seven layer model: **[18]**

a) Fieldbus.

b) Profibus PA.

c) HART.

d) CAN.

Q8) Write short notes. **[16]**

a) Wi-Fi.

b) MODBUS RTU.

Total No. of Questions : 8] [Total No. of Pages : 1

P1810

[3765]-740
M.E. (Instrumentation & Control)
INDUSTRIAL AUTOMATION
(2008 Course) (5061105)

Time : 3 Hours] *[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 indicate full marks.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) Design Fuzzy Logic Controller for water heating system. Assume suitable data if necessary. **[16]**

Q2) Explain in brief Back Propagation tuning of the multilayer Neural Network. **[16]**

Q3) Explain in brief Fiber Optic LAN & its application to MAP protocol. **[16]**

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

a) Model Predictive Control.

b) Statistical process Control.

SECTION - II

Q5) Explain in brief different types of Sequencer? Develop programmable ladder diagram for flashing of lamp for every 10 seconds. **[16]**

Q6) Discuss the method of interfacing PLC with SCADA Software. Also describe the internal PLC operation for analog I/O operation. **[16]**

Q7) Write notes on : **[16]**

a) Hybrid DCS/PLC

b) OPC.

Q8) Enlist main zones in steel plant. Suggest suitable automation strategy for the steel plant. **[18]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1811

[3765]-743

M.E. (Instrumentation & Control) (Specialization : Biomedical Instrumentation)

FUNDAMENTALS OF BIOMEDICAL INSTRUMENTATION

(2008 Course) (Elective - I) (5061201) (A)

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) Describe various electrodes used in biophysical measurements such as ECG, EEG and EMG. **[8]**

b) What are the modes of operation of a piezoelectric crystal? Discuss any one application of it in biomedical field. **[8]**

Q2) a) With the help of a suitable diagram, explain in detail the generation of action potential in a cell. **[8]**

b) What is Na Pump? **[4]**

c) Define polarizable and non polarizable electrodes. **[4]**

Q3) a) Draw a simplified diagram of computerized ECG recorder. Explain in brief each block of the system. **[8]**

b) Draw an arterial pressure wave indicating systole and diastole. Explain blood pressure measurement technique based on Korotkoff sounds. **[10]**

Q4) a) Explain the natural hearing mechanism of a human ear. How to detect the hearing loss? **[8]**

b) Write a short note on 'Tonometer'. **[8]**

SECTION - II

Q5) a) How the pacemakers are classified? Explain any one of them in detail. **[8]**

b) Briefly mention the physiological effect of current at commercial frequencies. Describe a line isolation monitor providing electrical safety during the working of medical equipment. **[8]**

Q6) a) Define plethysmography. With a suitable diagram, explain the working of photoplethysmography unit in detail. **[8]**

b) Describe the method to measure electrical activity of a muscle. What are the precautions to be taken while monitoring EMG? **[8]**

Q7) a) Explain following terms in relation to respiratory system. **[8]**

i) Tidal volume.
ii) Inspiratory reserve volume.
iii) Vital capacity.
iv) Total lung capacity.

b) State advantages of hemodialysis over peritoneal dialysis. With simplified diagram explain the operation of peritoneal dialysis. **[10]**

Q8) a) Explain laser based flow Cytometry. **[8]**

b) What is 'Biofeedback'? State and explain any two applications of it. **[8]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1815

[3765] - 755

M.E. (Instrumentation & Control)

Specialization : Biomedical Instrumentation

BIO IMAGING MODALITIES

(2008 Pattern) (5061205(A))

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) Explain various ranges of Electromagnetic spectrum that are used in biomedical applications. **[8]**

b) Define Acoustic Impedance and Attenuation Coefficient. How do they affect propagation of ultrasound waves in matter? **[8]**

Q2) a) What is the difference between characteristic x-ray and Bremsstrahlung X-ray? Draw the block diagram of X-ray machine and explain each block in brief. **[8]**

b) Explain various front panel controls of X-Ray machine and explain their effect on X-Ray generation. **[8]**

Q3) a) How X rays can be used for fluoroscopic measurements? Explain the use of Image Intensifier. **[8]**

b) What abnormalities can be detected by Mammography and how? **[8]**

Q4) a) Define Tomography. Discuss the necessity of computer in tomography. Explain the concept of CT number and its role in image reconstruction. **[10]**

b) With a simplified diagram, describe various generations of gantries used in CT scanner. Elaborate on how each generation is better than the earlier one. **[8]**

SECTION - II

Q5) a) Discuss various display modes of Ultrasound imaging? State one application of each mode. **[10]**

b) Define Doppler shift. How it is used in Color Doppler method for blood flow measurement? **[8]**

Q6) a) List and explain important parameters that are crucial in selecting Ultrasound transducer for particular application. **[8]**

b) Write a short note on 2D Echocardiography. **[8]**

Q7) a) Compare CAT and PET. **[8]**

b) Explain biological effects of radiation on human body. Which precautions to be taken to minimize the ill effects? **[8]**

Q8) a) With the help of a timing diagram, describe imaging pulse sequence in MRI. **[8]**

b) Explain instrumentation in Thermography. State the applications of Thermography in Biomedical field. **[8]**

Total No. of Questions : 8] [Total No. of Pages : 1

P1817

[3765]-761
M.E.(Polymer Engg.)
POLYMER REACTION ENGINEERING
(2008 Course)

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 two separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data wherever necessary.***
5) ***Use of electronic calculator is allowed.***

SECTION - I

Q1) Explain in detail the distinguishing features and challenges involved in polymer manufacturing as compared to monomer manufacturing. **[16]**

Q2) Review in brief different methods of polymerization with particular reference to their kinetic aspects. Give examples from industrial practice. **[16]**

Q3) Explain how the commercially significant properties of polymers depend on their MW and MWD. Also discuss the role of mixing in a reactor in deciding MWD of its product. **[18]**

Q4) What is Tromsdorff effect? Present a mathematical model for explaining this effect. **[16]**

SECTION - II

Q5) Discuss a mathematical model accounting for the performance of suspension polymerization. **[16]**

Q6) Explain Smith Ewart Model for batch emulsion polymerization. **[16]**

Q7) Discuss a mathematical model for interfacial polymerization. **[16]**

Q8) Write notes: **[18]**

a) Control Engineering Considerations in Operation of a Polymerization Process.

b) Coordination Polymerization in Fluidized Bed Reactor.

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Total No. of Questions : 12] [Total No. of Pages : 4

P1818

[3765]-763
M.E. (Polymer Engg.)
POLYMER RHEOLOGY
(2008 Course) (Elective - II)

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

Instructions to the candidates:

1) ***Answer Q.No. 1 or 2, Q.No. 3 or 4 and Q.No. 5 or 6 from section-I answer Q.No. 7 or 8, Q.No. 9 or 10 and Q.No. 11 or 12 from section-II.***
2) ***Answers to the two sections must be written in two separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data wherever required.***
5) ***Draw neat sketches wherever required.***
6) ***Use of pocket calculator, log paper, log-log paper is allowed.***

SECTION - I

Q1) a) Derive an equation for velocity profile for polymer melt flow through parallel plates. **[8]**

b) Write a note on Von Karman's approach for turbulent flow. **[8]**

Q2) a) Write a note on viscoplastic fluids. Give expression for the velocity distribution for the same. **[8]**

b) Discuss Maxwell model to describe viscoelastic behaviour of polymers. Derive governing equation and explain response under static creep and stress relaxation. **[8]**

Q3) a) Maxwell and Kelvin - Voigt - models are to be set up to simulate the creep behaviour of a plastic. The elastic and viscous constants for the Kelvin - Voigt - model are 2 GN/m^2 and 100 GN sec/m^2 respectively. Viscous component for Maxwell model is 200 GN/m^2. Estimate the suitable value for elastic constant for Maxwell model if both the models are to predict the creep strain after 50 sec. **[5]**

b) Discuss the tensor notation system for fluid flow taking any one suitable example of flow type. **[5]**

c) Discuss WLF equation. **[6]**

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Q4) a) The following fluid flow data has been obtained for a fluid at 295°K. By plotting the data on a linear scale and logarithmic scale, ascertain type of fluid ie Newtonian or non-newtonian. If fluid obey's power law, calculate flow behaviour index and consistency index. **[10]**

Shear rate sec^{-1}	Shear stress Pa	Shear rate sec^{-1}	Shear stress Pa
2.22	1.32	35.16	20.92
4.43	2.63	44.26	26.33
7.02	4.17	70.15	41.74
8.83	5.25	88.13	52.54
11.12	6.62	111.17	66.15
14.0	8.33	139.96	83.27
17.62	10.48	176.2	104.84
22.18	13.20	221.82	132.0
27.93	16.62	279.25	166.15

b) Write a short note on Boltzmann superposition principle. **[6]**

Q5) a) Discuss Ellis and Meter models and their use in flow analysis. **[10]**

b) Explain creep properly and discuss the use of isochronous and isometric graphs. **[8]**

Q6) a) Derive an equation for dynamic creep compliance for viscoelastic material. **[6]**

b) Derive an expression for work done in cyclic deformation of a viscoelastic body. **[6]**

c) A polyethylene rod of diameter 7.5mm and length 50 mm at 100°C is subjected to a sinusoidal force of ± 100N at 1 Hz. The experimental values of storage modulus and tan δ are 0.07 GPa and 0.754 respectively. Calculate : **[6]**

i) Input stress.
ii) Output strain.
iii) Input and output complex functions.

SECTION - II

Q7) a) Discuss the effect of molecular weight on viscosity function. **[6]**

b) Derive an expression for pressure flow in case of single screw extruder. **[6]**

c) Calculate pressure drop through a runner of circular shape with diameter equal to 6mm and having a length of 50mm. The mass flow rate of polymer is 50 gms/sec and melt density is 0.78 gms/cm^3. Power law equation for the polymer is $\tau = 1,60,000\ \dot{r}^{0.3}$ where τ is shear stress in N/m^2 and $\dot{r}$ is shear rate in sec^{-1}. **[4]**

Q8) a) Calculate the torque for a non-Newtonian polymer solution which obeys the power law eq^n $\tau = 47.8\ \dot{r}^{0.8}$ sheared in a cone and plate viscometer with cone radius 12cm and angle of cone as 1°. The viscosity of the fluid is 0.1 Pa-sec and the cone rotates with an angular velocity of 60 rad/minute. **[6]**

b) Derive an equation for relative viscosity, frequency of rotation and torque for a Brookfield viscometer. **[10]**

Q9) a) Discuss screw torque rheometers. **[5]**

b) Discuss basic concept of constant strain and constant stress type of rheometers. **[5]**

c) Analyse flow through calender roles. **[6]**

Q10) a) Discuss the effect of shear rate on the viscosity-molecular weight relationship. **[6]**

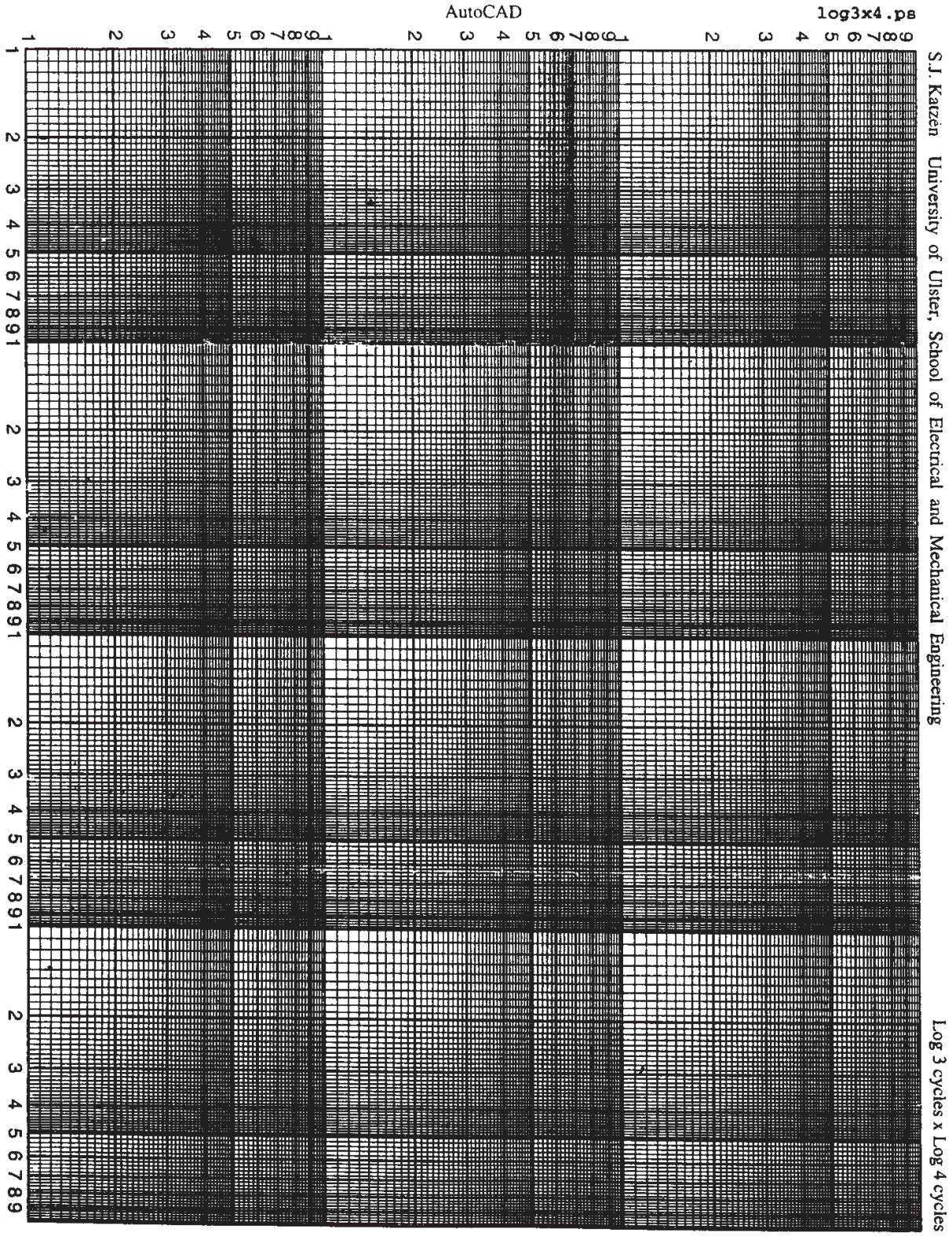
b) Explain the functioning of capillary rheometers and explain how entry losses are calculated using Bagley correction or couette corrections. **[10]**

Q11) a) Derive an expression for pressure drop due to shear, due to extensional flow and pressure drop at the die entry in case of a coni-cylindrical die. **[14]**

b) Write expression for residence time for non-newtonian fluid in case of circular and rectangular cross section. **[4]**

Q12) a) Obtain expression for swelling ratio due to shear stresses in case of long capillary and long rectangular channel. Also obtain expression for swelling ratio due to tensile stresses in case of short capillary and short rectangular channel. **[14]**

b) Discuss briefly effect of fillers on polymer melt rheology. **[4]**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S.J. Katzen University of Ulster, School of Electrical and Mechanical Engineering
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Total No. of Questions : 12] [Total No. of Pages :3

P1819

[3765] - 766

M.E. (Polymer)

POLYMER PHYSICS AND CHARACTERIZATION

(2008 Course) (509122)

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

Instructions to the candidates:

1) ***Answer 3 questions from Section I and 3 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 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 the peculiar properties of polymer solution. **[8]**

b) What is cohesive energy density? What are the assumptions underlying the Hildebrand theory of solution? Give applications of solubility parameter. **[10]**

OR

Q2) a) Explain the relationship between the Hildebrand's parameter and Flory's interaction parameter. Write their significance. **[8]**

b) "Polymeric solution properties change in very dilute, semi-dilute and concentrated solutions". Explain the statement. **[5]**

c) Explain the variation of solution properties of polymers with the variation in the temperature. **[5]**

Q3) a) Explain any two of the properties and elaborate experimental method to determine them. **[8]**

i) Creep.

ii) Thermal relaxation.

iii) Refractive index.

iv) transmittance.

b) Correlate the printability on a polymer and the contact angle of the same. **[4]**

c) Explain the difference in the scratch resistance of LDPE, HDPE and PP. **[4]**

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OR

Q4) a) How are the various viscoelastic relaxations detected in polymers? **[8]**

b) Write an informative note on pyrolysis gas chromatography. **[8]**

Q5) a) A recycled HDPE sample contained PP as an impurity. From the DSC scan of 10.5 mg of this sample following data was obtained **[8]**

Area Under endothermic peak (mJ)	Transition temperature degree Celsius	Enthalpy of fusion (J/g) ΔH
126	170	100 for PP
1663	130	18 for HDPE

Using above data calculate the percent composition of the blend.

b) Explain in brief TGA and DTGA technique as applied to polymer analysis. **[8]**

OR

Q6) a) How will you use DSC technique for studying glass transition temperature and kinetics of crystallization for polymers? **[8]**

b) Explain the use of TGA for analysis of rubbers and vulcanizates. **[8]**

SECTION - II

Q7) a) Compare the techniques of GPC and HPLC. What is the information obtained by them? **[8]**

b) Discuss any four of the following methods for fractionation of polymers. **[10]**

i) solubility
ii) chromatography
iii) sedimentation
iv) diffusion,
v) ultrafiltration
vi) Zone melting

OR

Q8) a) Describe any one method of determining micro structure of the polymers. **[5]**

b) What is the role of elemental analysis in the identification of polymers? **[5]**

c) What are the electrical properties of polymers that play critical role when the polymer is used in electrical applications? **[8]**

Q9) a) Describe various techniques using X-rays in the characterization of polymeric materials. **[8]**

b) Explain the use of proton NMR in characterization of polymeric material. **[8]**

OR

Q10) a) Is it possible to quantify the number of end groups using instrumental techniques? Discuss. **[8]**

b) What is the qualitative and quantitative information obtained from FTIR of the polymers? **[4]**

c) Is it possible to differentiate PMMA and Poly (vinyl acetate) using IR and NMR? Justify your answer with the help of suitable diagram. **[4]**

Q11) a) Discuss elongation flow and planer elongation or pure shear flow. Give stress tensors for the same. **[8]**

b) A certain linear polymer obeys Maxwell model having element constants as $G_i = 60\ MPa$ and $\eta_i = 6\ MPa$ – sec. If it is subjected to sinusoidal loading, calculate the storage modulus and $\tan\delta$ for the system at frequencies of 0.1, 1.0, 10.0, 25, 50 and 100 Hz and comment on the result. **[8]**

OR

Q12) a) Give classification and examples of different types of shear flows with neat figures. Give velocity field and expression for shear rate. **[8]**

b) Derive an expression for dynamic creep compliance for a linear viscoelastic material using the Kelvin-Voigt model. **[8]**

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Total No. of Questions : 12] [Total No. of Pages : 3

P1822

[3765] - 773

M.E. (Polymer)

ELASTOMER TECHNOLOGY

(Elective IV) (2008 Course) (509126)

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

Instructions to the candidates:

1) ***Answer 3 questions from section I and 3 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 logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What are molecular requirements for a polymer to exhibit elastomeric properties. **[8]**

b) Explain the rubber elasticity on the basis of Kinetic theory and thermodynamics. **[10]**

OR

Q2) a) What are the steps involved while using raw rubber and latex for processing. **[8]**

b) With the help of suitable diagram explain the stress strain behavior for raw and vulcanized rubber. **[5]**

c) Explain the mastication of natural rubber with an appropriate diagram. **[5]**

Q3) a) Why certain additives need to be added to the rubber? Describe the role of following in a rubber compounding. **[8]**

i) Fillers.

ii) Activators.

iii) Antioxidants.

Write one application example of each one of them and give their proportion in a typical formulation.

b) Discuss the use of fabric and short or long fibers in conjunction with rubbers. **[4]**

c) What are tackifiers? Give three examples of tackifiers used in rubber industry. **[4]**

OR

Q4) a) Discuss with suitable examples the need for addition, extent of addition and mechanism of functioning for the following additives: **[8]**

i) Peptizers.

ii) Blowing agents.

iii) Antioxidants.

b) Name the type of extenders used with rubbers, explain anyone. **[4]**

c) Enlist and explain various types of carbon blacks used in rubber technology. Discuss relative merit of each. **[4]**

Q5) a) Enlist the different techniques used for characterization of rubber, and explain any one in detail. **[8]**

b) Explain the effect of various additives on the rheological properties of rubber compound? **[8]**

OR

Q6) a) Explain various tests for the characterization of un-vulcanized rubber. **[8]**

b) Explain Thermo gravimetric analysis (TGA). What type of information is obtained from TGA? How is it used for the analysis of rubbers and vulcanizates. **[8]**

SECTION - II

Q7) a) Discuss the rubber injection moulding process from process parameter point of view. **[6]**

b) Discuss injection –compression moulding technique and the merits and demerits of the same. **[6]**

c) Explain how torque rheometer data can be used for process setting and grade selection of injection moulding and compression moulding process. **[6]**

OR

Q8) a) Differentiate between radial and cross ply tyre. **[6]**

b) Explain various steps in making of a conveyer belt. **[6]**

c) Explain the construction of a rubber hose with a neat sketch. Explain the purpose and formulation of different layers. **[6]**

Q9) a) What are thermoplastic elastomers? Explain various types. **[8]**

b) Give synthesis, compounding and cure characteristics of the following: **[8]**

i) SBR.

ii) Nitrile rubber.

OR

Q10) a) Which are the electrical tests carried out on rubbers intended for use in cables? Explain any two tests. **[6]**

b) What is rebound resilience? Give a test to measure it. **[5]**

c) What is compression set? Explain the procedure to find the compression set in tension and compression. **[5]**

Q11) a) What is vulcanization? How it is carried out? Name the various types of vulcanizing agents used with rubbers. Explain the role of activators and accelerators. **[8]**

b) Draw and explain the cure curve for rubber. **[4]**

c) What are the factors affecting the rate of cure? **[4]**

OR

Q12) a) How are following rubbers vulcanized? **[8]**

i) NR.

ii) CR.

iii) BR.

b) Explain the test procedure to find fatigue resistance of polymers. **[4]**

c) Give an instrumental technique to study cure rate of rubbers. **[4]**

Total No. of Questions : 6] [Total No. of Pages :6

P1823

[3765] - 774

M.E. (Printing Engineering and Graphic Communication)

PROBABILITY, STATISTICS AND QUEUEING THEORY

(2008 Course) (508101)

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 wherever necessary.*
4) *Assume suitable data wherever necessary.*
5) *Use of Electronic Calculator is permitted.*
6) *Use of Statistical Data tables is permitted.*
7) *Figures on right indicate marks.*

SECTION - I

Q1) a) A gambler wins 5 games on an average per day.

i) What is the probability that he wins more than 5 games a day?

ii) What is the probability that he wins less than 5 games on a particular day?

iii) What is the probability that for 5 consecutive days he wins alternatively more than 5 games and less than five games? Consider that on the first day he wins more than 5 games. Also there are not exactly 5 wins on any of those days. **[7]**

b) The probability of occurrence of numbers 0 to 5 in draw of a game is given as below :

Numbers	0	1	2	3	4	5
Probability	0.33	0.25	0.17	0.11	0.09	x

i) Determine the value of 'x'.

ii) What is the mean number output in the game?

iii) What is the standard deviation from mean?

iv) What is the probability of occurrence of a number below 2 on a given draw?

v) What is the probability that number 5 will be drawn first time on the 4th draw?

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vi) If probability of occurrence of '0' is decreased by 0.03, what should the probability that number 5 will be drawn first time on the 4th draw? **[10]**

c) The exponential distribution is applied to waiting times between successes in Poisson process. If there are average 6 people per hour arriving with Poisson distribution, the average time between two persons becomes 1/6 hours.

i) Find the probability that the time between two persons exceeds 20 minutes.

ii) Find the probability that the time between persons is less than 6 minutes.

iii) What is the probability that two successive persons in 3 randomly chosen persons will have time between them more than 20 minutes. **[8]**

Q2) a) Draw a schematic graph of standard normal distribution. On the graph, show the following :

i) Mark the area under the curve which is 50% and lower limit is -1.0.

ii) Mark 'k' if probability more than 'k' is 0.9664.

iii) Mark 'g' such that it will divide the area under the curve on right hand side of the mean into two equal parts. **[6]**

b) In an experiment following data was collected for two cases. Are the variances same for both the cases? Determine the 95% Cl for the difference between their mean values. Also determine 98% and 99% Cl for the same difference. **[12]**

Case 1	0.32	0.53	0.28	0.37	0.47	0.43	0.36	0.42	0.38	0.43
Case 2	0.26	0.43	0.47	0.49	0.52	0.75	0.79	0.86	0.62	0.46

c) If mean value of sample of size 'n' taken from normally distributed population is 250, determine the population variance in each of the following cases :

i) 95% Cl is (200, 300) and n is 5.

ii) 98% Cl is (200, 300) and n is 5.

iii) 98% Cl is (200, 300) and n is 6. **[7]**

Q3) a) An output of a linear regression model is given below. Complete the table by filling appropriate numbers at the positions marked with **A1, A2, A3, A4, A5, A6, B C1, C2, C3, C4, C5, C6, C7, C8**. Then answer the questions with the data given below.

In the table, y = dependent variable
x, z_1, z_2 = independent variables

Model is;

$$y_i = \beta_0 + \beta_1 x_i + \beta_2 Z_{1i} + \beta_3 Z_{2i} \qquad (i = 1, 2, 3 \text{-----}, n)$$

Also,

Z_1 = 1 for condition 1
= 0 for conditions 2 or 3;
Z_2 = 1 for condition 2
= 0 for conditions 1 or 3.

The REG Procedure
Model : Model 1
Dependent : y

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	FValue	Pr>F
Model	**A1**	80182	**A3**	**A5**	**A6**
Error	**A2**	5078.71318	**A4**		
Total	17	85260			

Root MSE	**B**	R-Square	0.9404
Dependent Mean	301.55556	Adj R-sq	0.9277
Coeff Var	6.31605		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	tValue	Pr>|t|
Intercept	**C1**	-167.89733	37.43316	-4.32	**C5**
x	**C2**	54.29403	4.75541	11.42	**C6**
Z_1	**1**	89.99806	11.052228	**C3**	**C7**
Z_2	**1**	27.16570	11.01043	**C4**	**C8**

i) What is value of 'n' (number of samples taken to develop this model)?

ii) Based on the tables above, estimate the value of y when x is 6.7 at condition 2.

iii) Based on the tables above, estimate the value of y when x is 8.7 at condition 3.

iv) What should be the real intercepts for 3 separate conditions? **[13]**

b) It is of interest to study the effect of population size in various cities in USA on ozone concentrations. The data consists of the 1999 population in the millions and the amount of ozone percent per hour in ppb (parts per billion). The data is as follows :

Ozone (ppb/hr), y	126	135	124	128	130	128	126	128	128	129
Population, x	0.6	4.9	0.2	0.5	1.1	0.1	1.1	2.3	0.6	2.3

i) Fit the linear regression model relating ozone concentration to population. Test $H_0 : \beta_1 = 0$ using the ANOVA approach.

ii) Do the test for lack of fit. Is the linear model appropriate base on the results of the test?

iii) Test of hypothesis of part '*i*' using 'pure MSE' in the F-test. Do the results change? **[12]**

SECTION - II

Q4) a) Write down the formulae required for plotting 'x_bar s' control chart. Using those formulae, plot the contol charts based on the given data and comment on it. **[16]**

Sample No.	Observations				
1	11	13	13	16	14
2	16	11	12	15	13
3	14	17	11	13	14
4	13	14	15	16	12
5	16	16	16	15	16
6	10	13	17	16	11
7	16	12	12	14	16
8	15	11	14	12	17
9	13	16	13	14	13
10	14	17	17	12	15
11	13	13	13	13	13
12	15	14	16	12	15

b) The acceptance-sampling scheme for purchasing lots containing a large number of batteries is to test no more than 75 randomly selected batteries and to reject a lot if a single battery fails.

i) If probability of failure is 0.001, what is the probability that the lot is accepted?

ii) Draw roughly two OC curves one for lot rejection with single failure and another for lot rejection at second battery failure. **[9]**

Q5) a) In an experiment 5 treatments were chosen. Find statistically if the treatments cause different in outcome of the experiment. **[8]**

No.	Treatment				
	1	**2**	**3**	**4**	**5**
1	14	15	14	15	13
2	12	15	13	14	14
3	12	11	10	12	11
4	11	12	11	11	12

b) For 2^k factorial experiment with 4 factors (A, B, C, D), draw a table of signs to calculate contrasts. Show how to find the contrast of factor 'A' with the help of table. **[7]**

c) For a 2^k factorial experiment write down the formulae to calculate Effect, Sum of Squares and Regression Coefficient using contrast. Using these formulae calculate the Regression coefficients for a 4-factor experiment with all having 2-levels and single replicates of readings. The model consists all main factors and two factor interactions. Also calculate the intercept for the regression line. The data is provided as below : **[10]**

Factor Combination	Response	Factor Combination	Response
(1)	72.68	bc	70.92
a	71.74	bd	74.28
b	76.09	cd	79.34
c	71.25	abc	104.96
d	73.52	abd	92.87
ab	93.19	acd	75.12
ac	70.59	bcd	79.67
ad	75.97	abcd	97.80

Q6) a) Write a note on queueing theory and explain the M/M/1 model. **[12]**

b) A financial company's branch office has only one application counter. The person on counter helps the customer to fill up the application form. The queue for this counter follows M/M/1 model. On an average 3 customers arrive per hour in the office for application. The person on counter takes on an average 15 minutes per customer to help them out.

i) What will be the average waiting time for the customer in the system and in the queue?

ii) If a new person is assigned to handle this task who takes on an average 17 minutes to handle a customer, what is the loss to the company if per minute waiting of a customer is considered as loss equivalent to Rs. 2 per customer?

iii) What will be the queue length if average 2 customers are arriving per hour?

iv) With change in average arrival rate of 3 customers/hr to 2 customers/hr how much extra time the person on counter gets to maintain same system length? **[13]**

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Total No. of Questions : 6] [Total No. of Pages : 2

P1825

[3765]-779

M.E. (Printing Engineering & Graphic Communication)

DESIGN OF EXPERIMENTS & RESEARCH METHODOLOGY

(2008 Course) (Elective - I) (508104 C)

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

Instructions to the candidates:

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

SECTION - I

Q1) Answer the following :

a) What is hypothesis? What is its significance? Explain with one example. **[16]**

b) Define Research? Explain the workflow for carrying out research work. **[9]**

Q2) Answer the following :

a) Differentiate between research and evaluation. **[8]**

b) Explain stages of formulation of research work. **[9]**

c) Explain significance of literature review in research work with the resources of obtaining the literature. **[8]**

Q3) Answer the following :

a) Explain concept of simulation long with its significance and purposes. **[9]**

b) Suppose there is a problem in dryer temperature of web machine. It is $100^{o}C$ at time 0sec. and $200^{o}C$ temperature at time 10sec. How much temperature will rise in 1 minute from time 0 seconds (in 60 seconds)? **[16]**

P.T.O.

SECTION - II

Q4) Answer the following :

a) Explain in detail the concept of experimental design. **[8]**

b) What do you mean by full factorial and fractional factorial design? Discuss and compare with examples. **[8]**

c) Describe : **[9]**

i) Informal Experimental Design.
ii) Randomized Block Design.
iii) Latin Square Design.

Q5) Answer the following :

a) What precaution one has to take while collecting data? **[6]**

b) A product rating organization tested battery life for four comparable makes of portable radios. Six radios of each make were purchased off the shelf from local retail stores and identical fully charged batteries were inserted on random basis. The observations on battery playing hours at high volume as follow : **[13]**

Observation		Treatment (j)		
(i)	1	2	3	4
1	5.5	4.7	6.1	4.5
2	5.0	3.9	5.7	5.1
3	5.2	4.3	5.0	4.3
4	5.3	4.5	5.3	4.1
5	4.8	4.1	5.2	4.5
6	4.8	4.3	6.3	5.1

Obtain the ANOVA table and state which radio is better.

c) Explain in brief simple and multiple linear regression? **[6]**

Q6) Answer the following :

a) Discuss in brief various types of research reports. **[8]**

b) Explain a general format of research report. **[9]**

c) What precaution one has to take while writing the research report. **[8]**

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Total No. of Questions : 6] [Total No. of Pages :2

P1826

[3765] - 783

M.E. (Printing Engineering and Graphic Communication)

PRINT MEDIA COMMUNICATION

(2008 Course) (508108)

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 wherever necessary.*
4) *Assume suitable data wherever necessary.*
5) *Figures on right indicate marks.*

SECTION - I

Q1) a) What is PDF? Explain difference in PDF and PDF / X file format. **[8]**

b) How does PDF/X-1a and PDF/X-3 file formats help in designing the printing job? Explain the file generation options for these formats. **[10]**

c) Explain giving an example, the workflow of paginating/designing a page.**[7]**

Q2) a) How does the Human vision system play important role in designing? What will happen if a vision deficient person designs print jobs for textiles and glass materials? **[9]**

b) Explain the components involved, and their role, in turning light into color in human vision system. **[8]**

c) Explain the term photopic vision, mesopic vision, and scotopic vision and the types of photoreceptors of the human eye concerned for each range. **[8]**

Q3) a) Choose one CIE standard illuminant and explain what kind of light source it represents. **[7]**

b) Do a rough sketch of its spectral power distribution showing the main characteristics of the source. **[5]**

c) Now choose a surface present in the room and describe all the processes taking place when the light of the source impinges on it. **[13]**

P.T.O.

SECTION - II

Q4) Explain designing of a book for 10 Indian Curries, which is to be sold in UK. Explain with neat diagrams. **[25]**

Q5) a) Explain the Designing for newspaper supplement for Diwali. **[8]**

b) What are ISO standards for printing and how do they help in newspaper industry? **[9]**

c) What do you mean by standardized input to output printing workflow? Explain it giving an example workflow of any printing process of Newspaper production. **[8]**

Q6) a) Explain how the InDesign helps in designing a page? **[6]**

b) Explain the 'Assign profile' and 'Convert to profile' options used in Adobe Photoshop CS4 when designing print images for typographic and pictorial element reproduction. **[8]**

c) Which digital proofing techniques are available? How do they help in identifying problems related to printing designs and solving them? **[11]**

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Total No. of Questions : 6] [Total No. of Pages : 2

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[3765] - 785

M.E. (Printing Engineering & Graphic Communication)

SUBSTRATE AND INK

(2008 Course) (508110)

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 wherever necessary.***
4) ***Assume suitable data wherever necessary.***
5) ***Figures on right indicate full marks.***

SECTION - I

Q1) a) Define and explain mechanical and chemical of pulping processes. **[9]**

b) Explain papermaking process in detail. **[8]**

c) Write short notes on : **[8]**

i) Hydrogen bonding.

ii) Refining and its influence.

Q2) a) State and explain plastic substrates used in printing and packaging. Also comment on bio-degradable plastics. **[9]**

b) How to assess the printability defects of publication job for chosen printing process and explain the tests required. **[8]**

c) What are chemical properties of paper? **[8]**

Q3) a) Give example of an ink formula and describe the importance of used components. **[9]**

b) Write importance of pigment dispersion and comment on process of dispersion. **[8]**

c) State and explain various ink properties that influence ink transfer. **[8]**

P.T.O.

SECTION - II

Q4) a) Write in detail about water based inks. **[13]**

b) Write short notes on : **[12]**

i) Scented ink.

ii) Ink-jet printing inks.

Q5) a) Calculate the working size of paper required for printing of an 8 page, A4 brochure trimmed to bleed on a single color offset machine. **[10]**

b) Calculate the quantity of black ink required for 25,000 copies of a 16 page booklet of A5 size each page with a print area of $200cm^2$. There are 10 pages printed in black ink from halftone pictures and 6 pages in type matter in black. The booklet is printed by photo-offset process on a coated art paper. **[10]**

c) Define and explain elements of cost. **[5]**

Q6) a) How do you define sustainability? Explain importance of sustainability and various efforts being taken by different bodies for printing industry. **[13]**

b) Comment on printing green. **[12]**

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Total No. of Questions : 6] [Total No. of Pages : 5

P1829

[3765] - 787

M.E. (Printing Engineering & Graphic Communication)

TOTAL PRODUCTIVE MAINTENANCE IN PRINTING

(Elective - III) (2008 Course) (508111(b))

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 answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data wherever necessary.***
5) ***Figures to the right indicate full marks.***

SECTION - I

Q1) Answer the following :

a) Explain the 8 pillars of TPM with reference to printing industry. **[16]**

b) Following are the element times of plate making operation. The corresponding rating and relaxation allowance are given below. Calculate standard time for these operations assuming contingency allowance of 3% of total normal time. **[9]**

Sr. No.	Elements	Observed Time	Rating Allowance	Relaxation Allowance (%)
1	Cleaning Film	0.15	80	13
2	Placing Film	0.05	80	13
3	Pasting	0.5	100	11
4	Setting Exposure	0.04	110	13
5	Exposing	0.1	120	13
6	Developing	0.05	100	11
7	Gumming	0.1	80	13

Q2) Answer the following :

a) Explain the procedure followed in practicing autonomous maintenance. **[10]**

b) Explain the principles followed in 5S technique by taking a suitable example of printing industry. **[10]**

c) The workers in a printing machine part manufacturing company are expected to work for 420 minutes in a shift of 8 hours. The remaining time is allowed for rest. **[5]**

i) Determine standard time per part when normal time is 4 min.

ii) Calculate no. of parts produced per day.

iii) If a worker produces 100 parts in a shift; what is his efficiency.

Q3) Answer the following :

a) Calculate and compare OEE for following printing machines. Also state possible actions to be taken to improve OEE by atleast 5%. Company runs for two shifts of eight hours each. **[15]**

Sr. No.	Printing Machine	Rated Speed (IPH)	Actual Speed (IPH)	Downtime per Shift (Hours)	Wastage (%)
1	ABC	15000	10000	1.5	7
2	XYZ	15000	9000	1	10

b) Explain the reasons of productivity waste and suggest remedies to eliminate those with reference to the Screen printing industry. **[10]**

SECTION - II

Q4) Solve the following :

a) During maintenance schedule, webs of paper are to be shifted from one warehouse to the other. The company has decided to purchase an automatic forklift for this purpose. Derive an equation to calculate weight of the web of paper in kilogram when web width, outer diameter, inner diameter, caliper, gsm are known. Calculate weight of the web in kilogram including core weight using following data. **[15]**

Maximum web width = 95 cm, Max. outer diameter = 115 cm,

Min. inner diameter = 20 cm, Caliper = 1/12 mm, Max. gsm = 90, Core weight = 500 gm.

b) A company, CMYK Arts has a following requirement of paper for a particular booklet job. **[10]**

i) 23" X 36", 60 gsm, 115 reams, uncoated

ii) 25" X 37", 110 gsm, 32 reams, matte coated

The rate for uncoated and coated paper is Rs. 56 and Rs. 65 respectively. The loading and unloading charges are Rs. 2 per kg for each operation. The warehouse to company distance is 27 kms and transportation charges are Rs. 750 per trip for weight upto 5 tonnes.
Calculate the total cost of paper incurred by the company.

Q5) Answer the following :

a) Six consecutive lots of labels received from a vendor were inspected by sampling process. The sample size was varied. The number of defectives in each sample is recorded as under : **[15]**

Sample No.	1	2	3	4	5	6
Sample Size	125	125	50	80	200	125
No. of Defectives	1	3	0	2	4	1

Construct control charts for i) fraction defectives ii) number of defectives.

b) PQR company produces dampening solution which must contain 3% of alcohol. The company tries to maintain the actual percentage in the range 3 ± 0.3. It tests 5 samples per hour. The following table shows the results of last five samples. Construct control charts for $\overline{X}$ and R. Examine whether the process is under control. $A_2 = 0.5768$, $D_3 = 0$, $D_4 = 2.115$. **[10]**

Sample	Percentage of Alcohol				
	1	2	3	4	5
1	2.9	2.8	3.0	2.8	3.1
2	2.9	3.0	3.0	3.0	3.0
3	3.0	3.1	3.1	3.1	2.9
4	3.0	3.0	3.0	3.0	3.0
5	2.9	3.0	3.1	2.9	3.1

Q6) Answer the following :

a) Blackbird Printers (P) Ltd. Undertakes jobs of A,B,C types. All of these jobs require use of special machine and computer. The computer is hired and hire charges work out to Rs. 4,20,000 per year. The expenses regarding the machine are as follows - **[16]**

Particulars	Rs.
Rent for 1 quarter	17,500
Depreciation per year	2,00,000
Indirect charges per year	1,50,000

During the first operation, following details were taken from the job register -

Particular	Machine		
	A	B	C
No. of hours machine was used without use of computer	600	900	--
No. of hours machine was used with use of computer	400	600	1000

Calculate the machine hour rate for the following cases -

i) For the company as a whole for the month when the job is done without computer and with computer.

ii) Cost of the individual jobs A, B, C.

b) A newspaper printing company is frequently experiencing web breaks after installation of its new heat set machine. The company uses 54 gsm newsprint (uncoated) and 90 gsm newsglaze (coated glossy). As an expert in Printing Technology, you are expected to carry out an inspection and prepare a detailed report elaborating importance of web tension and troubleshooting for web break. **[9]**

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Total No. of Questions : 6] [Total No. of Pages : 2

P1831

[3765] - 790

M.E. (Printing Engineering and Graphics Communication)

ANALYSIS OF SPOT AND PROCESS INKS

(2008 Course) (508112(C))

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 wherever necessary.***
4) ***Assume suitable data wherever necessary.***
5) ***Figures on right indicate marks.***

SECTION - I

Q1) a) What is the purpose of spot inks over process inks? **[15]**

b) How the inks are set? **[10]**

Q2) a) Give the selection criteria of the inks. **[10]**

b) Explain the vehicles and their properties. **[8]**

c) Explain types of pigments used in inks. **[7]**

Q3) a) Explain thixotrophy and its use in ink formulations. **[15]**

b) Write short notes on. **[10]**

i) Evaporation rate.

ii) pH Control.

SECTION - II

Q4) a) Explain alkide resins and its use in the offset inks. **[10]**

b) Write short notes on ink rheology and ink variables. **[8]**

c) How offset inks differ from flexo inks. **[7]**

P.T.O.

Q5) a) Explain ink test required for color, shade and strength. **[10]**

b) Write short notes on COF, rub resistance. **[8]**

c) How adhesion of ink is tested. **[7]**

Q6) a) How spot inks are selected for sharpness. **[10]**

b) Give details of colorimetric values of ink. **[8]**

c) What is visual analysis of ink? **[7]**

Total No. of Questions : 8] [Total No. of Pages :3

P1832

[3765] - 791

M.E. (E & TC - Signal Processing)

LINEAR ALGEBRA AND RANDOM PROCESSES

(2008 Course) (504501)

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

Instructions to the candidates:

1) ***Answer any 3 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) Prove that

$$\begin{vmatrix} o & x & y & z \\ -x & o & r & q \\ -y & -r & o & p \\ -z & -q & -p & o \end{vmatrix} = (px - qy + rz)^2.$$ **[9]**

b) Prove that

$$\Delta = \begin{vmatrix} a^2 & a^2-(b-c)^2 & bc \\ b^2 & b^2-(c-a)^2 & ca \\ c^2 & c^2-(a-b)^2 & ab \end{vmatrix} = \begin{matrix} (b-c)\,(c-a)\,(a-b)^* \\ (a+b+c)\,(a^2+b^2+c^2). \end{matrix}$$ **[9]**

Q2) a) Find the inverse of the matrix

$$A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}.$$ **[8]**

P.T.O.

b) Find the rank of the matrix.

$$A = \begin{bmatrix} 1 & 2 & 1 \\ -1 & 0 & 2 \\ 2 & 1 & -3 \end{bmatrix}.$$ **[4]**

c) Reduce the matrix to canonical form.

$$A = \begin{bmatrix} 1 & 2 & 1 & 0 \\ -2 & 4 & 3 & 0 \\ 1 & 0 & 2 & -8 \end{bmatrix}.$$ **[4]**

Q3) a) If A be any non-singular matrix and B a matrix such that AB exists, then show that AB and B have the same rank. **[4]**

b) Show that the only real value of λ for which the following equations have non-zero solution is 6.

$x + 2y + 3z = \lambda x$; $3x + y + 2z = \lambda y$; $2x + 3y + z = \lambda z$. **[8]**

c) State the conditions under which a system of non-homogeneous equations will have i) no solution ii) a unique solution iii) infinity of solutions. **[4]**

Q4) a) Determine the characteristic roots and the corresponding characteristic vectors of the matrix.

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}.$$ **[8]**

b) If α is a characteristic root of a non-singular matrix A, then prove that $\frac{|A|}{\alpha}$ is a characteristic root of Adj A. **[4]**

c) Find the rank of the matrix

$$A = \begin{bmatrix} 4 & 2 & 1 & 3 \\ 6 & 3 & 4 & 7 \\ 2 & 1 & 0 & 1 \end{bmatrix}.$$ **[4]**

SECTION - II

Q5) a) From a well shuffled pack of cards 3 cards are drawn at random. Find the probability that they form a king, Queen and Jack - combined. **[5]**

b) The outcome of an experiment is an integer whose value is equally likely to be any integer in the range $1 \leq \times \leq 12$. **[6]**
Let 'A' be the event that X is odd.
Let 'B' be the event that X is divisible by 3 and let 'C' be the event that X is divisible by 4. Find probabilities of events A, B, C, AB, AC and BC.

c) Draw and find out the CDF for an experiment of tossing of a coin. The random variable maps Head with value 'l' and tail with value '–l'. **[5]**

Q6) a) Explain Gaussian probability model with respect to its density and distribution function. **[8]**

b) 10,000 digits are transmitted over a noisy channel, having a probability of error per digit of 5×10^{-5}. Find the probability of getting only 2 digits in error using poisson distribution function. Also find the mean and variance. **[8]**

Q7) a) Differentiate between ensemble average and time average. What is auto correlation of a Random Process. **[6]**

b) With an example an equation, explain stationary, Non-stationary, strictly stationary, Jointly stationary and wide sense stationary process. **[10]**

Q8) a) 2R.V(X, Y) has

$$f(X,Y) = \begin{cases} 2e^{-(x+y)} & -----0 < y < x < \infty \\ 0 & -----\text{elsewhere} \end{cases}$$

Find i) E (X,Y) ii) Cov (X,Y) iii) ρxy **[11]**

b) Explain white Gaussian noise along with the significance of its p.s.d and auto correlation. **[3]**

c) Explain how narrow band noise is represented in terms of its in phase and quadrature components. **[4]**

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Total No. of Questions : 8] [Total No. of Pages :3

P1833

[3765] - 792

M.E. (E & TC) (Signal Processing)

SIGNAL PROCESSING TECHNIQUES

(2008 Course) (504502)

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

Instructions to the candidates:

1) ***Question Nos 1 and 5 are compulsory. Out of the remaining attempt 2 questions from Section I and 2 questions from Section II.***
2) ***Answer to the two sections should be written in separate books.***
3) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Difference between Liner Convolution and Circular Convolution and hence, find Liner Convolution of $x(n) = \{1,2,3\}$ and $h(n) = \{1,1,1\}$ using Circular convolution. **[6]**

b) Find IZT of

i) $X(Z) = \dfrac{z}{(z-1)^3}$ ii) $X(Z) = \dfrac{z\left(1-e^{-0.2T}\right)}{(z-1)\left(z-e^{-0.2T}\right)}$. **[6]**

c) Explain how Z-Transform can be used to find Causality and Stability of system. Is it possible to design non Causal and Stable System? If yes or no then give proper justification. **[6]**

Q2) a) If $x(n) = a^n u(n) + b^n u(-n-1)$, Find $X(z)$ and ROC if **[8]**

i) $a < b$

ii) $a > b$

iii) In which case $X(z)$ exist and why?

b) Explain the advantage of DFT over DTFT and hence, find N=8 Point DFT of **[8]**

$$x(n) = \sin \frac{3\pi}{8} n$$

Q3) a) Find N=8 point DFT using Radix-2 FFT DIF algorithm for given sequence.

$x(n) = \{1,1,2,3,5,8,13,21\}$ **[8]**

P.T.O.

b) Find the circular convolution of given sequence. **[4]**

$$x_1(n) = \delta(n) + \delta(n-1) + \delta(n-2)$$

$$x_2(n) = 2\delta(n) - \delta(n-1) + 2\delta(n-2)$$

c) State and explain Properties of ROC. **[4]**

Q4) a) State and explain the 4types of FIR filter. Draw the liner phase FIR structure for M=7. Specify the no of hardware element required. How to minimize hardware? **[8]**

b) Design a FIR low Pass filter for M = 7 and $\omega_c = 3\pi/4$ using Hamming window. **[8]**

SECTION - II

Q5) a) What are the advantages of Kaiser Window over other window? And Explain Gibb's Phenomenon? **[6]**

b) Why FIR Filter are Linear in Phase but IIR are Non Linear in phase. **[6]**

c) Give the comparison between Butterworth, Chebyshev-I, Chebyshv-II and Elliptical filter. **[6]**

Q6) a) For the given specification $A_p = 1dB$, $A_s = 30dB$, $\Omega_p = 200$ *rad/sec* and $\Omega_s = 600$ *rad/sec*. Determine the order of the filter and pole for Butterworth LPF. **[8]**

b) Obtain the direct form-I and Parallel form realization for the given difference equation.
$y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$. **[8]**

Q7) a) Design a Butterworth low pass filter using Impulse Invariance method for the following specification.

$$0.8 \le |H(e^{j\omega})| \le 0 \quad 0 \le \omega \le 0.2\pi$$

$$|H(e^{j\omega})| \le 0.2 \quad 0.6\pi \le \omega \le \pi$$

[8]

b) Explain the difference between Impulse invariant method and bilinear transformation Method in detail. Why it is not possible to design High Pass Filter and Band Pass Filter using impulse invariant Method? **[8]**

Q8) a) Explain in detail design of FIR filter using window method. What are the disadvantages of window method over other method? **[8]**

b) State and explain Convolution Property of z-Transform. Find $H(z)$ and $h(n)$ for a given difference equation

$y(n) - 3y(n-1) + 2y(n-2) = x(n) + x(n-1)$. **[8]**

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Total No. of Questions : 8] [Total No. of Pages : 3

P1835

[3765] - 799

M.E. (E & TC) (Signal Processing)

STATISTICAL SIGNAL PROCESSING

(2008 Course) (504507) (Sem. - II)

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

Instructions to the candidates:

1) ***Answer any three questions from each section.***
2) ***Question Nos. 1 and 5 are compulsory.***
3) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain the difference between Pade' and Prony's methods with examples. **[6]**

b) Implement the third order FIR filter $H(z) = 1 + 0.5z^{-1} - 0.1z^{-2} - 0.5z^{-3}$, using Lattice filter structure. **[6]**

c) Show how Wiener Filter can be used as a Noise Canceller. **[6]**

Q2) a) Explain the MYWE method for modeling an ARMA (p,q) process. **[8]**

b) Using MYWE method for modeling an ARMA (1,1) process find $H(z)$ for a given autocorrelation $r_x(k) = \{26, 7, 7/2\}$. **[8]**

Q3) a) State and explain Levinson Durbin algorithm. Explain how Levinson Durbin algorithm can be modified as step up Recursion. **[8]**

b) Using Levinson Durbin algorithm find Reflex coefficient Γ_j and filter coefficients $a_p(k)$ from the given autocorrelation $r_x(k) = \{1, -0.5, 0.625, -0.75\}$. **[8]**

P.T.O.

Q4) a) Explain and Derive the algorithm for All-Pole signal modeling using Prony's Method. **[8]**

b) For N = 2 FIR Least Square Inverse system having a unit sample response $g(n) = \delta(n) - 0.8\delta(n-1)$: **[8]**

i) Find residual energy due to truncation ε_t.

ii) FIR Coefficients $h(n)$.

iii) Minimum Square error $\{\varepsilon\}_{min}$.

SECTION - II

Q5) a) Explain the difference between parametric and Non-Parametric Method with advantages and disadvantages. **[6]**

b) Explain how DFT can be used to find Power Spectrum Estimation. **[6]**

c) Explain how FIR Wiener Filter can be used as one step predictor. **[6]**

Q6) a) Explain and derive the algorithm for Welch Method. **[8]**

b) Bartlett's Method is used to estimate the Power Spectrum of a process from a sequence of N = 2000 samples. **[8]**

i) What is the minimum length L that may be used for each sequence if we are to have a resolution of $\nabla f = 0.005$.

ii) Explain why it would not be advantageous to increase L beyond the value found in (a).

iii) What is the minimum number of data samples N that are necessary to achieve a resolution of $\nabla f = 0.008$ if the Quality Factor Q that is five times the Quality Factor of Periodogram?

Q7) a) Justify why Periodogram Method is asymptotically unbiased but not a consistent estimation. **[6]**

b) Consider a signal $x(n) = d(n) + v(n)$; where $d(n)$ is a AR(1) process that satisfies the difference equation. **[10]**

$$d(n) = 0.8d(n - 1) + w(n)$$

Where $w(n)$ is a white noise sequence with variance $\sigma_w^2 = 0.49$ and $\sigma_v^2 = 1$.

i) Determine the auto correlation sequence $r_x(k)$ and $r_x(k)$.

ii) Design a wiener filter of length M = 2 to estimate $d(n)$.

iii) Determine the MMSE for M = 2.

Q8) a) For Noncausal IIR wiener filter derive Wiener-Hope equation and Minimum error. **[8]**

b) Write a note on Minimum Variance Spectrum Estimation. **[8]**

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Total No. of Questions : 8] [Total No. of Pages : 3

P1836

[3765]-800
M.E. (E & TC) (Signal Processing)
ADVANCED DIGITAL SIGNAL PROCESSING
(2008 Course) (504508)

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) Explain and differentiate between decimation and Interpolation. **[4]**

b) Explain the concept of imaging in up-sampler. **[4]**

c) Explain sampling rate conversion by non-integer factors, with the help of a block diagram and waveforms. **[10]**

Q2) a) With the help of mathematical expression prove the aliasing occurs when the samples are down sampled. **[8]**

b) A signal $x(n)$ at a sampling frequency 2.048 KHz is to be decimated by a factor of 32 to yield a signal at a sampling frequency of 64 Hz. The signal band of internet entend from 0 to 30 Hz. The anti-alising digital filter should satisfy the following specifications.

PB deviation = 0.01 dB

SB deviation = 80 dB

PB = 0 – 30 Hz

SB = 32 – 64 Hz

The signal components in the range from 30 to 32 Hz should be protected from aliasing. Design suitable one stage decimator. What is the problem with single stage decimator? **[8]**

P.T.O.

Q3) a) Draw a diagram of direct form adaptive FIR filter structure and write mathematical expression. **[4]**

b) Explain use of adaptive filter in Echo cancellation in data transmission over telephone line. **[8]**

c) Write mathematical expression and draw block diagram of vocal track. **[4]**

Q4) Consider an arbitary digital filter with a transfer function.

$$H(z) = \sum_{h=-\infty}^{\infty} h(n)\, z^{-n}$$

a) Perform a two component polyphase decomposition of $H(z)$ by grouping the even numbered samples $h_0(n) = h(2n)$ and odd numbered samples $h_1(n) = h(2n+1)$. Thus show that $H(z)$ may be expressed as $H(z) = H_0(z^2) + z^{-1} H_1(z^2)$ and determine $H_0(z)$ and $H_1(z)$. **[8]**

b) Generalise the result in part by showing that $H(z)$ can be decomposed into an D component polyphase filter structure with transfer function.

$$H(z) = \sum_{k=0}^{D-1} z^{-k}\, H_k(z^D)$$ **[8]**

SECTION - II

Q5) a) Interface memory to ADSP 21 X X.

Boot memory – 8 k bytes.

Program memory – 32 k bytes.

Data memory – 32 k bytes.

Clearly show data bus length for each memory with clock. **[10]**

b) Write short note on : **[8]**

i) Barrel shifter.
ii) MAC.
iii) Circular addressing.
iv) ALU.

Q6) a) Compare microprocessor and digital signal processor. **[8]**

b) Write salient features of TMS 320 C 54 X X. **[4]**

c) Explain in short with application need of adaptive filters. **[4]**

Q7) a) Explain Widrow LMS algorithm. **[8]**

b) Design two stage decimator for following specifications. **[8]**

D = 100

Passband $0 \leq f \leq 50$

Transition band $50 \leq f \leq 55$

i/p sampling rate 10,000 Hz

Ripple $\delta_1 = 10^{-1}$ $\delta_2 = 10^{-3}$

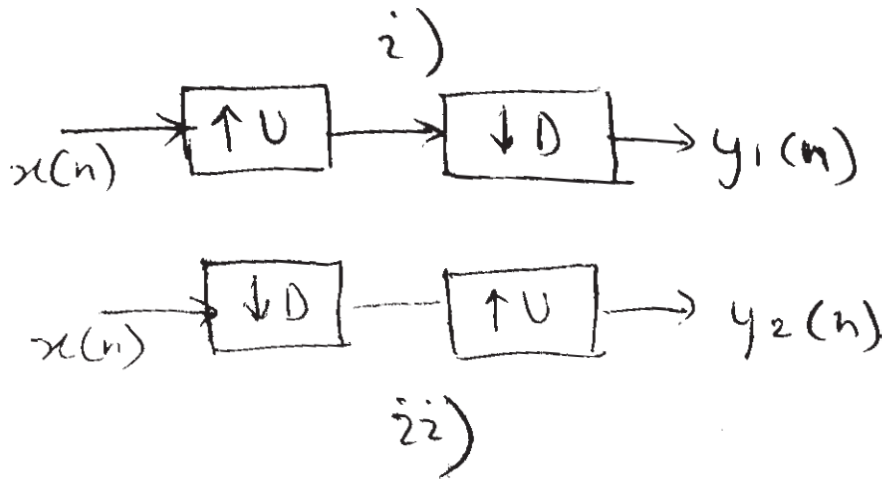
Q8) a) Explain use of least square method for system modeling. **[4]**

b) Write a note on : **[6]**

i) Prediction.

ii) Deconvolution in least square method.

c) Consider cascading of decimator and interpolator.



i) If D = U, show that outputs of 2 configurations are different and hence two systems are identical. **[3]**

ii) Show that two systems are identical if and only if D and U are relatively prime. **[3]**

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Total No. of Questions : 8] [Total No. of Pages : 4

P1837

[3765] - 801
M.E. (E & T/C) (Signal Processing)
VLSI IN SIGNAL PROCESSING
(2008 Course) (504509)

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) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) Find the Loop bound and Iteration bound for the DFG shown below. Also examine the precedence constraints and justify the loop bound calculated above. **[6]**

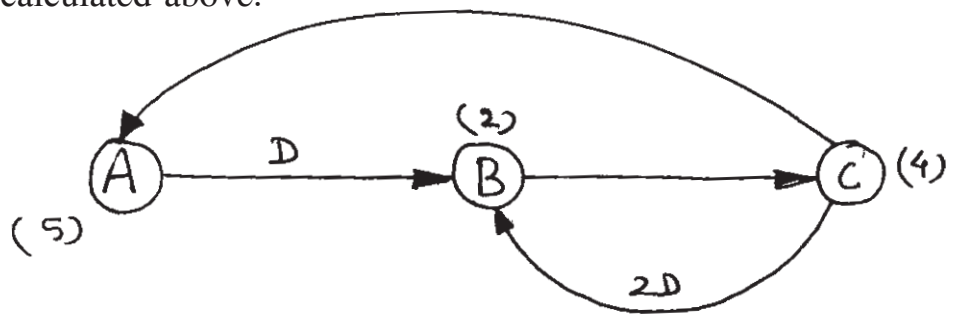

Fig. 1a

b) Explain the Minimum Cycle Mean algorithm. **[6]**

c) Draw Single rate DFG from the given Multi rate DFG. **[6]**

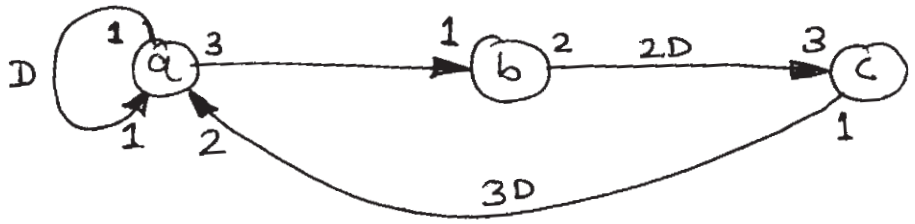

Fig. 1c

P.T.O.

Q2) a) For the DFG shown below, each operation in it requires T u.t. What is the maximum sample rate possible in this system? Place pipelining registers on feed forward paths such that sample rate of the system is approximately equal to 1/T. **[6]**

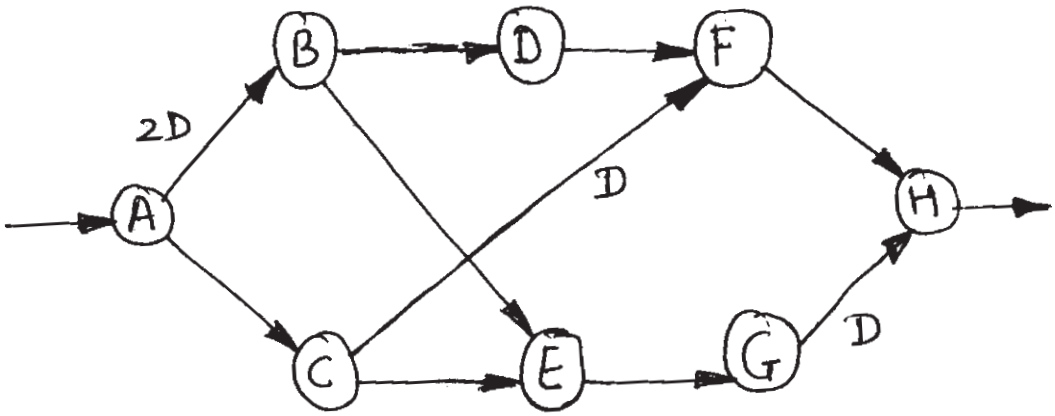

Fig. 2a

b) Retime the DFG shown below using cutest at appropriate location (s) and find whether feasibility and critical path constraints hold for clock period c = 2. Write the set of inequalities due to both. **[10]**

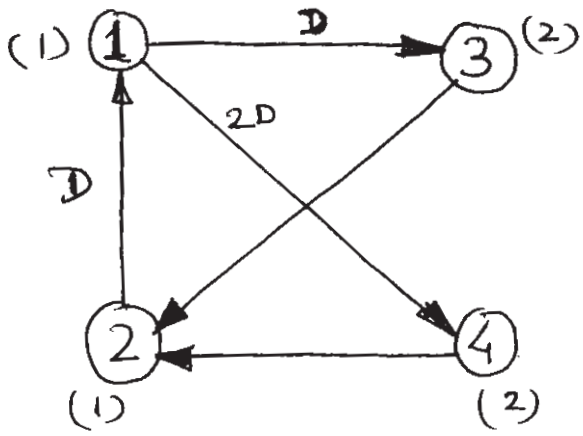

Fig. 2b

Q3) a) What are the applications of Unfolding? Explain each with an example. **[6]**

b) Design the folded architecture for the IIR filter shown. **[10]**

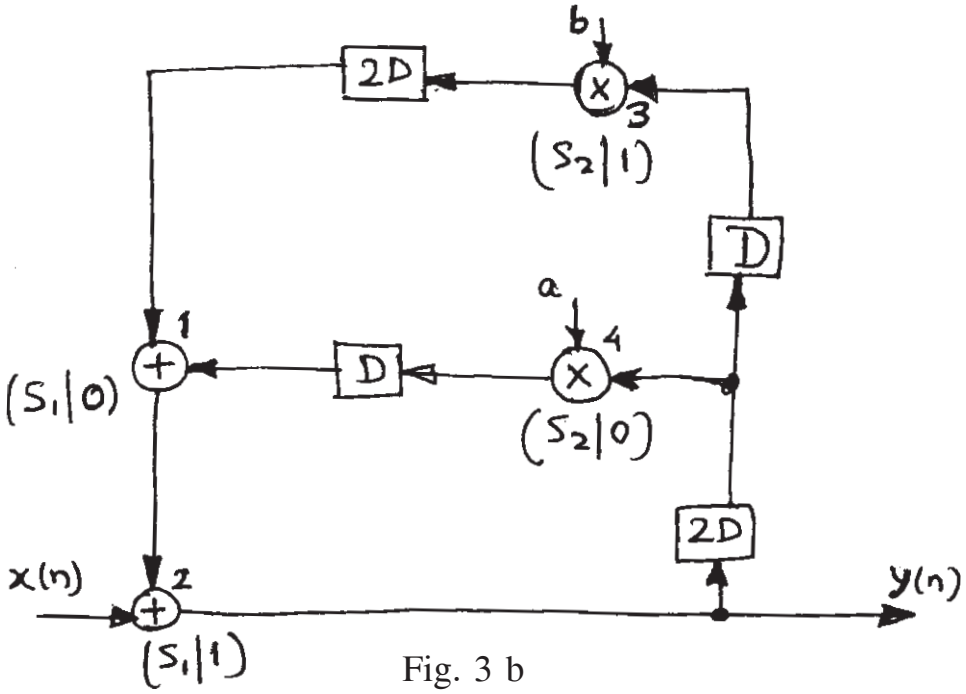

Fig. 3 b

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

a) Design B_2 for FIR systolic arrays.

b) LPM algorithm.

c) Parallel processing and pipelining architectures.

SECTION - II

Q5) a) Explain Parallel Carry-save and Carry-riple Array multipliers with sign bit extension. Draw dependence graph for each. **[10]**

b) Explain Baugh-Wooley Multiplier and draw its architecture. **[8]**

Q6) a) With the help of neat diagrams explain the IO block, CLB slices and Block memory of any FPGA. **[8]**

b) What are the clock distribution strategies applied for SoC designs? **[8]**

Q7) a) Explain the various routing resources available in a FPGA. What is PSM and discuss the trade off of size and routing ability of PSM. **[8]**

b) Explain floating point arithmetic and how it is implemented on FPGA. **[8]**

Q8) Write shorts notes on any two : **[16]**

a) Clock Managers.

b) Floor Planning in FPGAs.

c) Bit serial multipliers.

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Total No. of Questions : 10] [Total No. of Pages : 3

P1842

[3765] - 66

M.E. (Mechanical) (Design Engineering)

MACHINE TOOL DESIGN

Elective - I (2002 & Revised Course) (502207)

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

Instructions to the candidates:

1) ***Answer any Three questions from each section.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data, if necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of non-programmable electronic calculators is allowed.***

SECTION - I

Q1) a) What are the design considerations of gear box used for High Speed Machine Tools? **[4]**

b) Draw the suitable speed ray diagram for a 14 speed compromise gear box having six speeds for high range operation with ceramic tools, speeds varying from 4200 rpm to 160 rpm. Make a possible layout of the gear box. **[12]**

Q2) a) Give the classification of stepless drives used in Industry. State advantages and limitations of each one along with typical applications. **[6]**

b) How can you make a conical friction variator, having driving roller in contact with internal conical surface work with positive self locking? Deduce the necessary expression. **[10]**

Q3) a) What are the major requirements of guide ways suitable for machine tools? **[4]**

b) Show that the rigidity of a hydrostatic slide ways is 50% higher than the rigidity of the same slide ways under hydrodynamic lubrication. **[4]**

c) If the load of 8 kN is supported by guides on both sides, taken together and the viscosity of the oil used is 0.07 N.sec/m^2, find the breadth of the guide, assuming that the table moves with a velocity 40 mm/sec and minimum oil film thickness is 0.002 mm. If the intensity of the guide pressure is not allowed to exceed 0.05 N/mm^2, What will be the length of the table? **[8]**

P.T.O.

Q4) a) What are the characteristic advantages of a recirculating ball screw in comparison to traditional sliding friction lead screw? **[6]**

b) Evaluate the magnitude of the total pitch error of a conventional lead screw. Show that in a conventional sliding friction lead screw the distribution of the load on the threads of the nut is non-uniform. **[10]**

Q5) Write short notes: (any three): **[18]**

a) Combined friction slides.

b) Vertical roller feed screw.

c) Devices for intermittent motion.

d) Recent trends in development of machine tools.

e) Selection of electric motors for machine tools.

SECTION - II

Q6) a) Explain with sketch, construction of a typical spindle unit with mounting used on machine tool. **[8]**

b) What is meant by 'Stick slip' vibration in a machine tool? State the causes and commonly adopted methods in reducing the positional error due to stick-slip vibrations. **[8]**

Q7) a) With a neat sketch of the hydrostatic power pack used on machine tool. Show the functioning of each element on the system. **[5]**

b) Briefly explain the difference between static and dynamic rigidity of a machine tool. **[3]**

c) Assuming the tool in the tool post of a lathe machine being subjected to an impressed forced and damped vibrations, find out an expression for the dynamic rigidity of this system. **[8]**

Q8) a) Compare the following systems:- **[9]**

i) Stepper motor Vs. D.C. servomotor.

ii) Direct Numerical Control Vs. Standalone NC machine.

iii) Hybrid Hydrostatic Vs. Hybrid Aerostatic Spindle Supports.

b) With a neat sketch explain the operation of a thermal relay and push button control of a driving motor of a machine tool. **[7]**

Q9) a) Classify NC, CNC machines as against traditional machines, based on, functional movements etc. **[6]**

b) Discuss the method of programming a CNC machine with 'Automated Programming Tool' (APT) language with suitable illustration. **[6]**

c) What is the function of a shaft encoder? Why in some cases we use 'Gray Code' instead of 'Binary code' for designing encoders? **[4]**

Q10) Write short notes on:(any three): **[18]**

a) Methods of dynamic acceptance tests for Machine Tools.

b) Modular Design concept in machine tools.

c) Flexible Manufacturing Systems (FMS).

d) Preloading of bearings.

e) Retrofitting general purpose lathe into CNC lathe.

Total No. of Questions : 8] [Total No. of Pages : 3

P1843

[3765]-266
M.E. (Chemical)
ADVANCED PROCESS DYNAMICS & CONTROL
(2002 Course) (Semester - II)

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

Instructions to the candidates:

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

SECTION - I

Q1) a) Distinguish between process dynamics and process identification. State the mathematical tools used for these studies. **[6]**

b) The step response of certain system is given below. From this data, estimate the parameters K, τ & t_d for a postulated FOPDT model. **[12]**

Time (t) min	Response y(t)
0.0	0
0.5	0.003
1.0	0.005
1.5	0.09
2.0	0.16
2.5	0.27
3.0	0.45
3.5	0.73
4.0	1.21
4.5	2.00
5.0	3.30
5.5	5.44
6.0	8.95
6.5	14.64
7.0	15.86
7.5	16.00

Q2) For a conical tank with apex downwards having base radius 'R' and height 'H' in which liquid enters at the rate of 'F_i' (*cc/s*) and leaves at the rate 'F_o' (*cc/s*). **[16]**

a) Derive the expression for rate of change of level (*h*) of liquid in the tank assuming $F_o \propto \sqrt{h}$.

b) Linearize the model obtained in part (*a*) around steady-state values of flow (F_s) & height (h_s). Also derive the transfer function relating these variables.

Q3) a) Describe eigen value analysis of standard state-space model of the system. Sketch the node, saddle, focus and centre behaviour of systems in stable and unstable modes based on these eigen values. Also sketch the plot of 'trace (A)' versus |A|, showing all the above behaviours where A represent coefficient matrix of state-space model. **[8]**

b) What are time-delay systems? Explain control problem associated with these systems. Explain Smith predictor compensation for time delay systems. **[8]**

Q4) a) Explain the behaviour of open-loop unstable systems. **[8]**

b) Draw block diagram of a cascade control system. Give suitable physical example of such system. Explain how such systems overcome the effect of disturbance. **[8]**

SECTION - II

Q5) A 2 × 2 system having transfer function matrix $G_P(s) = \begin{bmatrix} G_{11}(s) & G_{12}(s) \\ G_{21}(s) & G_{22}(s) \end{bmatrix}$

which relate inputs $\overline{m}_1(s), \overline{m}_2(s)$ and output variables $\overline{y}_1(s), \overline{y}_2(s)$. **[16]**

a) Sketch the block diagram for this system and derive open-loop model for the system.

b) Derive the expression for RGA of the system.

c) State properties of RGA and the rules for selecting the best pairing of input and output variables which will result in the control loops with minimum interaction.

d) Derive the decouplers which will eliminate the interaction between the loops.

Q6) a) What are hold elements? How will you reconstruct the original continuous-time signal from the given discrete-time signal using ZOH & FOH elements. **[8]**

b) Starting from classical PID-controller equation, derive discrete-time equation in position and velocity forms. **[8]**

Q7) a) Describe control system for controlling throughput and composition of top and bottom product of a distillation column used to separate a binary mixture (A + B), where A is a more volatile component. **[8]**

b) Explain MPC strategy and state its advantages over classical controllers. **[8]**

Q8) Write short notes on the following : **[18]**

a) Antireset windup systems.

b) Limit cycle behaviour of systems.

c) Split range control systems.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1845

[3765] - 616
M.E. (Production)
TOOL AND DIE DESIGN
(2008 Revised Course) (511105) (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) Explain various types of tool wear and state their causes. **[8]**

b) For an orthogonal cutting process. **[8]**

Cutting speed = 120 m/min

Uncut chip thickness = 0.127 mm

Rake angle = 10°

Width of cut = 6.35 mm

Chip thickness = 2.90 mm

Cutting force = 556.25 N

Thrust force = 222.50 N

Calculate the percentage of total energy that goes into overcoming friction at the tool-chip interface.

Q2) a) Explain the geometry of twist drill with neat sketch and also specify the importance of each element. **[8]**

b) Design a shell-inserted-blade reamer tipped with cemented carbides for reaming a through hole, diameter 55 H7 in a workpiece of structural alloy steel with ultimate strength of 1050 Mpa. The diameter of the premachined hole is 54.65 mm. **[8]**

Q3) A square blank of size 60 mm x 60 mm with a central hole of diameter is to be produced from a strip of thickness 2 mm, having a shear strength 360 N/mm^2. Design a progressive die for the component. **[16]**

Q4) A circular blank of diameter 60 mm with a central square hole of size 10 mm x 10 mm is to be produced from a strip of thickness 1 mm having shear strength 360 N/mm^2. Design a compound die for the given component. **[18]**

SECTION - II

Q5) a) Explain the design of 'edging impression' of forging die for a connecting rod. **[8]**

b) Explain the importance of grain flow line while designing the following component. **[10]**

i) Gear blank.

ii) Coupling hook.

Q6) a) Explain various principles to be followed for locating surfaces of work piece. **[10]**

b) Explain briefly V-locators and its suitability. **[6]**

Q7) a) Explain compression molding and blow molding state the applications. **[8]**

b) Explain the ejection system used in injection molding process. **[8]**

Q8) a) Explain various types of dies used in die casting. **[8]**

b) Explain the cooling system in die casting machines. **[8]**

Total No. of Questions : 8] [Total No. of Pages : 2

P1845

[3765] - 616
M.E. (Production)
TOOL AND DIE DESIGN
(2008 Revised Course) (511105) (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

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b) For an orthogonal cutting process. **[8]**

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Uncut chip thickness = 0.127 mm

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Q2) a) Explain the geometry of twist drill with neat sketch and also specify the importance of each element. **[8]**

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SECTION - II

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b) Explain the importance of grain flow line while designing the following component. **[10]**

i) Gear blank.

ii) Coupling hook.

Q6) a) Explain various principles to be followed for locating surfaces of work piece. **[10]**

b) Explain briefly V-locators and its suitability. **[6]**

Q7) a) Explain compression molding and blow molding state the applications. **[8]**

b) Explain the ejection system used in injection molding process. **[8]**

Q8) a) Explain various types of dies used in die casting. **[8]**

b) Explain the cooling system in die casting machines. **[8]**

Total No. of Questions : 8] [Total No. of Pages : 2

P1846

[3765]-620
M.E. (Production) (Manufacturing & Automation)
INDUSTRIAL AUTOMATION
(2008 Course) (51110)

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) Following list defines the precedence relationship and elemental times for a new model.

Element	1	2	3	4	5	6	7	8
Te (min)	1	0.5	0.8	0.3	1.2	0.2	0.5	1.5
Immidiate Predecessor	-	-	1.2	2	3	3,4	4	5,6,7

Construct the precedence diagram. Use largest candidate rule to assign work element to stations and also calculate the balance delay. **[8]**

b) Explain the analysis for determining efficiency of two stage line with storage buffers of finite capacity. **[8]**

Q2) a) For a 50 kN press, tool, weigh 4 kN. Calculate the pressure required for pressing operation if bore diameter of cylinder is 40mm, rod area is 32mm and counter balance valve is used in circuit. **[10]**

b) For a meter in hydraulic circuit, calculate the pump pressure required to achieve 40 bar pressure at full bore end of cylinder if the pressure loss across various elements is as below :

Flow control valve = 15 bar, direction control valve (both side) = 3 bar, filter = 5 bar. **[6]**

P.T.O.

Q3) a) Explain fluidic NOR/OR and AND/NAND gate with suitable sketch. **[8]**

b) What is function of twin pressure valve. Draw suitable pneumatic circuit showing its application. **[8]**

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

a) Variable displacement pump control for constant flow.

b) Meter out circuit to maintain constant feed rate with variation in load.

c) Cascade method for pneumatic circuit design.

d) Hydro-pneumatic systems.

SECTION - II

Q5) a) What do you understand by multiprocessor based system? Explain different factors for selection. **[6]**

b) During powder metallurgy process, the die is filled with powder when start button is pressed. A punch is then advanced and applied pressure for 10 seconds. After which punch is retracted. The pressed compact is then ejected from die and cycle repeats. Construct a ladder diagram to perform this task. **[10]**

Q6) a) Explain advantages of AGV over other material handling processes. **[8]**

b) Explain basic guidelines for design and operation of material handling system. **[8]**

Q7) a) An RR robot has two links of 2.0m length :

i) Determine the co-ordinates of end effector point if joint rotations are 40° at both joints.

ii) Determine the joint rotations if end effectors are located at (1.8667, 0.5). **[8]**

b) Explain various sensors which are normally used in robots. **[8]**

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

a) ADC and DAC as input devices.

b) Types of part feeders.

c) AS/RS.

d) Use of thermal relay in machine tools.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1847

[3765] - 622
M.E. (Production)
PRODUCT LIFE CYCLE MANAGEMENT
(Elective - III) (2008 Course) (511111)

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) ***Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Figures to the right indicate full marks.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain the primary product design phases in detail. **[10]**

b) Explain the 'Physical realizability. **[6]**

Q2) a) Explain three types of new products being created in today's global competitive environment. **[10]**

b) Explain concurrent engineering. State the advantages and disadvantages. **[6]**

Q3) a) Explain product configuration chain in relation to product design activity, design management and subcomponent design activity. **[10]**

b) Explain Capability Maturity Model (CMM) to assess PLM. **[6]**

Q4) Write short note on **[18]**

a) Value engineering and product design.

b) Characteristics of PLM.

c) PDM system architecture.

P.T.O.

SECTION - II

Q5) a) Explain in detail the method (any one) for translating customer requirements into product with suitable illustration. **[10]**

b) Explain 'Design for Environment'. **[6]**

Q6) a) Explain and state the guidelines of 'Design for Assembly'. **[10]**

b) Explain the role of human factors in product design. **[6]**

Q7) a) Explain six types of modularity for mass customization of products and services. **[10]**

b) Explain 'First Mover' advantage and disadvantage while launching the new products. **[8]**

Q8) a) Explain the steps involved in mapping the technology environment. **[8]**

b) Explain 'S-Curve' approach with suitable illustration. **[8]**

Total No. of Questions : 8] [Total No. of Pages : 3

P1848

[3765]-658
M.E. (Chemical)
APPLIED STATISTICS FOR CHEMICAL ENGINEERING
(2008 Course) (Sem. - I)

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

Instructions to the candidates:

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

SECTION - I

Q1) For the following distribution :

Class	100 - 109	110 - 119	120 - 129	130 - 139	140 - 149	150 - 159	160 - 169	170 - 179
Frequency	15	44	133	150	125	82	35	16

a) Find mean, mode, median using step deviation method with assumed mean a = 134.5 and h = 10. **[6]**

b) Find SD, variance, QD and COV. **[6]**

c) Find Karl Pearson and Bowley's coefficient of skewness. Hence comment on symmetry of distribution. **[2]**

d) Calculate excess Kurtosis and comment on nature of Kurtosis. **[2]**

Q2) a) Find the correlation coefficient between x and y from the given data :**[8]**

x :	78	89	97	69	59	79	68	57
y :	125	137	156	112	107	138	123	108

b) Find the correlation between x (marks in mathematics) and y (marks in Engg. Drawing) given in the following data : **[8]**

y \ x	10 - 40	40 - 70	70 - 100	Total
0 - 30	5	20	-	25
30 - 60	-	28	2	30
60 - 90	-	32	13	45
Total	5	80	15	100

P.T.O.

Q3) a) In a city A 20% of a random sample of 900 school boys had a certain physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant? Take confidence limit of $\pm$ 1.96 at 1% LOS. **[6]**

b) The means of simple samples of sizes 1000 and 2000 are 67.5cm and 68.0cm respectively. Can the samples be regarded as drawn from the same population of S.D. 2.5cm. Take confidence limit of $\pm$ 2.58. **[6]**

c) A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160cm. Can it be reasonably regarded that in the population the mean height is 165cm and S.D. 10cm. Take LOS 1% with $Z\alpha = 2.58$. **[6]**

Q4) a) State point and interval methods for estimating population parameters. **[8]**

b) Explain Fisher's criteria for the best estimator of population parameters. **[8]**

SECTION - II

Q5) a) Define : **[8]**

i) Statistical hypothesis.
ii) Null hypothesis.
iii) Alternative hypothesis.
iv) Testing of hypothesis.

b) Show that for a random sample of size 100, drawn with replacement, the standard error of sample proportion can't exceed 0.05. **[4]**

c) Before an increase in excise duty on tea, 800 people out of a sample of 1000 were consumers of tea. After an increase in duty, 800 people were consumers of tea in a sample of 1200 persons. Find whether there is a significant decrease in the consumption of tea after increase in the duty. Take $Z\alpha = 2.33$ at 1% LOS. **[4]**

Q6) a) Explain the following tests of significance for small samples. **[8]**

i) t-test.
ii) F-test.
iii) χ^2-test.

b) Tests made on breaking strengths of 10 pieces of a metal gave the following results.

578, 572, 570, 568, 572, 570, 570, 572, 596, 584 kg. Test if the mean breaking strength of the wire can be assumed as 577 kg.

Given : At $\upsilon = 9$, $t_{0.05} = 2.26$ **[8]**

Q7) a) A total number of 3759 individuals were interviewed in a public opinion survey on a political proposal. Of them, 1872 were men and the rest women. A total of 2257 individuals were in favour of the proposal and 917 were opposed to it. A total of 243 men were undecided and 442 women were opposed to the proposal. Do you justify or contradict the hypothesis that there is no association between sex and attitude.

Take $\chi^2_{(0.05)}(\upsilon = 2) = 5.99$ **[8]**

b) Explain the basic principles of design of experiments. **[8]**

i) Randomisation.
ii) Replication.
iii) Local control.

Q8) a) A car rental agency uses 5 different brands of tyres. The following table gives the lives (in thousand kilometers run) of each of 5 tyres of each brand. Test the hypothesis that the 5 tyre brands have almost the same average life.

Take $F_{5\%}(\upsilon_1 = 20, \upsilon_2 = 4) = 5.8$. **[10]**

b) Explain the assignment problem in LP with suitable examples. **[8]**

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Total No. of Questions : 8] [Total No. of Pages : 3

P1849

[3765]-671
M.E. (Chemical)
ADVANCED PROCESS CONTROL
(2008 Course) (Semester - 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) Derive the transfer function model $\bar{h}(s)/\bar{F}_i(s)$ & $\bar{F}_o(s)/\bar{F}_i(s)$ for a liquid tank of cross-section area A. The liquid of constant density ρ enters the tank at the volumetric flow rate F_i & leaves the tank at the rate F_o. The level of liquid inside the tank is h. (Assume - $F_o \propto h$). **[6]**

b) If input flow rate is given unit step change, find the response of height of liquid inside the tank. Sketch the input and output response and represent steady-state gain and time constant on the graph. **[6]**

c) If input flow rate is given unit impulse change, find the response of height of liquid inside the tank. Sketch the response. **[6]**

Q2) a) What is process identification? **[4]**

b) With suitable block diagram, explain cascade control system. State its advantages over single-loop control systems. **[6]**

c) A second order system having $G_P = \dfrac{10}{(s+1)(2s+1)}$ is controlled using a P-controller with $Kc = 5$. Assuming $Gm = Gf = 1$, find the characteristic equation of the system. Check stability of the closed-loop system using Routh-Hurwitz method. **[6]**

P.T.O.

Q3) a) Sketch block diagram of a 2 × 2 MIMO system modeled as

$$\overline{Y}_1(s) = K_{11} G_{11}(s) \overline{m}_1(s) + K_{12} G_{12}(s) \overline{m}_2(s)$$

$$\overline{Y}_2(s) = K_{21} G_{21}(s) \overline{m}_1(s) + K_{22} G_{22}(s) \overline{m}_2(s)$$

If controller GC_1 is installed between $\overline{m}_1 - \overline{y}_1$ and GC_2 is installed between $\overline{m}_2 - \overline{y}_2$, then derive the closed loop response equation in vector-matrix notation. Define poles and zeros of the closed-loop servo transfer function. **[8]**

b) A 3 × 3 system modeled as $\dot{X} = AX + BU, Y = CX,$

where $A = \begin{bmatrix} -6 & 2 & -4 \\ -18 & 3 & -8 \\ -6 & 1 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix}$, $C = \begin{bmatrix} 1 & -1 & 2 \end{bmatrix}$

Test observability and controllability of the system. **[8]**

Q4) a) A 2 × 2 system has steady-state gain matrix.

$$K = \begin{array}{c} \begin{array}{cc} m_1 & m_2 \end{array} \\ \begin{bmatrix} 5 & 2 \\ -4 & 1 \end{bmatrix} \end{array} \begin{array}{c} Y_1 \\ Y_2 \end{array}$$

Find RGA of the system. Based on RGA, recommend the best pairing of input and output variable which will result in control loops with minimum interaction. **[8]**

b) Design decouplers for a 2 × 2 system modeled as given in Q.3 (a). Explain how they eliminate interaction between the control loops formed between m_1-y_1 & m_2-y_2. **[8]**

SECTION - II

Q5) a) Explain MPC control strategy in detail. State its advantages over classical feedback control systems. **[8]**

b) Explain IMC-based PID control system. **[8]**

Q6) a) Explain basic principles of statistical process control systems. **[8]**

b) Explain batch process control systems with suitable examples. **[8]**

Q7) a) Explain interaction of plant design and control system design in case of plant wide control systems. **[8]**

b) Explain the effect of control structure on closed-loop performance of control system. **[8]**

Q8) Write short notes on the following : **[18]**

a) ANN Control Systems.

b) Fuzzy logic Control Systems.

c) Set-point Weighted PID Controller.

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Total No. of Questions :8] [Total No. of Pages : 2

P1854

[3765]-7
M.E. (Civil) (Construction Management)
CONSTRUCTION TECHNIQUES
(Revised Course 2002)

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) For tunneling in rock, what are the factors which decides "Selection of" – method of tunneling. List out and explain them in details.

b) Explain with a neat sketch basic operations involved in one boring cycle in rock tunneling using "Full face Tunnel Boring Machine (T.B.M)".

[16]

Q2) a) Give corrective measures adopted in correcting the "Tilts in well foundations".

b) Explain with sketches "Pneumatic sinking of caissons" used for bridge foundations at a creek location.

[16]

Q3) a) List out problems and precautions you will take in construction of high-rise buildings.

b) Explain in details method of construction of micropiles.

[16]

Q4) Write short notes on any three of the following : **[18]**

a) Burn cut in rock tunneling.

b) Shotcreting.

c) Advantages of "Part Face Tunnel Boring Machines".

d) Tremie concreting method used in construction of diaphragm walls.

e) Negative skin friction in piles.

P.T.O.

SECTION - II

Q5) a) List out different 'Tunnel Lining Methods' used and explain any one in details.

b) How does the method of Tunnel lining affects the " Rate of Advance" in a tunnel. **[16]**

Q6) a) List out different types of Cofferdams used for construction of a Bridge foundation in a flowing river.

b) Explain any of the methods of construction of the Cofferdam in details including its removal after completion of foundation.

[16]

Q7) a) Explain "Jet Grout" technique used in "Tunneling in soft soil"

b) Give advantages and disadvantages of "Jet Grout". Columns with other methods of grouting used. **[16]**

Q8) Write short notes on any three of the following : **[18]**

a) Precautions in use of concrete pumps in construction of High-Rise buildings.

b) Specifications and properties of Bentonite slurry used in large diameter piles.

c) Chemical Grout applications in civil works.

d) Advantages of 'Well-paint' system of dewatering.

e) 'Tunnel Formwork' used in High Rise buildings.

# # # #

Total No. of Questions : 8] [Total No. of Pages : 2

P1855

[3765]-21
M.E. (Civil) (Hydraulic Engg.)
SEDIMENT TRANSPORT AND RIVER MECHANICS
(2002 Course)

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 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) What are the significant sediment properties? Explain them briefly. **[6]**

b) State the various theories of initiation of sediment movement. Explain Shields' analysis in detail. For a 2.00mm diameter sediment particle, what is the critical stress at 20°C? **[10]**

Q2) a) Explain with neat sketches, various flow regimes with changing flow conditions. State their significance. **[10]**

b) How do the form resistance and grain resistance vary in different regimes? **[6]**

Q3) a) Briefly describe the various modes of sediment transport. **[6]**

b) Using Meyer-Peter and Muller's procedure, estimate the bed load transport of sediment in an alluvial channel 120 m wide and 3 m deep carrying a discharge of 300 m^3/sec. The bed slope of the channel is 1 in 3600 and the mean size of the sediment is 0.25 mm. **[8]**

c) Briefly explain the use of remote sensing in estimating the sediment load. **[4]**

Q4) a) State the merits and demerits of Kennedy's method and Lacey's method of design of stable channel in alluvium. **[6]**

b) Design a stable channel in alluvial soil to carry a discharge of 500 m^3/sec by using Lacey's method. The mean size of the sediment particles is v.045 mm. **[10]**

P.T.O.

SECTION - II

Q5) a) Write Rouse's equation to estimate the concentration of suspended sediment at mid depth in a wide channel. Explain all the terms of equation. **[4]**

b) Define any four : **[4]**

i) Contact load.
ii) Saltation load.
iii) Bed load.
iv) Suspended load.
v) Wash load.
vi) Total load.

c) Explain process of aggradation and degradation on the basis of hydraulic aspects in an open channel. **[8]**

Q6) a) State any three methods of river gauging and explain any one with help of sketch. **[8]**

b) Differentiate between confluence and bifurcation of river and explain with neat sketch, why it occurs? **[8]**

Q7) a) State and explain any three classifications of rivers. **[8]**

b) Define : **[8]**

i) Meander length.
ii) Meander belt.
iii) Meander ratio.
iv) Tortuosity.
v) Cross over.
vi) Cut off ratio.
vii) Angle of swing.
viii) AFFLUX.

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

a) Groynes-concept-application-types

b) Bed load measurements.

c) Silting of reservoirs.

d) Artificial cut off.

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Total No. of Questions : 8] [Total No. of Pages : 3

P1856

[3765] - 22

M.E. (Civil) (Hydraulic Engineering)

IRRIGATION AND DRAINAGE

(Old Course)

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, and non-programmable electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Define soil water. Explain the classification of soil water depending on its existance in soil in various forms. **[8]**

b) Name the different soil-moisture constants and explain each of them briefly. **[8]**

Q2) a) Explain the following terms : **[4]**

i) Evaporation.

ii) Transpiration.

b) Differentiate clearly between potential evapotranspiration and actual evapotranspiration. **[6]**

c) After how many days will you order irrigation for the crop in order to ensure healthy growth of the said crop having following soil and crop characteristics : **[6]**

i) Field capacity of soil = 29%

ii) Permanent witting point = 11%

iii) Soil density = 1300 kg/m^3

iv) Effective depth of root zone of the crop = 750 mm

v) Daily consumptive use of water for the crop = 12.5 mm

vi) Percentage of readily available moisture = 80%.

Q3) a) What are saline and alkaline soils? What are the causes of salinity and alkalinity of soils? How are such soils reclaimed? **[10]**

b) Explain the causes of soil erosion and the corresponding measures to be taken to prevent it. **[6]**

Q4) Write short notes on any three of the following : **[18]**

a) Flow of water in saturated and unsaturated soils.

b) Consumptive use concept in irrigation.

c) Drip irrigation method and its design concepts.

d) Advantages and disadvantages of drip irrigation.

SECTION - II

Q5) a) State concept of lift irrigation and with help of a neat sketch of layout, explain different elements of lift irrigation scheme. **[8]**

b) With help of equations, explain design consideration in distribution system of lift irrigation scheme. **[8]**

Q6) a) With a neat sketch, state concept and different components of sprinkler irrigation scheme. **[8]**

b) Enlist flow chart of design steps of sprinkler irrigation. **[8]**

Q7) a) State concept of command area development. What are the different on farm structures? Explain any one of it. **[8]**

b) Define and explain the drainage coefficient. A tile drain system drains off 15 ha land for 2 days. Estimate volume of water that can be drained off in this period with drainage coefficient of 1.5 cm. **[8]**

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

a) Gravity outlet and Pump outlet.

b) French drain-concept-sketch-functioning.

c) Herring bone system of layout of tile drain.

d) Flowchart of design steps of drainage system.

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Total No. of Questions : 6] [Total No. of Pages : 2

P1857

[3765]-32
M.E. (Civil / Structure)
EARTHQUAKE RESISTANT DESIGN OF BUILDINGS
(2002 Course)

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 indicate full marks.***
5) ***Your answers will be valued as a whole.***
6) ***Use of electronic pocket calculator is allowed.***
7) ***Assume suitable data, if necessary.***
8) ***Use of IS 1893-2002 and IS 456-2000 is allowed.***

SECTION - I

Q1) a) What are the causes of an earthquake? Explain principles and philosophy behind earthquake resistant design of structure. **[9]**

b) Write notes on : **[16]**

i) Response spectrum method of dynamic analysis.
ii) Simplicity and symmetry of a structure.
iii) Soft and weak storey in construction.
iv) Strength and stiffness of a building.

Q2) a) Discuss how the soil and the structure interact during an earthquake.**[9]**

b) Describe various co-efficient taken into account in assessing lateral design forces. **[16]**

Q3) A simple one storey building having two shear walls are in M-25 grade concrete and 200 mm thick. Design shear force is 100 kN in either direction. Compute design lateral forces in Y-direction using torsion provisions. Refer Figure 3.1 **[25]**

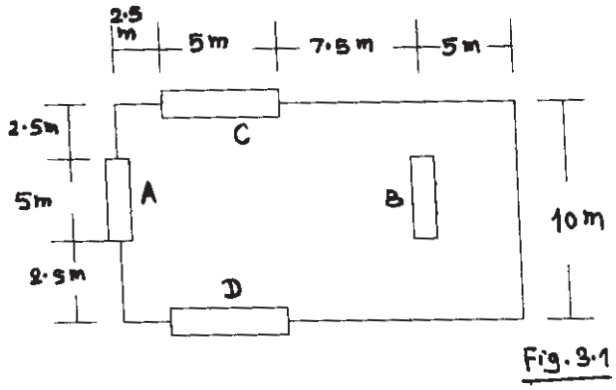

Fig. 3.1

P.T.O.

SECTION - II

Q4) a) Discuss behavior of following masonry walls in seismic regions. **[10]**

i) Un-reinforced masonry walls.

ii) Reinforced masonry walls.

iii) Infill walls.

b) Classify and describe various retrofitting techniques in RC buildings. **[15]**

Q5) Determine seismic forces and shear at each floor level for a five storey building as shown in Figure 5.1. The height between the floors in 3 m. The dead load/unit area is 4 kN/m^2 and a live load of 3 kN/m^2 at each floor. Use M-25 grade concrete and Fe 415 steel. The soil below the foundation is hard and building located in Zone III. **[25]**

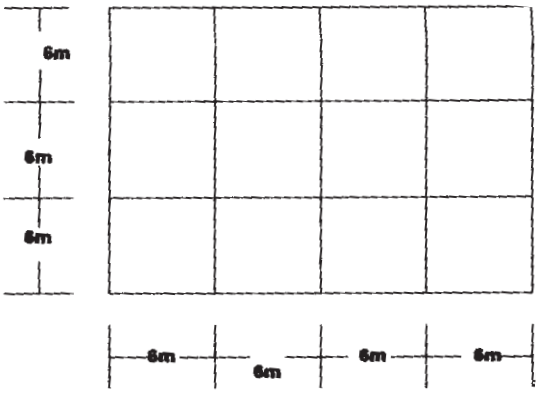

Figure 5.1

Q6) A RCC beam of rectangular cross section has to carry a distributed live load of 20 kN/m in addition to self weight and a dead load of 25 kN/m. The maximum bending moment and shear force due to earthquake is 60 kN-m and 40 kN. The span is 6 m. Assuming M-20 grade concrete and Fe 415 steel, design the beam. **[25]**

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Total No. of Questions : 6] [Total No. of Pages : 3

P1858

[3765]-37
M.E. (Civil) (Structure)
STRUCTURAL DYNAMICS
(2002 Course)

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 indicate full marks.***
5) ***Your answers will be valued as a whole.***
6) ***Use of electronic pocket calculator is allowed.***
7) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Define the following with neat diagrams :- **[6]**

i) Degree of freedom.
ii) Damping.
iii) Amplitude of motion.
iv) Period of vibration.
v) Phase angle.

b) Define vibrations. What are the types of vibrations? Obtain the equation for natural frequency for damped free vibrations of SDOF system. **[9]**

c) For the system shown in the figure, find the mass if the system has natural frequency of 10 Hz. **[10]**

(Refer Fig. 1·1)

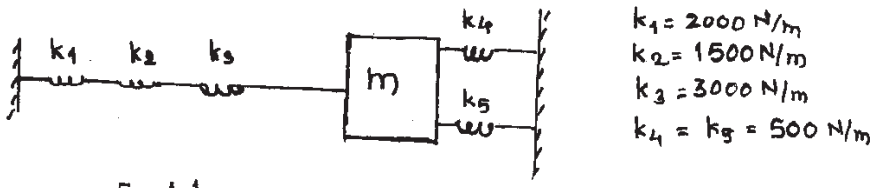

Fig. 1·1

Q2) a) A damped S.D.O.F. system with mass 'm' and dampening coefficient 'ξ' and stiffness 'K' is subjected to forcing function '$F_0 \sin \omega t$'. Obtain an expression for it's magnification factor. **[10]**

P.T.O.

b) A vibrating system consists of mass 5 kg, spring stiffness of 20 N/m and damping co-efficient is 5N-s/m. determine :- **[15]**

i) Damping factor.
ii) Natural frequency of damped vibration.
iii) Logarithmic decrement.
iv) The ratio of two successive amplitudes.
v) The number of cycles when the initial amplitude is reduced to 25%.

Q3) Write notes on :- (any five) **[25]**

a) Wilson theta method.
b) Damping and it's estimation.
c) Transmissibility and base isolation.
d) Dahamal's integration for response of undamped SDOF.
e) Frequency response curve.
f) Non-linear analysis by linear acceleration method.

SECTION - II

Q4) a) Explain any one numerical method to compute natural frequency of M.D.O.F. system. **[8]**

b) Compute natural frequency and draw mode shapes for the system shown below. **[9]**

(Ref. Figure 4.1)

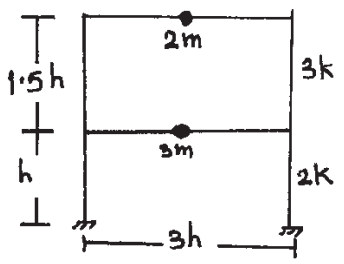

Fig. 4.1

c) Write a note on "Mode Superposition Method". **[8]**

Q5) a) Derive equation of motion for a freely vibrating beam with both ends fixed and mass uniformly distributed along its length. **[10]**

b) Explain Rayleigh's Method to obtain natural frequencies for a freely vibrating propped cantilever beam with uniformly distributed mass. **[15]**

Q6) a) Write the algorithm for step-by-step solution of a linear systems by use of Wilson-Theta Method. **[10]**

b) Obtain natural frequencies and sketch the mode shapes for a freely vibrating shear building as shown below. **[15]**

(Fig-6.1)

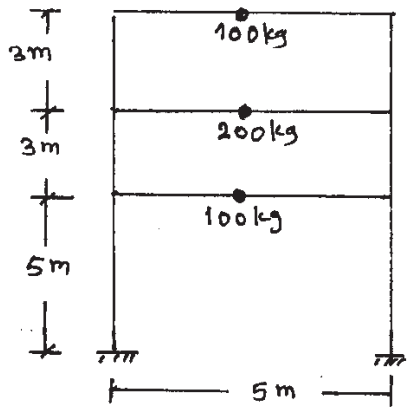

Fig 6.1

Assume $E = 2 \times 10^4$ MPa

All beams c/s = 300 mm x 500 mm

1st Floor Columns = 300 mm x 400 mm

2nd Floor Columns = (300 mm x 300 mm)

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Total No. of Questions : 6] [Total No. of Pages : 3

P1859

[3765] - 38

M.E. (Civil) (Structures)

BRIDGE ENGINEERING

(2002 Course)

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) ***Figures to the right indicate full marks.***
4) ***Use of IRC codes, IS 1343, IS 456-2000 & non programmable calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***
6) ***Assume any other data, if necessary.***

SECTION - I

Q1) a) Write short note on Forces on Abutments. **[8]**

b) Write detail note box girder bridge. **[8]**

c) What are the factors affecting the span of bridge. **[9]**

Q2) Design intermediate post tensioned prestressed concrete Tee Beam Bridge girder for the following **[25]**

Effective span = 15m, width of carriageway = 7.5m, No. of beams 4, equally spaced along the carriageway width, Spacing of cross girders = 3m c/c, No footpath on either side loading class = IRC class AA, kerb size = 150 × 600mm, concrete grade M45 Design should include detail load, bending moment calculation, Check fiber stresses in concrete Draw sketches showing cable profiles.

P.T.O.

Q3) a) Design the culvert with the data : **[18]**

Clear span of the culvert = 7m

Clear carriage way width = 7.5m

Size of kerb = 300 mm × 600 mm

Average thickness of wearing coat 100 mm

Use material M25, Fe 500

Loading class A

Draw the cross section showing details of reinforcement at mid-span and at junction of the slab are kerb.

b) Compare simply supported PSC girder with balanced cantilever PSC girder. **[7]**

SECTION - II

Q4) a) Explain with sketches, how tilting of sinking well foundation is corrected. **[9]**

b) List the different forces to be considered for design of bridge abutment design, explain importance of each. **[8]**

c) Describe different factor affecting the type of bridge foundations. **[8]**

Q5) a) Design wall type RCC pier for the following : **[20]**

Top width of pier = 1m with semicircular ends

Length of pier = 7m excluding the semicircular part

Height of above footing = 10m

HFL above the top of footing = 8m

Total DL Reaction = 2000kN

Total LL Reaction = 1100kN

Tractive force = 130kN

C/C distance of bearing on either side of centre line of pier = 1m

BM in traffic direction due to unequal DL & LL = 600 kN-m

Material of pier and footing = M40 & Fe500

Safe bearing capacity = 200 kN/m^2

Velocity of water current = 4m/s consider the cross current also

Design the RCC footing and reinforcement in pier, check the stresses at the bottom of pier.

b) List merits and demerits pile type well type foundation used for bridge. **[5]**

Q6) a) Write a short note on metallic bearing, Draw sketches. Explain its merits and demerits. **[5]**

b) Design a reinforced elastomeric bearing at a pinned end of a plate girder of a bridge with following data. **[20]**

Maximum vertical load = 1000 kN

Dynamic vertical load = 80 kN

Transverse lateral load = 40 kN

Longitudinal load = 50 kN

Longitudinal total translation 12 mm

Rotation at support 0.003°

Shear modulus of elastomeric bearing = 1.2 N/mm^2

Allowable comp. stress for concrete = 8 N/mm^2

Allowable comp. stress for elastomer = 10 N/mm^2

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Total No. of Questions : 10] [Total No. of Pages : 4

P1860

[3765]-69
M.E. (Mechanical) (Design Engg.)
RELIABILITY ENGINEERING
(2002 Course) (Elective - II) (502208)

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

Instructions to the candidates:

1) ***Answer any three questions from each section.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data, if necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use non-programmable electronic calculators is allowed.***

SECTION - I

Q1) a) Calculate the reliability for the system shown in Fig.1. The numbers in each block shows the reliability of individual component. **[10]**

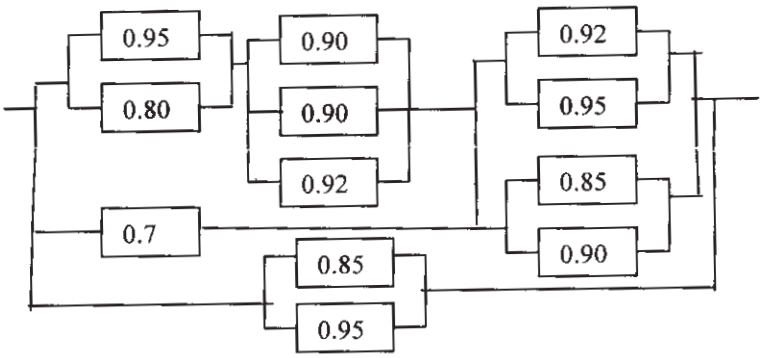

Fig.1

b) Explain the characteristics of Normal and Lognormal distributions. **[6]**

Q2) a) In an engineering manufacture plant, 80% of the crankshafts are ground by machinist R and 20% by machinist S. It is known from past experience that the crankshafts ground by machinists R and S contain 5 percent and 4 percent defective units respectively. If a randomly selected crankshaft is found to be defective, find the probability that it was ground by the machinist R. **[10]**

b) Explain Center Line Theorem. **[6]**

P.T.O.

Q3) a) Write a short note on Chebyshev inequality. **[6]**

b) Define availability and maintainability for the system from the following data collected at a plant : **[10]**

Mean time before failure : 35 Hrs
Mean time to repair : 10 Hrs
Administrative logistic time : 50% of MTTR
Calculate operational availability and inherent availability of the plant.

Q4) a) Write a note on three parameter weibull distribution. **[8]**

b) Failure rates of three components are 0.000065, 0.00018 and 0.00096 per hour. Evaluate the failure rate, MTTF of the system and the reliability at 500 hrs if these components are connected in series. **[8]**

Q5) Write short note on following (any three) : **[18]**

a) Bath Tub Curve.

b) ARINC method for Reliability allocation.

c) Event Tree Analysis.

d) Conditional Probability.

SECTION - II

Q6) a) The mean strength and the standard deviation of a bolted joint are 3000kg/cm^2 and 300kg/cm^2 respectively. The joint is loaded such that stress induced has a mean value of 2500kg/cm^2 with a standard deviation of 50kg/cm^2. Assuming that shear strength and the induced stresses are independent and normally distributed, find out the probability of survival of the bolted joint. Extract of data from statistical table is given below : **[8]**

Z	1.2	1.3	1.4	1.5	1.6	1.7	1.8
ϕ (z)	0.8849	0.9032	0.9192	0.9331	0.9452	0.9550	0.9640

b) Find the reliability of system shown in Fig.2 using conditional probability method. The values in the blocks show reliabilities of each element. **[8]**

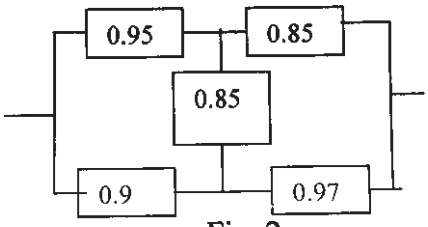

Fig. 2

Q7) a) Explain the various accelerated life tests carried out for reliability analysis. **[6]**

b) In a short sample "accelerated life testing" of a system, based on Weibull distribution the following data is recorded. **[10]**

Failure No.	1	2	3	4	5	6	7	8	9
MTTF (HRs)	24	22	12.0	28	35	38	30	19	25

Plot the variation of reliability against time using

i) Mean ranking and

ii) Median Ranking Method.

Q8) a) Find out the failure rates of the components so that the system reliability becomes 0.96 using AGREE method, the data being given below : **[8]**

Sr. No. Components	No. of Component Modules (n_i)	Operating Time (t_i)	Prob. of system due to failure of subsystem (w_i)
1	4	12	0.90
2	8	4	0.80
3	6	10	1
4	13	15	1
5	10	10	0.90

b) The following data refer to predicted reliability of six components in series. In case the desired reliability of the system is not to fall below 0.80 find the reliability goal for individual components. **[8]**

Components	1	2	3	4	5	6
Predicted reliability	0.99	0.94	0.95	0.96	0.97	0.98

Q9) a) Explain the causes of failures of engineering components and systems. **[8]**

b) Write tie sets and cust sets for the system shown in Fig.3. Determine the reliability assuming R = 0.95 as the reliability of each element. **[8]**

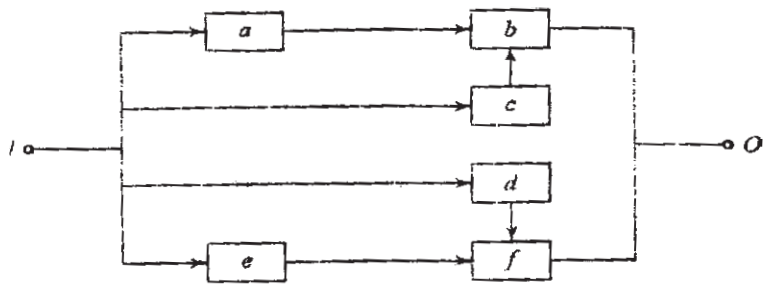

Fig.3

Q10) Write short notes on (any three) : **[18]**

a) Loading Roughness and safety margin.

b) Risk Priority Number.

c) Symbols used in Fault tree construction.

d) Steps in FMECA.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1863

[3765] - 149

M.E. (Electronics Engg.)

COMPILER CONSTRUCTION

(Elective - II) (Computer) (Revised Course)

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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Write LEX specification and necessary code to read a text file and display its contents in upper case. **[12]**

b) Why generally blank spaces are not allowed to form an identifier in a program written in a high level language. **[4]**

Q2) a) Consider the following context free grammar. **[10]**

$S \rightarrow iCtS \mid iCtSeS \mid a$

$C \rightarrow b$

Construct a LL (1) parser for this grammar. Is the Grammar LL (1)?

b) Show the moves of LL (1) parser constructed in Q 2 (a) above while parsing the following string "ibtaeibta" **[6]**

Q3) a) Construct LALR (k) parser table for the grammar in Q2 (a) above. Are there any conflicts in the parser table. **[12]**

b) Why a shift-shift conflict can never occur in a LR parser table? **[4]**

Q4) a) Write syntax directed translation to construct a syntax tree from a given input arithmetic expression. **[12]**

b) Translate the following statement into **[6]**

i) Triple.

ii) Quadruple and

iii) Indirect Triple notations.

d = a + b * - c

SECTION - II

Q5) a) Discuss various forms of Peep-hole optimization. **[8]**

b) Explain the technique of Backpatching. **[10]**

Q6) a) Write a note on "Display" mechanism used by a Pascal compiler to access non local names. **[10]**

b) Compare static, stack and heap methods for storage management. **[6]**

Q7) a) Describe any code generation algorithm. **[10]**

b) Write a note on application of DAG in code generation. **[6]**

Q8) a) What are principle sources of code optimization. **[8]**

b) What is a basic block and a flow graph? Explain with suitable example, the algorithm to identify basic blocks from the intermediate code. **[8]**

Total No. of Questions : 6] [Total No. of Pages : 2

P1864

[3765]-165
M.E. (Electrical) (Power Systems)
POWER SYSTEM PLANNING AND RELIABILITY
(2002 Course)

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 wherever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Explain short term, medium term and long term planning in power system. **[15]**

b) Explain the role of power system engineer in long term planning. **[10]**

Q2) a) Explain load forecasting . Explain its importance. What are the difficulties in load forecasting? **[13]**

b) Explain classification and characteristics of loads. **[12]**

Q3) Write short notes on : **[25]**

a) Generation planning.

b) Energy forecasting.

c) Weather sensitive loads.

SECTION - II

Q4) a) Explain reliability. Describe two state model and prove that MTTF is reciprocal of failure rate. **[12]**

b) Explain distribution system planning. What is the importance of distribution planning in India? **[13]**

P.T.O.

Q5) a) Explain continuous Markov process. Explain frequency and duration approach. **[15]**

b) What is LOLP? How it is used in the power system planning? **[10]**

Q6) Write short notes on : **[25]**

a) Horizon year planning approach.

b) Transmission planning.

c) Recursive techniques.

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Total No. of Questions :6] [Total No. of Pages : 1

P1865

[3765]-168
M.E. (Electrical) (Power System)
HIGH VOLTAGE POWER TRANSMISSION
(503204) (2002 Course)

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 wherever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Discuss with neat sketches the lightning stroke mechanism. **[15]**

b) Explain dynamic voltage rise and operating characteristics of lightning arresters. **[10]**

Q2) a) Discuss generation of overvoltages in EHV systems caused by switching operations. **[15]**

b) Discuss guiding principles of insulation coordination. **[10]**

Q3) Write short notes on :

a) Voltage control using synchronous condensers. **[8]**

b) Shunt and series compensation. **[9]**

c) Static reactive compensation system. **[8]**

SECTION - II

Q4) a) Discuss operation of 3-phase bridge converter with overlap greater than 60 degree. **[12]**

b) Explain with neat sketch the operation of 12 pulse converter. **[13]**

Q5) a) Discuss basic means of control and power reversal in case of HVDC transmission system. **[10]**

b) Explain principle of DC reactors, circuit breakers and overvoltage protection in HVDC transmission system. **[15]**

Q6) Write short notes on :

a) Advantages and problems of ground return in HVDC system. **[8]**

b) Harmonics and their control of HVDC system. **[8]**

c) Reactive power control in HVDC system. **[9]**

# # # #

Total No. of Questions : 6] [Total No. of Pages : 2

P1866

[3765] - 170

M.E. (Electrical) (Power System)

SPECIAL TOPICS IN HIGH VOLTAGE ENGINEERING

(2002 Course) (503210 (a))

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 wherever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Discuss breakdown mechanism in composite insulation system. **[10]**

b) Explain various theories of breakdown for liquid insulation system. **[15]**

Q2) a) Discuss voltage multiplier circuit used for generation of high voltage d.c. **[10]**

b) With reference to electrostatic generator explain : **[15]**

i) Generation of charges.

ii) Transportation of charges.

iii) Collection of charges and.

iv) Generation of high voltages.

Q3) Write short notes on :

a) Marx circuit. **[8]**

b) Effect of inductance on wave shape of lightning impulse voltage. **[8]**

c) Mixed divider. **[9]**

P.T.O.

SECTION - II

Q4) Write short notes on :

a) Fencing, earthing and shielding of high voltage test setup. **[8]**

b) Auxilliary facilities required for high voltage test setup. **[9]**

c) Safety circuits for high voltage labs. **[8]**

Q5) a) Draw a neat schematic diagram of straight detection method and explain principle of operation of partial discharge measurement. **[15]**

b) Explain artificial pollution tests on high voltage insulators. **[10]**

Q6) a) Discuss radio interference and its measurement used in high voltage laboratories. **[15]**

b) Explain capacitance and dielectric loss measurement test setup. **[10]**

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Total No. of Questions :8] **[Total No. of Pages : 3**

P1868

[3765]-190
M.E. (Computer)
ADVANCED DATABASE MANAGEMENT SYSTEMS
(2002 Revised Course) (Theory)

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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) Explain with examples following concepts in the context of databases. **[16]**

a) Foreign keys, primary keys, candidate keys.

b) Object relational mapping.

c) Round robin partitioning of parallel databases.

d) Serialisability.

Q2) Give good example queries for any system of your own choice for the following cases (queries can be in plain English or SQL whichever appropriate). State your assumptions, data assumed clearly. **[16]**

a) A point query and a range query.

b) Any Example : Decision support system query.

c) A SQL query with WHERE clause.

d) Any two table or Multi table query.

Q3) Answer with examples and neat diagrams if relevant. **[16]**

a) What is Multidimensional data and multi dimensional queries.

b) Draw an ER diagram for a hypothetical College Library system.

c) What do you understand by Data dictionary and metadata.

d) What do you understand by database transactactions.

P.T.O.

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

a) Functions, stored procedures, Triggers.

b) Pivoting, dicing, rollup drill down in OLAP.

c) Spatial Geographic Map based databases.

d) Query parallelism (intra, inter, inter operation ....)

e) Commit/Rollback and Two phase commit.

f) Role of Log Writer process, checkpoint process, Lock Manager process.

g) Normalization of databases.

SECTION - II

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

a) SQL and its variants, features.

b) Data mining and applications.

c) Database applications for a Cricket sports website.

d) Search engines, advanced searches, relevance of search results.

e) JDBC or ODBC.

f) Failures, Recovery, Availability of databases.

Q6) Write how databases are useful, important and what kind of data, tables and what kind of queries, what kind of applications will be relevant in following domains. Can you also think of applications in following domain related to maps/geographic data, Website application scenario (ie say what can a hospital achieve by having a website for hospital?..), Data warehousing applications scenarios? **[16]**

a) A Hospital.

b) A College.

Q7) Banks are doing transactions, business, and customer support online. In context of banking and online web based banking in particular, explain with examples the following. **[16]**

a) What kind of data will bank keep, what kind of online transactions/ queries can bank support over the internet?

b) Need for privacy, confidentiality and security of customers, accounts.

c) Performance and response time for transactions.

d) Need for databases, issues and challenges in credit card applications.

Q8) Explain the CONCEPT, its features and give example applications for following with relevant diagrams if required to illustrate the concept/ application. **[16]**

a) Distributed databases.

b) Deadlocks.

c) GUI, front-end for database applications (Hint: like Visual basic forms, HTML forms)

d) Possible Applications of Databases for Governments/citizens (Hint:E-Governance, online tax payment etc).

# # # #

Total No. of Questions : 6] [Total No. of Pages : 1

P1870

[3765]-223
M.E. (Instrumentation)
ADVANCED ELECTRONIC INSTRUMENTATION
(2002 Course) (506103)

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 wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Your answers will be valued as a whole.***
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) Explain principle and working of counter type analog to digital converter (ADC). What are the advantages and limitations of this ADC. **[25]**

Q2) How does a pulse generator helps to detect bandwidth of a cathode ray oscilloscope (CRO)? Explain experimental set-up and procedure. **[25]**

Q3) Write short notes on the following : **[25]**

a) Lux meter.

b) Recorders.

SECTION - II

Q4) How does the detection of crossover frequency helps to minimize +/- 1 count getting error in frequency counter? Support your answer with an example. **[25]**

Q5) What are the different parts of a Data Acquisition System? How does it help to improve performance of a plant? **[25]**

Q6) Write short notes on the following : **[25]**

a) Arbitrary wave form generator.

b) Gauss meter.

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Total No. of Questions :8] **[Total No. of Pages : 2**

P1872

[3765]-440
M.E. (Civil) (Hydraulic Engg.)
DAM ENGINEERING
(Elective - I) (2008 Course)

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 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 pseudostatic and dynamic response approach of earthquake force evaluation in gravity dam. **[8]**

b) Enlist design steps of 2-D method of design of gravity dam. **[8]**

Q2) a) Derive equation of thick cylinder theory of design of an arch dam. **[8]**

b) Explain general concept of trial load theory of design of an arch dam. **[8]**

Q3) a) Explain different measures taken to protect upstream and downstream slopes of an earth dam. **[8]**

b) Enlist the steps to draw a phreatic line in an earth dam. **[8]**

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

a) Stress concentration around openings in gravity dam.

b) Sudden drawdown condition and its significance in an earth dam.

c) Reservoir operation.

d) Foundation treatment in gravity dam.

P.T.O.

SECTION - II

Q5) a) Explain design principles of rockfill dam. **[8]**

b) Differentiate between rockfill dam and earth dam. **[8]**

Q6) a) Explain concept and types of buttress dam. **[8]**

b) Enlist design steps of buttress dam. **[8]**

Q7) a) State classification of spillway and explain design of an ogee spillway. **[8]**

b) With neat sketches, explain any for energy dissipation devices in spillways. **[8]**

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

a) Tainter gate - concept - sketch - merits.

b) Siphon spillway.

c) Characteristics of rockfill materials.

d) Automatic gates.

# # # #

Total No. of Questions :6] **[Total No. of Pages : 2**

P1875

[3765]-455
M.E. (Civil) (Structures)
STRUCTURAL DESIGN OF CONCRETE BRIDGES
(2008 Course)

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) ***Figures to the right indicate full marks.***
4) ***Use of IRC- 5,6,18,27,45,78, & 83 codes, IS 1343, IS 456-2000 is allowed.***
5) ***Mere reproduction of theory from IS or IRC codes as answer will not get full credit.***
6) ***Neat diagrams must be drawn wherever necessary.***
7) ***Assume suitable data, if necessary.***

SECTION - I

Q1) Write detail notes with sketches.

a) Cellular bridge decks. **[8]**

b) Economical span of bridge. **[8]**

c) Explain Guyon – Massonet orthotropic plate theory of analysis of bridge deck. **[9]**

Q2) a) Write short note skew bridges. **[8]**

b) Design box culvert with the data : **[17]**
Clear span of the culvert = 5m.
Clear carriage way width = 7.5m.
Size of kerb= 150mm × 600 mm.
Average thickness of wearing coat 80 mm.
Use material M30, Fe 500.
Loading IRC class A.
Draw the cross section showing details of reinforcement at mid-span and at junction of the slab are kerb.

Q3) Design intermediate post tensioned prestressed concrete Tee Beam Bridge assuming suitable slab depth for the following : **[25]**

Effective span=15m, width of carriageway=7.5m, No. of beams 4, equally spaced along the carriageway width, Spacing of cross girders=3m c/c, width of footpath on either side of carriageway=1.2m loading class=IRC class AA,

P.T.O.

kerb size=200 × 600 mm, concrete grade M45 Design should include detail load, bending moment calculation, check fiber stresses in concrete, Draw sketches showing cable profiles.

SECTION - II

Q4) a) Structural differences between simply supported bridges and om rigid frame bridges. **[9]**

b) Write short note Wing wall. **[8]**

c) Describe different factor affecting the design of rigid frame bridge. **[8]**

Q5) a) Write a short note on roller and rocker bearings. **[5]**

b) Design a reinforced elastomeric bearing at a pinned end of a plate girder of a bridge with following data. **[20]**

Maximum vertical load= 900 kN.
Dynamic vertical load= 90 kN.
Transverse lateral load= 50 kN.
Longitudinal load= 60 kN.
Longitudinal total translation 10 mm.
Rotation at support 0.003°.
Shear modulus of elastomeric bearing= 1.2 N/mm^2.
Allowable comp. stress for concrete= 8 N/mm^2.
Allowable comp. stress for elastomer= 10 N/mm^2.

Q6) a) Design RCC wall type pier for the following : **[20]**

Top width of pier= 1.2m with semicircular ends.
Length of pier= 7.5m excluding the semicircular part.
Height of above footing=9m.
HFL above the top of footing= 7m.
Total DL Reaction= 2400kN.
Total LL Reaction= 1200kN.
Tractive force= 140 kN.
C/C distance of bearing on either side of centre line of pier= 1m.
BM in traffic direction due to unequal DL & LL= 500 kN-m.
Material of pier and footing=M40 & Fe500.
Safe bearing capacity= 240 kN/m^2.
Velocity of water current= 4m/s consider the cross current also design the RCC footing and reinforcement in pier, check the stresses at the bottom of pier.

b) Write short note on Pneumatic caissons. **[5]**

# # # #

Total No. of Questions : 6] [Total No. of Pages : 2

P1876

[3765]-456
M.E. (Civil) (Structures)
DESIGN OF COMPOSITE CONSTRUCTION
(Revised Course 2008) (Elective - I)

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 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 concept of composite structure and state any six benefits of it. **[10]**

b) Explain 'no interation' and 'full interaction' case of elastic behaviour of composite beams by deriving the equations for maximum bending stress and deflection. **[15]**

Q2) a) Explain with sketches : **[8]**

i) Devetail profile.
ii) Chevron indents.
iii) Horizontal indents.
iv) Circular indents.

b) With help of a concept sketch, derive the equation for design resistance to sagging moment for a composite slab. **[17]**

Q3) A composite column of 400 mm × 400 mm × 4000 mm is cast with M 30 concrete grade and ISHB 250 steel section. It consists of four bars of 16 mm diameter of Fe 415. If the design axial load is 2000 kN and design bending moment @ XX and YY axis is 200 kN-m and O kN-m respectively, check adequacy of concrete encased composite section for uniaxial bending. For ISHB 250, $f_y = 250$ N/mm^2 & $E_a = 200$ kN/mm^2 for M30, $E_m = 31220$ N/mm^2.

Take partial safety factors γ_a & $\gamma_s = 1.15$, $\gamma_c = 1.5$ **[25]**

P.T.O.

SECTION - II

Q4) A composite truss has following features. **[25]**

a) Span - 12 m.

b) Truss spacing - 3 m.

c) Slab thickness - 150 mm.

d) Profile depth - 75 mm.

e) Self weight = 3 kN/m^2.

f) Max. laterally unrestrained length in top chord = 1.5 m.

g) Grade of concrete = M20.

– i) Evaluate precomposite stage loading.
– ii) Design the top chord.
– iii) Design the bottom chord for composite stage.
– iv) Determine capacity of composite section in compression.

Q5) Enlist the design steps for a multy storeyed commercial composite building for – **[25]**

a) Composite beam.

b) Compression members.

c) Slab with profile deck.

Q6) Enlist design steps for design of composite construction of bridges for following components -

a) One way deck slab for class AA loading. **[10]**

b) Design of longitudinal girders. **[15]**

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Total No. of Questions : 12] [Total No. of Pages : 3

P1877

[3765]-465
M.E. (Civil) (Structure)
EARTHQUAKE RESISTANT DESIGN OF STRUCTURES
(2008 Course)

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

Instructions to the candidates:

1) *Solve Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6 from Section I and Q.No.7 or Q.No.8, Q.No.9 or Q.No.10, Q.No.11 or Q.No.12 from Section II.*
2) *Use of IS 1893 - 2002 and IS 456 - 2000 is allowed.*
3) *Answers to the two sections should be written in separate books.*
4) *Neat diagrams must be drawn wherever necessary.*
5) *Figures to the right indicate full marks.*
6) *Your answers will be valued as a whole.*
7) *Use of electronic pocket calculator is allowed.*
8) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) What is earthquake? Describe fully the intensity and magnitude of an earthquake? **[6]**

b) Describe measurements of ground motions during an earthquake. **[6]**

c) Write notes on : **[6]**

i) Plate techtonic theory.

ii) Soil structure interaction.

OR

Q2) a) Describe code based methods of seismic design. **[6]**

b) Explain philosophy behind ERD of structures. **[6]**

c) State soil conditions under which liquefaction can occur. What are the measures taken to reduce the possibility of liquefaction? **[6]**

Q3) a) Explain with sketches the vertical and plan irregularities in building. How the building should be planned to have substantial torsional rigidity? **[7]**

b) Write notes on : **[9]**

i) Soft and weak storey in construction.

ii) Simplicity and symmetry of building.

iii) Storey drifts.

P.T.O.

OR

Q4) a) What is 'seismo resistant' building architecture'? Explain major aspects involved in seismo resistant building construction. **[7]**

b) List some of major earthquakes occurred in India. What are the lessons learnt from damages of past earthquakes? **[9]**

Q5) A Three storey OMRF Building has plan dimensions as shown in Fig. 5.1. The storey height is 3 m. The live load is 3.5 kN/m^2 and it is to be constructed in Zone IV. Workout the seismic forces and shear on the structure. The size of columns are 400 mm × 400 mm. The beams are 230 mm × 230 mm and the roof and floor slab is 120 mm thick. The structure is resting on Type III soil and damping ratio 5%. Use Seismic Coefficient method. **[16]**

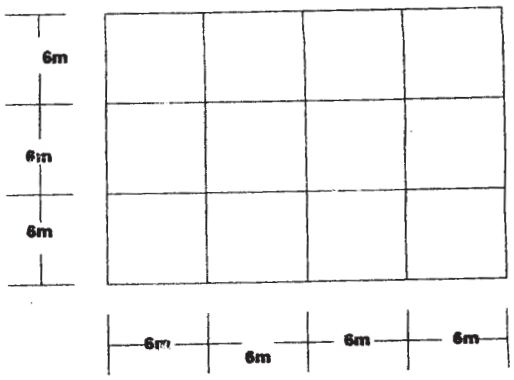

Figure 5.1

OR

Q6) Determine the design eccentricity and torsion moment at each floor in Y-direction for a four storey building subjected to seismic shears at various storey and with plan irregularity as shown in Fig. 5.2. The Total Seismic Weight/floor = 450 kN, Column size = 400 mm × 600 mm. Assume grade of Concrete M 25. **[16]**

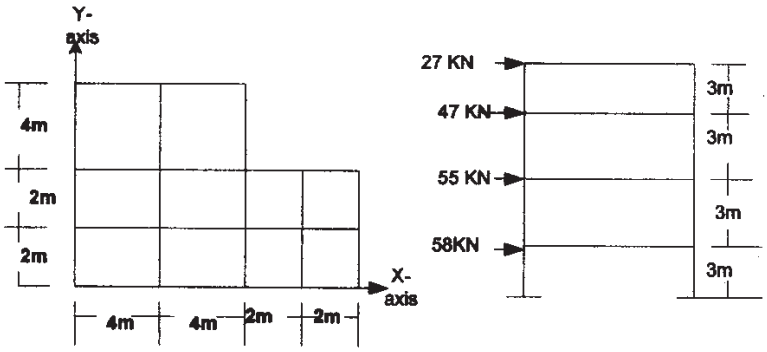

Figure 5.2

SECTION - II

Q7) a) What are different types of steel frames used in buildings in earthquake prone areas? Explain neat sketches and the types and behavior of the braced frames. **[8]**

b) Describe with neat sketches various earthquake protective systems. **[8]**

OR

Q8) a) Give reasons for poor performance of masonry buildings? How to improve seismic behaviour of masonry building. **[8]**

b) Write notes on :- **[8]**

i) Restoration of masonry walls.

ii) Ductility and factors affecting ductility of a structure.

iii) Response spectrum method of dynamic analysis.

Q9) a) Explain in detail the non-conventional techniques for retrofitting for RC building. **[9]**

b) Describe the concept of base isolation. What are the different techniques of base isolation? **[9]**

OR

Q10) Write notes on : **[18]**

a) Bonds in masonry buildings.

b) Infill brick walls and their structural behaviour.

c) Seismic design of RC elevated water tank.

d) Restoration and strengthening of RC structure.

Q11) Design a RC rectangular beam of span 6 m supported on RCC column to carry a point load of 100 kN load in addition to its self weight and a live load of 3 kN/m. The moment due to seismic load is 5.01 kN-m and shear force is 32 kN. Use M20 Grade Concrete and Fe-415. **[16]**

OR

Q12) a) Define shear walls and their classification. Describe the structural behaviour of the long shear wall. **[8]**

b) Discuss the advantages and disadvantages of the different types of the steel frames in building in an earthquake prone area. **[8]**

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Total No. of Questions : 6] [Total No. of Pages : 2

P1878

[3765] - 470

M.E. Civil (Structures)

MECHANICS OF MODERN MATERIALS

(2008 Course)

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 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) Explain Various types of fibers and resins used in FRPC. **[9]**

b) Explain commercial and industrial application of fiber reinforced composites. **[6]**

c) Explain in detail shape memory alloys (SMA) and functionally graded materials.(FGM) **[10]**

Q2) a) Explain in detail processing methods available for FRP composites. **[6]**

b) Write generalized Hook's law for an Isotropic material in 1-2-3 co-ordinate systems also write the compliance and stiffness matrices for plane stress condition in case of Isotropic material. **[16]**

c) What are the assumptions made in analysis of composites. **[3]**

Q3) a) Obtain strain displacement relationship for the laminates. **[8]**

b) Write short note on various failure theories. **[6]**

c) Explain and compare in details Tsai-Hill and Tsai-wu failure criterions.**[11]**

SECTION - II

Q4) a) Explain the laminate configuration for following laminates with neat sketches. **[15]**

i) Symmetric laminates.

ii) Balanced laminates.

iii) Anti-Symmetric laminates.

iv) Anti-Symmetric cross ply laminates.

v) Quasi–Isotropic laminates.

b) Obtain the Naviers solution for rectangular plate of orthotropic laminates with all edges simply supported. **[10]**

Q5) a) Explain the effect of Hygothermal forces on mechanical behaviour of composites. **[10]**

b) Determine the coefficient of thermal expansion αx for a $[\pm 30]s$ laminates with the following properties. **[15]**

$E_1 = 142$ Gpa, $E_2 = 10.3$ Gpa, $E_6 = 7.2$ Gpa, $V_{12} = 0.27$, $V_{21} = 0.2$, $\alpha_1 = -0.9 \times 10\text{-}6/^\circ c$ $\alpha_2 = 27 \times 10\text{-}6$ $/^\circ c$.

Q6) a) Explain in detail Anisotropic strength and failure theories. **[10]**

b) What are the manufacturing defects observed in composites. **[5]**

c) Explain in detail autoclave curing for high performance composite material. **[5]**

d) Write short note on residual stresses in composite laminates. **[5]**

Total No. of Questions : 10] [Total No. of Pages : 3

P1880

[3765]-511
M.E. (Mechanical) (Mechatronics)
DIGITAL SIGNAL PROCESSING
(2008 Course)

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

Instructions to the candidates:

1) ***Answer any three questions from each section.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Consider the analog signal **[8]**

$$x_a(t) = 4\cos 200\pi t.$$

i) Determine the minimum sampling rate required to avoid aliasing.

ii) Suppose that the signal is sampled at the rate F_s = 400Hz. What is the discrete time signal obtained after sampling?

iii) Suppose that the signal is sampled at the rate F_s = 150Hz. What is the discrete time signal obtained after sampling?

b) Prove that the necessary and sufficient condition for an LTI system to be stable is $\sum_{-\infty}^{\infty} |h(n)| < \infty$ **[8]**

Q2) a) Find the convolution of the signals **[8]**

$$x(n) = 1 \quad n = -2, 0, 1$$
$$= 2 \quad n = -1$$
$$= 0 \quad \text{elsewhere}$$
$$h(n) = \delta(n) - \delta(n-1) + \delta(n-2) - \delta(n-3)$$

b) Determine whether each of the following systems defined below is causal, Linear, Dynamic and Time invariant. **[8]**

i) $y(n) = e^{x(n)}$

ii) $y(n) = \sin^2 wn \; x(n)$

P.T.O.

Q3) a) Find the z-transform of the following discrete time signals, and ROC for each. **[10]**

i) $x(n) = \frac{1}{2}\delta(n) + \delta(n-1) - \frac{1}{3}\delta(n-2)$

ii) $x(n) = u(n)$

b) State and prove **[8]**

i) Linearity property of 'z' transform.

ii) Time reversal property of 'z' transform.

Q4) Explain in details the DIF-FFT algorithm using mathematical derivation and butterfly pattern for 8 data point. **[16]**

Q5) Write short notes on (any four) : **[16]**

a) Circular convolution.

b) Relation between FT and ZT.

c) Energy and power signals.

d) DTMF.

e) Barrel Shifter.

SECTION - II

Q6) a) Compute the DFT of the signal $x(n)=\{\underset{\uparrow}{4},3,-1,5\}$ considering N = 4. **[8]**

b) Perform the circular convolution of the following two sequences. **[8]**

$x_1(n)=\{\underset{\uparrow}{1},1,1,1\}$

$x_2(n)=\{\underset{\uparrow}{2},3,4,5\}$

Q7) a) Distinguish between Microprocessor and digital signal processor. **[8]**

b) With a neat block diagram, explain the architectural details of DSP chip. **[10]**

Q8) a) Establish the system transfer function for the system defined by

$$y(n) - \frac{1}{4}y(n-1) = x(n) - \frac{3}{4}x(n-1).$$

Also realise the same using DF - I and DF - II methods. **[10]**

b) Give the equations for and characteristics of the following windows. **[6]**

i) Hanning.

ii) Triangular window.

Q9) a) With the help of frequency response explain HPF and BPF in detail. **[8]**

b) Explain any one application of DSP in Mechatronics in brief. **[8]**

Q10) Write short notes on (any four) : **[16]**

a) Selection criteria for any DSP processor as per application.

b) Power spectral density.

c) Linear filtering based on DFT.

d) Harvard architecture.

e) Filter structures.

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Total No. of Questions :8] [Total No. of Pages : 2

P1885

[3765]-598
M.E. (Electronics) (Digital Systems)
EMBEDDED SYSTEMS
(504201) (2008 Course) (Sem. - 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 answer 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) With the help of suitable examples, explain the following characteristics of an embedded system. **[8]**

i) Reactive and Real time.

ii) Tightly constrained.

b) Architecture of CPLD is less suitable for large and complex design. Explain why? Describe various features of FPGA. **[10]**

Q2) a) With the help of suitable block diagram, describe the architecture of ARM 7 core processor **[10]**

b) What is long multiplication and multiplication with accumulate in ARM processor. Explain with suitable examples. **[6]**

Q3) a) Which are the different interrupts in ARM processors? How they are handled? **[8]**

b) Explain the role of advanced microprocessor bus architecture (AMBA) in ARM processors. Explain the timers in ARM processors. **[8]**

Q4) a) What is IEEE 802.11 protocol? Explain the data transfer using this protocol. **[8]**

b) Draw and explain following fields of standard format of CAN protocol. **[8]**

i) Arbitration.

ii) Control.

iii) Data.

iv) CRC.

P.T.O.

SECTION - II

Q5) a) How does debuggers and emulators help in testing and debugging assembly language program and systems? **[8]**

b) Describe development cycle of Embedded system? Describe different development tools used in Embedded system. **[8]**

Q6) a) Explain Round Robin architecture with interrupt in detail with example. **[8]**

b) Why C & C++ is specially suitable for programming in Embedded systems? **[8]**

Q7) a) Explain the use of semaphore and its related OS functions. **[8]**

b) Explain the memory management functions of RTOS. **[8]**

Q8) a) What are the features of µCOS-II. Explain the following with respect to µCOS-II. **[10]**

i) Porting of µCOS.

ii) Timer related functions.

b) With suitable example explain inter process communication (IPC) using mailbox/queue in RTOS? **[8]**

# # # #

Total No. of Questions :8] [Total No. of Pages : 2

P1886

[3765]-615
M.E. (Production)
SHEET METAL PROCESSING
(Elective - II) (2008 Course)

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

Instructions to the candidates:

1) ***Solve any three questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Figures to the right indicate full marks.***
4) ***Draw neat sketches wherever required.***

SECTION - I

Q1) a) Explain rate sensitivity and its effect on sheet metal product? Give any one test to asses it. **[8]**

b) Explain different defects appearing in sheet metal product. **[8]**

Q2) a) Describe various steps taken from the product design stage to finished product while manufacturing in a large quantity, for petrol tank for bike. **[8]**

b) Explain slip line fields for all possible friction coefficient applicable to compression with width / height = 2:1. **[8]**

Q3) a) Write steps followed in bending process. **[8]**

b) Explain process analysis for deep drawing of axissymetric parts. **[8]**

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

a) Methods of spring back compensation.

b) Fine blanking.

c) Forming limit diagram.

d) Press tools used in sheet metal operation.

P.T.O.

SECTION - II

Q5) a) Explain design consideration in contour roll forming. **[8]**

b) Explain diffusion bonding process and give two examples. **[8]**

Q6) a) Make brief classification of presses. Explain the method of selection of press for a corrugated sheet. **[8]**

b) Identify possible accidental area inn press shop. State necessary safety devices for it. **[8]**

Q7) a) Explain the scope of CAD in sheet metal forming processes. **[8]**

b) Explain CAD/CAM in improving the quality of sheet metal operation. **[8]**

Q8) Write a short notes on any three : **[18]**

a) Press rakes.

b) Tube hydroforming.

c) Deformation in welding contours.

d) Centre of pressure in press operation.

# # # #

Total No. of Questions : 8] [Total No. of Pages : 2

P1887

[3765]-624
M.E. (Production)
SURFACE TREATMENT PROCESSES
(2008 Course) (Elective - III)

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

Instructions to the candidates:

1) ***Solve any three questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Figures to the right indicate full marks.***
4) ***Draw neat sketches wherever required***

SECTION - I

Q1) a) Discuss various surface dependent properties and its importance in assemblies. **[8]**

b) Explain the mechanism of surface degradation and its effect on surface. **[8]**

Q2) a) Explain need for surface cleaning and explain salt bath process in detail with its application. **[8]**

b) Discuss environmental concern of various surface cleaning processes. **[8]**

Q3) a) Make a brief classification of surface modification techniques and explain various methods of improving mechanical properties of metal. **[8]**

b) What meant by electro chemistry? Explain electroless deposition and its scope. **[8]**

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

a) Ultra sonic surface cleaning process.

b) Tailoring of surface of advanced material.

c) Carbon thin film coating.

d) Anodizing.

P.T.O.

SECTION - II

Q5) a) Explain principle of thermal spray coating and give its application and limitation. **[8]**

b) Discuss the influence of manufacturing processes on various surface properties of an engineering components. **[8]**

Q6) a) Explain how is the surface geometry of a coated surface is achieved?**[8]**

b) What are the methods for adhesion measurement of coated surface?**[8]**

Q7) a) Explain characteristics of surface machined at macro, micro, nanolevel. **[8]**

b) Explain evaluation of tribological characteristics of surface in micro scale. **[8]**

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

a) Use of laser in surface engineering.

b) CVD.

c) Plasma coating.

d) Ion Implantation.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1888

[3765] - 637

M.E. (Computer)

ADVANCED COMPILERS

(2008 Course)

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

Instructions to the candidates:

1) ***Answer any three questions from Section - I and three questions from Section - II.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain in detail various issues in designing a compiler. **[8]**

b) What are features of YACC tool? Give YACC specification for parsing of arithmetic expressions. **[8]**

Q2) a) Discuss various issues involved in efficient code generation. **[8]**

b) Explain : Code generator. **[8]**

Q3) a) Explain in detail the unified algorithm for data flow analysis. **[8]**

b) Which are different techniques for code optimization? Support your answer with proper examples. **[8]**

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

a) LEX.

b) Code generation for pipelined machines.

c) Data flow analysis.

d) SSA form.

P.T.O.

SECTION - II

Q5) a) Explain in detail the need for parallel compilers. Which are design parameters for parallel compilers. **[8]**

b) Explain parallelism detection with respect to parallel compilers. **[8]**

Q6) a) What is dynamic compilation? **[6]**

b) Explain : Compilation for distributed machines. **[10]**

Q7) a) Explain register allocation for distributed machines. **[6]**

b) Explain in detail the need, advantages and disadvantages of JIT compilers. **[10]**

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

a) Symbol table.

b) Auto scheduling compilers.

c) Tools for compilers.

d) Machine optimization for distributed machines.

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Total No. of Questions : 8] [Total No. of Pages : 3

P1889

[3765] - 638
M.E. (Computer)
WEB SERVICES AND SOA
(2008 Course) (Theory)

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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) Discuss following statements with examples in context of contemporary SOA : **[16]**

a) SOA is a service oriented computing paradigm.

b) Contemporary SOA increases quality of service like transactional capabilities.

c) Contemporary SOA supports, fosters, promotes : vendor diversity.

d) Contemporary SOA supports, fosters, promotes : business modeling.

Q2) a) What is XML, explain how XML is suitable for SOA. **[6]**

b) What are objectives of service oriented analysis. **[4]**

c) What do you understand by tools for SOA. **[6]**

Q3) Explain concepts and if relevant illustrate with diagrams/examples : **[16]**

a) WSDL.

b) Scripting languages.

c) XSD.

d) Two values for SOAP STYLE attribute (document, rpc).

P.T.O.

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

a) Service administration and governance.

b) Meeting customer functional/nonfunctional requirements with SOA.

c) Messaging with SOAP.

d) Need for Enterprise service Bus.

SECTION - II

Q5) a) Write what you understand by Usability/User friendliness in a website. What are the typical usability features that one sees in well designed websites (Hint sitemap, GUI controls like lists, navigability like back button.) How does one make such sites interactive using HTML, CSS, DHTML, plug-In, Applets, Active X controls. **[8]**

b) What is AJAX, what are the advantages, describe some effects as seen by endusers of a website with an example Homepage of say a hypothetical cricket website, asynchronous communications involved and XmlHttp request involved in communications and responses. **[8]**

Q6) In brief explain : **[16]**

a) RSS feeds, ATOM, automatic updation with feeds, advantages of feeds.

b) Terms : Sockets, RPC.

c) Service level agreements (say for performance).

d) Digital signature.

Q7) Give your own examples for following and explain : **[16]**

a) Two tier architecture with a diagram.

b) XML data and schemas for "patient history" in a hypothetical hospital system.

c) Different Security threats in a web application.

d) Webservices.

Q8) Write short notes any three : **[18]**

a) Advantages of Service Oriented Architecture over middleware like CORBA/.NET/COM.

b) Object oriented principals and their advantages.

c) Java and J2EE.

d) Software design and architecture.

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Total No. of Questions :8] [Total No. of Pages : 2

P1890

[3765]-649
M.E. (Computer Engg.)
DATA WAREHOUSING & DATA MINING
(2008 Course)

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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) With a suitable example, explain the star, Snowflex and fact constellation schemas used for implementing a data warehouse. Discuss their relative merits and demerits. **[18]**

Q2) Draw a neat diagram showing various stages that are used to carry out data mining. Explain each stage in details. **[16]**

Q3) a) With suitable examples, explain the following data mining tasks. **[8]**

i) Prediction.

ii) Association.

iii) Clustering.

iv) Characterization.

b) Compare : **[8]**

i) DBMS and Decision support systems.

ii) SQL Queries and Data Mining queries.

Q4) a) Explain the working of Lazy Classifiers and compare it with decision tree and neural network classifiers. **[8]**

b) What do you mean by incremental and decremental instance selection? Explain briefly any one algorithm you know. **[8]**

P.T.O.

SECTION - II

Q5) a) What is cross validation? What is significance of validation set? **[6]**

b) With a suitable example, explain any decision tree algorithm you know. **[10]**

Q6) a) Describe the taxonomy of clustering techniques and briefly comment. **[6]**

b) Explain K-means clustering algorithm. **[10]**

Q7) Discuss in details : **[18]**

a) Web mining.

b) Text Mining.

Q8) a) With a suitable example, explain Apriori algorithm. **[10]**

b) Write a short note on Spatial Data Mining. **[6]**

# # # #

Total No. of Questions : 8] [Total No. of Pages : 4

P1892

[3765]-687
M.E. (Petroleum)
WELL CONTROL
(2008 New Course) (512105) (Elective - II (d))

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

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate books.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Q. 1 and Q. 5 are compulsory. Out of the remaining attempt two questions from section-I and two questions from section-II.***
4) ***Use of cm scale graph paper is allowed.***
5) ***Figures to the right indicate full marks.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Discuss in brief different causes and symptoms of a kick. **[4]**

b) A 6,000 ft T.V.D well observed a kick after closing the surface BOP. Well data available in, **[10]**

API field unit is as follows.

Current drilling mud = 11.4 ppg

Casing shoe data : size = 13.3/8", TVD 4800ft, Hole data : size 12-1/4". TVD 6400ft.

Drill pipe 5", Capacity, 0.0176 bbls/ft. Drill collar 8" × 3", 530ft long capacity, 0.0087 bbls/ft.

Drill collars open hole 0.0836 bbls/ft. Drill pipe in open hole 0.1215 bbls/ft.

Drill pipe in casing 0.1353 bbls/ft.

Mud pump output 0.119 bbls/stroke.

Slow circulation rate 440 psi at 30 spm.

SIDP pressure = 340 psi, SICP = 410 psi, pit gain = 12 bbls.

Calculate :

i) Initial circulating pressure.
ii) Kill mud weight.
iii) Final circulating pressure.
iv) Prepare step down plan on graph paper for driller's method.

c) Explain in brie, 'slow circulation pressure' (SCP). **[4]**

P.T.O.

Q2) a) You have two flanges - APl 6bx and 6B, indicate the type of gasket that matches the flanges

i) Type R octagonal.
ii) Type R oval.
iii) Type RX.
iv) Type BX. **[4]**

b) Explain pressure testing of blind/shear ram with neat sketch. **[8]**

c) Using the given information, anwer the following : **[4]**

Accumulator bottle capacity = 10 Gallons.
No. of bottles = 15.
Max operating pressure = 3000 psi, minimum operating pressure = 1200 psi.
Precharge pressure = 1000 psi, Electric pump discharge volumetric rate = 5 gpm.

i) During BOP function test, the pressure on the accumulator on the bottle bank drops from 3000 psi to 1800 psi. How many gallons of fluid did that function use?
ii) If electric pump was switched off during above operation, how long would it take to recharge the bottle bank switch on?

Q3) a) Show and explain, 3D insitu stress tensor. Write the procedure to find the values of 3D stresses. **[8]**

b) Find normal stress and shear stress on a fracture plane making an angle 30°, if two principle stresses are, 20 psi and 10 psi. Use Mohr's circle and equations. **[8]**

Q4) a) A well is closed in on a 30 bbl gas kick, while drilling 8.5" at 11000 ft (TVD) with 5" drill pipe and 750 ft of 6.5" drill collars. **[3]**

Annular capacities :

5" drill pipe in 8.5" hole = 0.0495 bbl/ft, 6.5" drill collar in 8.5" hole = 0.0292 bbl/ft.

Mud weight = 12.3 ppg, SIDPP = 350 psi, Gas gradient = 0.115 psi/ft. What will be sicp?

b) While pulling out driller forgot to fill the hole and 40 stands of drill pipes were pulled out dry. What will be the reduction in bottom hole pressure? Calculate with the following data. well depth = 9200 ft (TVD), casing shoe depth = 5240 ft (TVD), mud weight = 13.8 ppg, open hole capacity = 0.1482 bbl/ft, casing capacity = 0.1611 bbl/ft, drill pipe metal displacement = 0.0076 bbl/ft, length of one stand = 93 ft. **[3]**

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

i) Leak off test.

ii) Wait and weight method.

SECTION - II

Q5) Using driller's method calculate : **[18]**

a) Pressure at 2000 ft.

b) Pressure at casing seat when the top of the gas bubble reach at that point.

c) Annulus pressure when gas bubble reaches the surface.

d) Height of gas bubble at surface.

e) Pressure at the casing seat when gas bubble reaches the surface.

f) Total pit volume increase with the influx at the surface.

Given data :

Well depth = 10000 ft, hole size = 7-7/8", drill pipe size = 4.5", 8-5/8" surface casing = 2000 ft.

Casing ID = 8.017", fracture gradient = 0.76 psi/ft, fracture pressure = 1520 psi.

Mud weight = 9.6 ppg, mud gradient = 0.50 psi/ft.

A kick is taken with the drill string on bottom.

SIDPP = 200 psi, SICP = 300 psi, pit level increase = 10 bbls, kill mud weight = 10 ppg.

Normal circulation 6 bpm at 30 spm, kill rate = 3 bpm at 30 spm.

Circulating pressure at kill rate = 510 psi.

Pump capacity = 0.1 bbl/stks, capacity of drill pipe (inside) = 0.0142 bbl/ft.

Capacity of drill pipe casing annulus = 0.0428 bbl/ft, drill pipe hole annulus = 0.0406 bbl/ft.

Initial displacement pressure = 700 psi at 30 spm, shut in bottom hole pressure = 5200 psi.

Bottom temp. = 620° R, Z_b = 1.007, MASP = 520 psi, Temp., at 2000 ft = 540° R, Z_{2000} = 0.811.

Surface temp. = 520° R, Z_s = 0.875, P_F = 24 psi, h_b = 246 ft, annular area = 32.80 $inch^2$.

$$P \times \frac{B}{2} + (B^2/2 + P_b\, e_m\, Z_x\, T_x\, h_b\, A_b/Z_b\, T_b\, A_x)^{1/2}$$

$$B = P_b - e_m\,(D - X) - P_f\; A_b/A_x$$

Q6) a) Describe well control problems in oil base mud along with hydrocarbon phase diagram. **[8]**

b) Write short note on : **[8]**

i) Relief well.

ii) Underground blow out.

Q7) a) Discuss advantages and disadvantages of 'concurrent method of well control'. **[8]**

b) What is snubbing? Describe with suitable diagram, snubbing stack and snubbing operation. **[8]**

Q8) a) Discuss well completion operation of abnormal pressure zones. **[8]**

b) What is momentum kill? Show that : **[8]**

Momentum. $M = (e.\ q)^2\ Z_1\ T_1\ R/s.g\ Ma\ P_1\ gc\ A$.

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Total No. of Questions : 8] [Total No. of Pages : 3

P1893

[3765]-700
M.E. (Computer Science & Engineering) (IT)
SOFTWARE ARCHITECTURE
(Revised Course 2008) (Elective - I) (514404) (Theory)

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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) Write in brief on ALL of following : **[18]**

a) Software development life cycle and place for Software architecture in it.

b) Interfaces and Documenting software interfaces.

c) Application interface level EAI.

d) Components and connectors.

e) Archetype pattern: CRM.

f) Reusability.

Q2) a) Explain the following concepts with examples related to enterprise architecture patterns : client session state, foreign key mapping, remote façade, single table inheritance. **[10]**

b) Write short notes on Software Architecture. **[6]**

Q3) a) Write short notes on software components. **[6]**

b) In context of networked and concurrent objects what do you understand by following concepts: event handling, threads and synchronization. **[6]**

c) What is Global analysis. **[4]**

P.T.O.

Q4) Answer all questions in context of design and architecture patterns. **[16]**

a) How design patterns capture design experience, solve recurring problem and lead to better design, explain with example of ITERATOR pattern.

b) What is an MVC pattern and how does it help modifiability/changes to program.

c) What is Wrapper pattern.

d) Good examples of Applications of proxy pattern.

SECTION - II

Q5) In brief state the concept/term; illustrate with good examples for the following concepts. **[16]**

a) Publish subscribe.

b) Web technologies (HTML, Plug-in, CSS, AJAX etc) and usability.

c) Legacy applications.

d) XML applications, advantages.

Q6) Write short notes on ANY THREE : **[18]**

a) Web services and protocols http, SOAP, WSDL.

b) Java, Java technologies, Java middleware, JDBC.

c) RPC.

d) Distributed systems and CORBA.

e) Advantages of architecture (civil) in building houses and role of an Architect in civil engineering.

Q7) Write in brief on following : **[16]**

a) Resource caching, resource pooling.

b) Web services versus SOA.

c) Distributed systems advantages in terms of fault tolerance, availability.

d) Classes versus components.

Q8) State what you understand by following approaches for architecting software systems and what are the advantages of the approach. Give example applications of your own to illustrate following : **[16]**

a) Multi tier (3 ..)approach for web based applications.

b) Modules and subsystems approach and Package diagram to architect systems.

c) Object oriented approach (classes) for a college library system.

d) Distributed application approach with multiple servers for handling very large number of clients.

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Total No. of Questions : 8] [Total No. of Pages : 3

P1895

[3765] - 708

M.E. (IT)

MANAGEMENT TRENDS IN INFORMATION TECHNOLOGY

(2008 Course) (Sem. - II)

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

Instructions to the candidates:

1) ***Question Nos. 4 and 8 are compulsory. Out of the remaining attempt 2 questions from Section - I and 2 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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Consider the setting up of the infrastructure for conduction of an on-line examination. List down the work break down structures for the system. Draw the project network diagram for the same using different techniques of precedence diagramming method. Find the critical path for the said system from the PND. **[12]**

b) Elaborate on the various constraints the team has to deal with in building the project plan. **[4]**

Q2) a) Define traditional conflict and modern conflict and compare the two. Explain in detail the reasons that cause workplace conflicts and different ways to deal with conflict. **[8]**

b) Write a note on IT/IS audits. **[8]**

P.T.O.

Q3) a) Consider a social service organisation which is working towards making India polio-free by 2015. Perform system analysis of the existing system and customize the general model of management information system (MIS) to suit the above mentioned social service organisation. **[8]**

b) Define the following with eg. :

Copyrights, patents, tradesecrets and trademarks.

Write a note on copyrights in general and copy rights in India. **[8]**

Q4) a) Compare and contrast various project quality standards. **[6]**

b) What is corporate social responsibility? Explain its impact on society. **[6]**

c) Consider the development of an online shopping portal. Explain the different ways of estimating the budget for the system. Prepare an excel sheet of the project budget. Explain the various techniques of keeping track of budgetary expenses. **[6]**

SECTION - II

Q5) a) You are required to decide upon the setting up of a network for distance learning. Create and elaborate on the following parameters w.r.t. to the system and explain their significance : **[12]**

i) Project charter.

ii) Stakeholders.

iii) Feasibility plan.

b) Explain the process of change management in a system of your choice. **[4]**

Q6) a) In detail explain the four forces that shape ethical conduct. **[8]**

b) With the model explain various stages of formal group development. Also explain various criteria for informal group formation. **[8]**

Q7) a) "The concept of Datawarehouses (DW) emerges from several sets of information which users need". Justify the statement by projecting the DW as an effective management information system. **[8]**

b) Write notes on Intellectual property Rights (IPR) and IPR in India. **[8]**

Q8) a) Consider the crashing of a hugely popular social networking site on the internet due to the absence of an effective disaster recovery strategy. Design a disaster management plan (DMP) by listing down the threats & the corresponding counter measures to those threats. **[6]**

b) Explain E-commerce as a MIS. Illustrate with example. **[6]**

c) Write notes on energy audit/energy management. **[6]**

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Total No. of Questions : 6] [Total No. of Pages : 3

P1896

[3765]-745
M.E. (Instrumentation)
CONTROL SYSTEM DESIGN
(2008 Course)

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

Instructions to the candidates:

1) *Answer any two questions from each section.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*

SECTION - I

Q1) a) The forward path transfer function of a unity feedback control system is given below :

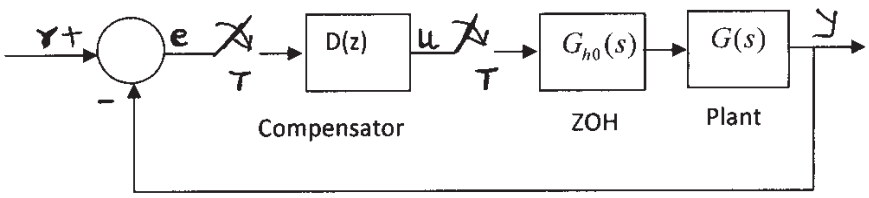
$$G(s) = \frac{100}{s(s+9)}$$

It is desired to have a peak overshoot as 9.4% and natural frequency of oscillation 12 rad/sec. Design a suitable phase lead compensation network. **[16]**

b) Design a controller for the system with transfer function given below :

$G(s) = \dfrac{1}{(1+4s)(1+5s)}$, to get the closed loop response denoted by, $Q(s) = \dfrac{1}{(1+2s)(1+3s)}$ by direct controller synthesis. **[9]**

Q2) Consider the digital control system as shown below :

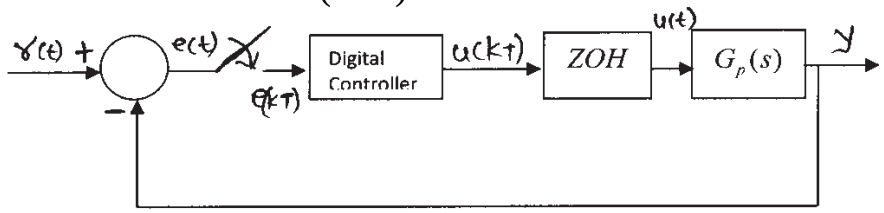


P.T.O.

The transfer function of the plant is $G(s) = 1/[s(s+1)]$. Design a lead compensator D(z) in the *w*-plane such that the phase margin is 50°, the gain margin is at least 10dB, and velocity error constant K_v is 2. Assume that the sampling period is 0.2 sec. **[25]**

Q3) a) Consider the digital control system as shown below, where the plant transfer function

$G_P(s)$ is given by $G_P(s) = \dfrac{1}{s(s+1)}$



Design a digital controller $G_D(z)$ such that the closed-loop system will exhibit a Deadbeat response to unit step input. The sampling period is assumed to be 1 sec. **[16]**

b) Explain the structure and design method of IMC. **[9]**

SECTION - II

Q4) Consider the system defined by **[25]**

$$\dot{X} = Ax + Bu$$

Where, $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$ By using the state-feedback control $u = -Kx$, it is desired to have the closed-loop poles at $s = -2 \pm j4$, $s = -10$. Determine the state-feedback gain matrix K using following methods.

a) Using transformation matrix.

b) Using Direct substitution method.

c) Using Ackermann's formula.

Q5) Derive an expression for Model Predictive Controller with step response model. Design MPC for a system with open loop transfer function $G(s) = \dfrac{1}{(1+5s)}$. Assume P = 5, N = 10, M = 1. **[25]**

Q6) a) Derive Ackermann's formula for pole placement of a discrete time control system and use it to find K for the following system. Desired closed-loop pole location at $z = 0.5 \pm j0.5$

$$x(k+1) = Gx(k) + Hu(k), \text{ where } G = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix}, H = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$ **[16]**

b) What is state observer? Explain its necessity. State and define its types. **[9]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1897

[3765]-753

M.E. (Instrumentation & Control) (Process and Biomedical)
ADVANCED PROCESS INSTRUMENTATION
(2008 Course)

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) Design Neural Network based identification & control strategy for temperature control of a water bath. Assume suitable data if necessary. **[16]**

Q2) Describe with suitable application Cascade Control. Also discuss design criteria & tuning of Cascade Control. **[16]**

Q3) Explain in brief internal Model Control (IMC). Design IMC controller for the process with the open loop transfer function.

$$G_m = \frac{K_m e^{-\theta_m s}}{T_m s + 1}$$

Comment on the result. **[16]**

Q4) a) Explain with suitable example interaction & Decoupling of process variables.

b) Explain with suitable application how an Override Control scheme is implemented to protect the equipment.

[18]

SECTION - II

Q5) What is the significance of SPC in Process Plants? Elaborate with the different type of charts used. **[16]**

P.T.O.

Q6) a) Two liquid ingredients A & B are to be blended in the proportion of 1 : 2. Draw control Loop schematics to indicate the two ways in which this task can be achieved. Explain operation of each of them. **[10]**

b) Explain in brief Time Delay Compensation. **[6]**

Q7) Describe with suitable application Feedforward controller. Design Feedforward controller for the process and the disturbance transfer functions as given below : **[16]**

$$Gp(s) = \frac{0.4e^{-1.8s}}{3.5s+1}$$

$$Gd(s) = \frac{0.1e^{-1.1s}}{4.2s+1}$$

Q8) Describe the process reaction curve method for identifying dynamic models. Develop Fundamental model for continuously stirred tank reactor. Assume suitable data. **[18]**

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Total No. of Questions : 12] [Total No. of Pages : 4

P1898

[3765]-771
M.E. (Polymer)
SPECIALITY POLYMERS
(2008 Course) (509111) (Elective - III)

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

Instructions to the candidates:

1) ***Answer 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 logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What structural features are needed in a polymer for it to exhibit liquid crystalline state? Explain with suitable examples. **[6]**

b) How liquid crystalline polymers are synthesized? Give synthesis of at least one commercially important LCP. **[6]**

c) What are molecular composites? How they can be prepared using LCPs? **[4]**

OR

Q2) a) Enlist the unique properties of LCPs. Further explain how these properties lead to specialized applications. **[6]**

b) What do you understand by the term liquid crystalline state? Explain the structural theory behind the formation of liquid crystals and liquid crystalline polymers. **[6]**

c) Explain the terms : **[4]**

i) Nematic.
ii) Cholesteric.
iii) Smectic.
iv) Mesogen.

P.T.O.

Q3) a) Draw structures of polyaniline, polypyrrole, polythiophene and polyacetylene. **[4]**

b) Explain the mechanism of conduction in intrinsically conducting polymers. **[6]**

c) Compare Chemical and Electrochemical synthesis of conducting polymers. **[6]**

OR

Q4) a) Define the following terms in context of CPs : Doping, Doping level, n-and p-doping, Pristine. List common cationic and anionic dopants.**[6]**

b) How conducting polymers are synthesized? Give synthesis of any one of them. **[6]**

c) Discuss the applications of conducting polymers for sensors. **[4]**

Q5) a) Enumerate and explain various structural features responsible for heat resistance in polymers. **[7]**

b) Give different methods for manufacturing membranes. **[7]**

c) Discuss various mechanisms by which selectivity is introduced in polymeric membranes. **[4]**

OR

Q6) a) Give preparation, properties and applications of any two of the following polymers : **[8]**

i) PPO.
ii) PEEK.
iii) Polysulphone.
iv) PPS.

b) What are basic requirements for a polymeric film to serve as a permselective membrane? **[4]**

c) Describe how following separations can be effected by using polymer membranes : **[6]**

i) Desalination of water.
ii) Separation of hydrogen from nitrogen in the tail gas from Haber process.
iii) Production of caustic soda and chlorine from purified brine solution.

SECTION - II

Q7) a) Enumerate various polymers used in controlled drug delivery. Explain the mechanism of controlled drug release with reference to polymers. **[7]**

b) Explain the role of polymers used as : **[9]**

i) Rehabilitation aids.
ii) Surgical implants.
iii) Blood substitutes.

OR

Q8) a) Write a note on applications of controlled drug release in gastrointestinal tract, nose, eyes and mouth. **[8]**

b) State various Polymers used as, **[8]**

i) Medical textiles in surgical operations, along with their knot strength.
ii) Bone implants.

Which properties of above polymers are relevant in each application?

Q9) a) What are the polymers used in telecommunication? Which properties of the polymers are critical in such applications? **[8]**

b) What is non linear optics? Explain the importance of polymeric materials in nonlinear optical communications. **[8]**

OR

Q10) a) Write the importance of polymers in any two of the following agricultural applications. **[8]**

i) Poly-houses.
ii) Drip irrigation.
iii) Rainwater harvesting.
iv) Release of agrochemicals.
v) Mulching.

b) Enlist and explain the factors governing the extent of swelling of water absorbing polymers? Give the applications of hydrogels. **[8]**

Q11) a) Starting with Flory-Huggins theory show that polymers with similar molar masses will be compatible with each other if their molecular mass will be less than the critical molar mass $\underline{M_{cr}}$ given by the expression : $M_{cr} = [(2\ \rho\ RT) / (\Delta A - \Delta B)^2]$. What are limitations of this approach? **[9]**

b) What do understand by the term compatibilization? Explain in brief different methods for compatibilization of polyblends. **[9]**

OR

Q12) a) Discuss the role of thermodynamics in compatibilization of a polyblend. **[5]**

b) Discuss any two commercial polymer blends. **[5]**

c) Explain the different guiding principles used in designing a polymer blend with specified end properties, illustrate with suitable examples. **[8]**

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Total No. of Questions :6] [Total No. of Pages : 1

P1900

[3765]-778

M.E. (Printing Engineering & Graphic Communication)

PRINTING & PACKAGING MATERIALS

(508104(b)) (2008 New Course)

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 wherever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Describe the materials used for pre-press operation. **[10]**

b) Discuss various types of light sources. **[8]**

c) Explain various types of chemicals used for Gravure cylinder. **[7]**

Q2) a) With reference to papers used for printing and packaging discuss : **[15]**

i) Various types.
ii) Properties of papers and
iii) Interaction with other materials.

b) Explain the manufacturing process of metalized polyster film. **[10]**

Q3) a) Explain various methods used for identifying the printing materials. **[15]**

b) Explain burning tests for Pet, BOPP, P.A. and P.E. **[10]**

SECTION - II

Q4) a) Describe various tests carried out on packaging materials. **[15]**

b) Write short note on Rub Resistance. **[10]**

Q5) a) Describe various inks used for printing applications. **[10]**

b) Explain the manufacturing process of solvent base inks. **[10]**

c) Discuss chemical structure of inks. **[5]**

Q6) a) Explain colour comparison by draw down and printing. **[8]**

b) Explain tack measurement of ink. **[8]**

c) Discuss troubleshooting methods used for inks. **[9]**

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Total No. of Questions :6] [Total No. of Pages : 2

P1901

[3765]-784
M.E. (Printing Engg & Graphic communication)
WEB HANDLING ON PRESS
(508109) (2008 Course)

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 answer books.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*

SECTION - I

Q1) a) What are the various requirements of web in laser show? **[10]**

b) Draw a neat sketch and explain basic principle of operation of stroboscope. How it is used in web setting? **[15]**

Q2) a) Explain the principle of operation of corona treatment. **[15]**

b) Discuss basic principle of flame treatment required in some applications of printing. **[5]**

c) Explain the purpose of antistatic eliminator. **[5]**

Q3) a) Write a note on - Three zonal tension control of web handling. **[15]**

b) Explain various types of tension controller used in printing machines. **[10]**

SECTION - II

Q4) a) Discuss the method adopted for direction registration control in press. **[8]**

b) Explain various methods used to control machine direction registration control. **[10]**

c) Why automatic registration controller is not advisible for small quantity production used? **[7]**

P.T.O.

Q5) a) Explain web guiding system. **[8]**

b) How imbalance of roller affects the quality of printing? **[8]**

c) Explain static and dynamic balancing of rollers. **[9]**

Q6) a) Draw a neat sketch of wrap angle and explain its operation. **[8]**

b) Explain procedure followed for deciding diameter of transport roller. **[8]**

c) Explain mathematical method used for calculation of deflection of web guide rollers. **[9]**

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Total No. of Questions : 6] [Total No. of Pages : 2

P1902

[3765] - 789

M.E. (Printing Engineering and Graphic Communication)

ADVANCES IN CONVERTING AND PACKAGING

(2008 Course) (Elective - IV) (508112(b)) (Sem. - II)

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 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 the principle of operation of online Integrated Machines using CIP - 3 and CIP - 4. **[15]**

b) Discuss basic principle and applications of die cutting. **[10]**

Q2) a) Explain the concept of embossing. **[10]**

b) Discuss various procedures followed for coating and varnishing. **[8]**

c) Write a brief note on : **[7]**

Loose Leaf Adhesive Binding.

Q3) a) Discuss various types of lamination techniques and also explain adhesives used for lamination. **[15]**

b) What is extrusion lamination? Explain advantages of extrusion lamination over adhesive lamination. **[10]**

P.T.O.

SECTION - II

Q4) a) Explain plastic extrusion process. **[15]**

b) Write short notes on : **[10]**

i) Shrink wrap.

ii) Stretch wrap.

Q5) a) Calculate the cost of pouch of size 150mm × 250mm made from 3kyer laminate used for 250gm of food products. **[9]**

b) Enlist various requirements of packaging material used for microwave packaging. **[8]**

c) Draw a neat layout of stand up pouch used for printing. **[8]**

Q6) a) Explain various types of barrier properties required for packaging material. **[10]**

b) Write short notes on :

i) Aseptic packaging. **[8]**

ii) Automatic pouching machine. **[7]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1904

[3765] - 807

M.E. (E & TC) (Signal Processing)

COMPUTER VISION

(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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain working of CCD camera sensor. Explain the effect of sensor size on image quality. **[8]**

b) What is Bayer filter array? How it is used to capture color information. **[8]**

Q2) a) What is perspective projection? Give properties of perspective projection. **[8]**

b) Explain orthographic and weak perspective projection. **[8]**

Q3) a) What is affine transform? Find rotation matrix for an object rotation of 30 degrees around the Z axis, followed by 60 degrees around the X axis. All rotations are counter clock wise. **[8]**

b) Explain camera parameters & camera matrix. **[10]**

P.T.O.

Q4) a) Explain the terms world coordinates, camera coordinates and image coordinates. Explain use of perspective transform in imaging geometry. **[8]**

b) Assume that first the camera center is at the origin of the world coordinates. Next the camera is translated by (0, 2, 2) units in x, y & z direction respectively and then rotated by 90 degrees around z axis in the clockwise directions. Image is formed by perspective projection. Assume that focal length of the camera is 0.030 Find the image coordinates of the point which has world coordinates (1,1, 0.2). **[8]**

SECTION - II

Q5) a) What is stereo imaging? Explain need and applications of stereo imaging. **[8]**

b) Explain epipolar geometry, epipolar line and epipoles. Explain the term disparity. **[8]**

Q6) a) Give constraints and assumptions while establishing correspondence between stereo images. **[8]**

b) Explain correlation based correspondence search in stereo images. **[8]**

Q7) a) Define optical flow in images. What is brightness consistency assumption in optical flow estimation? **[8]**

b) Explain optical flow iterative estimation technique. **[8]**

Q8) a) With the help of block diagram, explain principal of Tomography. **[9]**

b) Explain Fourier slice theorem for image reconstruction. **[9]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1905

[3765]-11
M.E. (Civil) (Construction Management)
ADVANCED CONSTRUCTION ENGG.
(Revised 2002 Course)

Time : 4 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 metro railway is proposed to be constructed along Karve Road from Garware college to Karve statue at Kothrad in Pune. Underground construction is proposed for the entire length. **[18]**

a) List out precautions you will take to safeguard exusting petrol pumps, road crossings and structures with open foundations - which are close to the alignment of the route.

b) Method of construction you will adopt.

c) List out major items forming "Bill of Quantities" to be attached with the tender document.

Q2) a) List out the major items of work involved in deciding "Bridge Management System". Explain any one of them in detail.

b) Explain how Bridge Inspection and documentation helps in Bridge Maintainance work.

[16]

Q3) a) List out and explain various factors which control the "Performance of the Earth Dams".

b) Explain with sketches when "instability of slopes" occurs on down stream and upstream side slopes in an earth dam.

[16]

P.T.O.

Q4) Write short notes on any three of the following : **[16]**

a) Slipform method of concreting in multi-flue chimney.

b) Braced frames in earthquake resistant structures.

c) Safety measures in underground Metro Railway.

d) Defects in construction of RCC diaphragm walls.

e) 'Non destructive Tests' in Bridges.

SECTION - II

Q5) a) List out and explain measures adopted in ensuring "Full leak tightness" in Nuclear containment structures.

b) Prepare "Method Statement" with sequence of construction in "Natural Draught Cooling Towers"

[16]

Q6) a) Explain in details, what is "MCA" in Nuclear containment structures.

b) Explain advantages of "climbing shutters" in construction of chimneys.

[16]

Q7) a) Explain different construction methods adopted in carrying out "River Training Works".

b) Prepare a checklist and proforma for inspection of superstructure of prestressed concrete girder bridge.

[16]

Q8) Write short notes on any three of the following : **[18]**

a) Use of fire-bricks in multi-fire chimney.

b) Vibration study in Machine Foundations.

c) Bridge Maintainance Policy.

d) Geosynthetics use in river training works.

e) Advantages of WRG over normal reinforcements in earthquake resistant structures.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1908

[3765]-263
M.E. (Chemical)
ADVANCED THERMODYNAMICS
(2002 Course)

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) Explain the effect of centrifugal field. What are the two approaches when centrifugal field is considered? **[10]**

b) What is surface internal energy? Derive an equation for it. **[8]**

Q2) a) What are I & II order transitions? Explain with example. **[8]**

b) What are the five types of fluid-fluid phase diagrams in type I systems? **[8]**

Q3) a) Explain equilibrium in liquid-liquid systems. **[8]**

b) What is superconductivity? **[8]**

Q4) a) What is phosphorylation of glucose & hydrolysis of ATP? Explain. **[8]**

b) Explain order-disorder transitions involving position, orientation & magnetic disorder. **[8]**

SECTION - II

Q5) a) What is the statistical analogue of Entropy? Derive relevant equations. **[10]**

b) What is retrograde condensation. **[8]**

Q6) a) Briefly explain the difference between statistical & classical Thermodynamics. **[6]**

b) Derive the Debey-Huckle theory equation. **[10]**

P.T.O.

Q7) a) What is an open system? Explain the production of entropy in open systems. **[10]**

b) Define reaction coordinate & canonical ensemble. **[6]**

Q8) a) What is De Donder's inequality & uncompensated heat? **[8]**

b) What is Isopiestic Method? **[8]**

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Total No. of Questions : 8] [Total No. of Pages : 4

P1909

[3765]-451
M.E. (Civil / Structures)
STRUCTURAL MATHEMATICS
(Revised Course 2008) (501401)

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) Using Flexibility method, find the forces in the members AE and CE of the truss shown in Fig.1.a by taking these forces as the redundant. Axial rigidity for vertical and horizontal members is EA and for diagonal members is 2EA. **[12]**

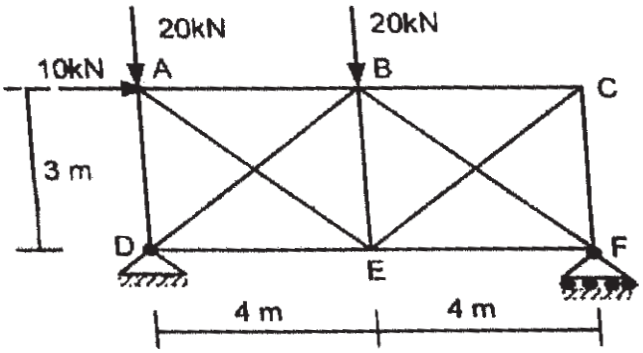

Fig.1.a

b) What is static and kinematic indeterminacy? Compare force and displacement methods with reference to static and kinematic indeterminacy. **[5]**

P.T.O.

Q2) a) Determine the joint stiffness matrix for the plane frame shown in the Fig.2.a if all the members have the same cross-sectional properties. Assume the following data : **[12]**

$E = 200 \times 10^6$ kN/m^2, L = 2m, $I_z = 1.5 \times 10^{-3}$ m^4, $A_x = .01$m^2

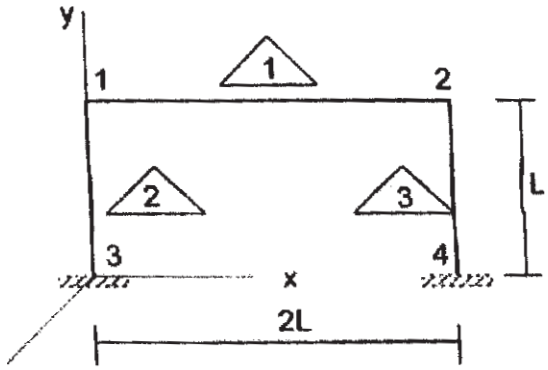

Fig. 2.a

b) Write short note on Inverse of matrix. **[5]**

Q3) a) For a general grid member, develop the member stiffness matrix with proper sketches. **[6]**

b) Determine the critical load for the pin-ended column with variable moment of inertia shown in Fig.3.b **[10]**

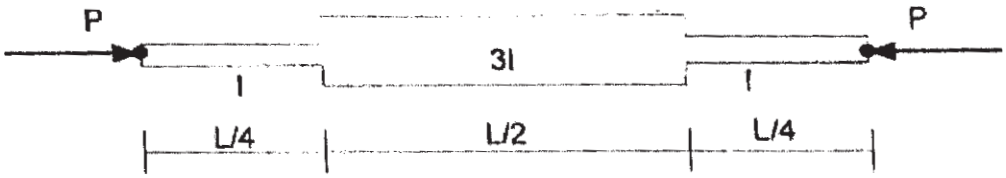

Fig. 3.b

Q4) a) Using fourth order Runga-Kutta method, solve the following equation taking each step of t = 0.1 **[10]**

$dy/dx = (4t/y) - t.y$; given $y(0) = 3$.

b) Using Euler's method, solve the differential equation $dy/dx + xy = 0$; $y(0) = 1$ from x = 0 to $x = 0.25$ taking interval 0.05. **[6]**

SECTION - II

Q5) a) A cantilever beam of length, L supports a uniformly distributed load of intensity w kN/m over complete span length. Estimate the deflection at quarter span points. Also find the corresponding bending moments using finite difference formulae. **[8]**

b) A simply supported uniform rectangular plate of sides 2a and a supports a uniformly distributed load of intensity w kN/m^2 over portion (a × a) as shown in Fig.5.b. Estimate the deflections at the interior nodes. Divide the plate into 2 × 4 meshes. Use finite difference method. **[9]**

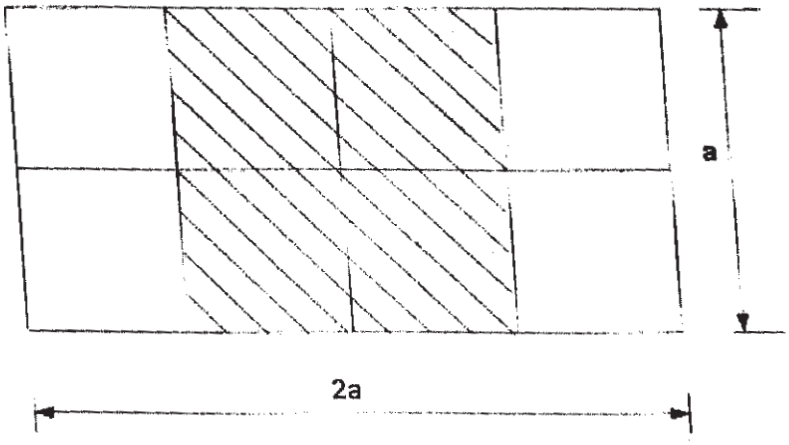

Fig 5.b

Q6) a) An experiment gave the following table of values for dependent variable y for a set of known values of x. Obtain an appropriate least squares fit for the data. **[8]**

x	1	2	3	4	5	6	7	8	9
y	5.5	7.0	9.6	11.5	12.6	14.4	17.6	19.5	20.5

b) Given $\log_{10}654 = 2.8156$, $\log_{10}658 = 2.8182$, $\log_{10}659 = 2.8189$, $\log_{10}661 = 2.8202$, find by using Lagrange's interpolation formula, the value of $\log_{10}656$. **[8]**

Q7) a) Compare trapezoidal, Simpson and Gauss Quadrature formulae for numerical integration. **[5]**

b) Find the cubic splines for the following table of values, hence evaluate $y(1.5)$, $y'(2)$. **[11]**

x	1	2	3
y	–6	–1	16

Q8) a) Compute the Integral $\int_{-2}^{4}\left(2x^3 - 3x^2 + 4x - 5\right)dx$ using Gaussian three point formula. Compare it with Simpson's 3 point rule. **[7]**

b) Determine the first two harmonics of the fourier series for the following table which gives the variation of periodic force of a period. **[10]**

t	0	1	2	3	4	5
p	7	15	22	26	24	19

☒☒☒☒

Total No. of Questions : 8] [Total No. of Pages : 2

P1910

[3765] - 590

M.E. (Electronics) (Digital Systems)

MICRO ELECTRONICS

(2008 Course) (504195)

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

Instructions to candidates:

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

SECTION - I

Q1) a) Draw a CMOS inverter DC transfer characteristic with operating regions. What is the influence of β_n / β_p ratio on inverter characteristics? **[8]**

b) Write VHDL code for BCD up-down counters. **[8]**

Q2) a) Explain MOS switch along with its I-V characteristics. State the reason of clock feed through effect in monolithic switches. **[8]**

b) Write VHDL code for FSM which detects sequence 110 by Moore method. **[8]**

Q3) a) Draw a stick diagram layout of CMOS NOR gate. **[6]**

b) Explain in detail power dissipation in CMOS. **[10]**

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

a) CMOS parasitic.

b) Domino logic.

c) VHDL data objects.

P.T.O.

SECTION - II

Q5) a) Explain NMOS and PMOS transistor operation in transmission gate. Draw a CMOS implementation of XOR gate using transmission gate. **[10]**

b) Explain types of physical clocking networks. Which are the ways to improve clock distribution. **[8]**

Q6) a) Explain various pad design techniques. **[8]**

b) Write VHDL code for 2 to 4 binary decoder using Behavioral modeling style. **[8]**

Q7) Design CMOS logic gates for following functions. **[16]**

a) $Z = \overline{A(D+E)+BC}$

b) $Z = \overline{(D+E+A)\,(BC)}$

Q8) a) Write a short notes on Ultra fast VLSI circuits and systems. **[8]**

b) What is the need of attributes in VHDL? Explain any two attributes with example. Mention whether they are synthesizable or not? **[8]**

Total No. of Questions :8] **[Total No. of Pages : 2**

P1911

[3765]-640
M.E. (Computer Engineering)
DISTRIBUTED SYSTEMS
(510108)

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) List out the various communication failures in handling remote objects. Why do these failures happen and give your suggestions to overcome such failures? **[8]**

b) Explain what is meant by transparency and give examples of different types of transparency. **[4]**

c) Explain why transient synchronous communication has inherent scalability problems and how these could be solved. **[6]**

Q2) a) Show that Byzantine agreement can be reached for three generals,with one of them faulty, if the generals digitally sign their messages. **[8]**

b) A distributed system may have multiple, independent critical regions. Imagine that process 0 wants to enter critical region A and process 1 wants to enter critical region B. Can Ricart and Agrawala's algorithm lead to deadlocks? Explain your answer. **[8]**

Q3) a) How does AFS gain control when an open or close system call referring to a file in the shared file space is issued by a client. **[8]**

b) Discuss the different DNS navigation schemes and comparatively analyze which method is advantageous in real-time distributed networking scenario. **[8]**

P.T.O.

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

a) Peer-to-peer Systems.

b) Events and Notifications.

c) RMI and RPC.

d) Directory Service.

SECTION - II

Q5) a) Describe the possible pitfalls in DSM approach when two programs try to access the same memory location. **[6]**

b) Why is thrashing an important issue in DSM systems and what methods are available for dealing with it? **[8]**

c) Explain why DSM approach is advantageous in client-server systems. **[4]**

Q6) a) Name a few advantages and disadvantages of using centralized servers for key management. **[4]**

b) What is a digital signature? What are its uses in the security of a distributed system? Give a method to create a digital signature. Describe how digital signature can be used for ensuring message integrity in a distributed system. **[8]**

c) The Diffie-Hellman Key-exchange protocol can also be used to establish a shared secret key between three parties. Explain how? **[4]**

Q7) a) Explain why UDDI can be described as being both a name service and a directory service. **[8]**

b) To what extent do web services satisfy the requirements for supporting Grid? Outline how the OGSI services add the functionality that web services do not provide. **[8]**

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

a) XML security.

b) Secure digest functions.

c) Release consistency.

d) Coordination of web services.

# # # #

Total No. of Questions : 6] [Total No. of Pages : 2

P1912

[3765]-452
M.E. (Civil/Structures)
ADVANCED SOLID MECHANICS
(2008 Course)

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 indicate full marks.***
5) ***Your answers will be valued as a whole.***
6) ***Use of electronic pocket calculator is allowed.***
7) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What is compatibility of strains? Obtain strain compatibility equation for 2D problem in elasticity. **[8]**

b) Write down the constitutive relations for strains in terms of stresses for elasticity problem. **[5]**

c) At a point in a stressed body, the cartesian components of stresses are σ_{xx} = 40 MPa. σ_{yy} = – 40 MPa, σ_{zz} = 20 MPa, τ_{xy} = – 40 MPa, τ_{yz} = 20 MPa, τ_{zx} = 30 MPa.

Determine :

i) Normal and shear stresses whose outer normal has direction cosines cos (z, x) = 0.429, cos (x, y) = 0.514, cos (x, z) = 0.743.

ii) Angle between stress resultant and outer normal. **[10]**

Q2) a) Explain the concept of "Stress Invariant". Hence discuss the state of pure sheer and hydrostatic state of stress. **[7]**

b) What is Airy's stress function? Obtain expressions for stresses for fourth degree polynomial stress function for 2D problem of elasticity. **[8]**

c) Find stress and strain component of cantilever beam loaded with the point load 'p' at the free end using Airy's stress function. **[10]**

Q3) a) Define plain strain problem. Write the basic equations for equilibrium, strain-displacement and stress-strain relationship for a plane strain 2D problem in polar co-ordinates. **[7]**

b) Obtain differential equations of equilibrium in polar co-ordinates. **[8]**

P.T.O.

c) Obtain the equations for σ_r and σ_0 for a hollow cylinder of inner radius 'a' and outer radius 'b' when subjected to internal pressure only. **[10]**

SECTION - II

Q4) a) Explain with examples the axisymmetric problems? Hence write down the corresponding basic equations for equilibrium, compatibility, strain displacement relationship and stress components. **[10]**

b) For a rotating disc of unit thickness with mass density 'ρ' and angular speed 'ω', obtain stress distribution for radial and tangential stresses assuming that

$\sigma_r = \Phi/r$ and $\sigma_0 = d\Phi/dr + \rho.\omega.^2 r^2$ **[15]**

Q5) a) Derive Poisson's equation for torsion of prismatic bars of non-circular section in terms of stress function Φ. Neglect body forces. **[10]**

b) What are different analogous methods used for solving torsion problem? Explain Prandlt's theory for torsion of solid section. **[15]**

Q6) a) What is Winkler type of foundation? Obtain differential equation for beam resting on elastic foundation. **[10]**

b) An infinite elastic beam is subjected to concentrated load 'P'. Obtain and plot the equations for slope, deflection, bending moment and shear force. **[15]**

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Total No. of Questions :6] **[Total No. of Pages : 2**

P1913

[3765]-689
M.E. (Petroleum Engineering)
ENVIRONMENTAL MANAGEMENT TECHNOLOGY & SAFETY MEASURES
(2008 Course)

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

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Attempt any two questions each from section I and section II.***
3) ***Neat diagrams should be drawn wherever necessary.***

SECTION - I

Q1) a) Explain the nature of pollutants generated and their migration onto land, air and water during drilling and petroleum production operations? **[15]**

b) What is the importance scientifically decommissioning of onshore and offshore structures. Give an outline of the methods involved and safety precautions. **[10]**

Q2) a) Describe the process of purification of natural gas obtained from a well. **[10]**

b) Explain the safety measures taken while-handling CNG, LPG, and LNG on commercial scale. **[10]**

c) Write a note on safety in H_2S environment. **[5]**

Q3) Explain the physical and chemical methods to clean-up offshore oil spills. **[25]**

SECTION - II

Q4) a) Describe the guideline design principles involved in environmentally safe transportation of oil and gas through pipelines. **[10]**

b) Write notes on : **[15]**

i) CO_2 sequestration.

ii) Sea survival techniques.

iii) Emergency response upon accident of a petroleum product tanker on a busy highway road.

P.T.O.

Q5) Describe the case study of recent oil spill in the Gulf of Mexico, emphasizing environmental impact and economic consequences. **[25]**

Q6) Write notes on the following : **[25]**

a) Water production and water disposal problems in CBM fields.

b) Possible effects of recent volcanic ash eruption in Iceland on petroleum industry in Northern Europe.

c) Site assessment for environmental impact of petroleum operations.

d) Significance of addition of ethanol to gasoline.

e) Disaster Management Plan for an oil installation.

# # # #

Total No. of Questions : 8] [Total No. of Pages : 2

P1914

[3765]-4

M.E. (Civil) (Construction & Management)
PROJECT ECONOMICS & FINANCIAL MANAGEMENT

Time : 4 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 rules and electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) Explain in detail, the following : **[16]**

a) Preference shares.

b) Debentures.

c) Cash-credit.

d) Term-loans.

Q2) Following two projects A and B have the cash flows as indicated. **[18]**

Year	Project A		Project B	
	Cash in flow (Rs. - Lakhs)	Cash out flow (Rs. - Lakhs)	Cash in flow (Rs. - Lakhs)	Cash out flow (Rs. - Lakhs)
0	-	100	-	160
1	-	120	20	-
2	-	60	40	-
3	-	20	60	-
4	200	-	80	-
5	400	-	20	-

a) Determine

i) The NPV and

ii) B/C ratio at an interest rate of 14% p.a. for the projects.

b) Determine the IRR.

c) Justify the choice of the project for investment based on the data given above.

P.T.O.

Q3) a) Distinguish clearly between **[6]**

i) Interest rate and discount rate.

ii) Mutually exclusive projects and mutually compatible projects.

b) Explain briefly payback period method and ARR. Compare them with B/C, NPV and IRR criteria of project evaluation. Comment on the choice of each criteria. **[10]**

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

a) Role of finance manager.

b) Micro-finance.

c) Techno-economic appraisal of any construction project from the point of view of its feasibility.

SECTION - II

Q5) Explain the basic cash-flow cycle. Explain in detail how the working capital requirements for any construction project are estimated. **[16]**

Q6) Explain the following with examples and their utility in detail : **[18]**

a) Balance Sheet.

b) Funds Flow.

c) Profit and Loss Account.

Q7) a) What is CAPM? Explain its utility and the assumptions involved. **[5]**

b) A portfolio consists of two assets. The investment in Asset 'A' is Rs. 80 lakhs, whereas that in Asset 'B' is Rs. 35 lakhs. Returns from asset 'A' are at 12% whereas the returns from asset 'B' are at 16%. The risk associated with asset 'A' is at 10%, whereas the risk associated asset 'B' is 12%. There exists a perfect negative correlation between assets A and B. Determine the combined risk-return characteristics of the portfolio. **[11]**

Q8) Explain the following : **[16]**

a) Debt-Equity ratio and its importance.

b) Venture capital.

c) Cost planning and control during design and construction.

d) Problems of expansion and merger of companies.

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Total No. of Questions : 8] [Total No. of Pages : 4

P1915

[3765]-412

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

CONSTRUCTION CONTRACTS ADMINISTRATION & MANAGEMENT

(2008 Course)

Time : 4 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) Draft a brief tender notice for executing the construction work of a flexible pavement using hot mix asphalt coat, consisting of typical standard layers of an estimated cost of Rs.1000/- crores to be executed in 18 calendar months. The notice should include the pre-qualifications necessary for the above work. The client is the NHAI. **[6]**

b) Prepare a 3 point score, weighted average system of total 300 points in order to evaluate the pre-qualification bid document of the tenderers submitting their bids for the above work. **[12]**

Q2) a) Compare and contrast between the MOS and PI conditions and the FIDIC conditions of the Red book as regards the following clauses. **[12]**

i) Various advances to be given and their recovery.

ii) R.A bills and final bills.

iii) Dispute resolution mechanism.

iv) Penalty and Bonus clause.

b) Explain any 8 purposes of valuation in brief. **[4]**

P.T.O.

Q3) a) It was decided to give 70% weightage to the financial bid and 30% weightage to the technocommercial evaluation. The details of the 3 tenderers are as follows. **[4]**

Contractor	Price quoted in Rs. (crores)	Percentile score in pre-qualification
A	12.5	85
B	11.5	80
C	13.5	90

you are the officer, deciding the award of the tender. Which tenderer should be awarded the work? Why?

b) A tenderer is being evaluated for his bid capacity, based on the FIDIC document. The total estimated cost of the works is 500 crores and the estimated duration of works is 3 years. The value of the works done by the tenderer in the past three years is as follows : **[4]**

Year 1	Rs.190 crores
Year 2	Rs.200 crores
Year 3	Rs.185 crores

Other financial data is as given below :

i) Sub-contractor liabilities on previous works - Rs.125 crores.

ii) Financial institution loans on previous works - Rs.200 crores.

iii) Material suppliers bills on previous and current works - Rs.400 crores.

iv) Miscellaneous liabilities - Rs. 50 crores.

Suggest, with facts and reason, whether the tenderer has the adequate bid capacity for executing the above work.

c) In a particular contract, there existed a condition of penalty for delay; the maximum amount being equal to 5% of the contract price, based on (1/2)% per week delayed. In this contract, due to lapses on part of the contractor, a particular milestone got delayed by a month. At the end of this milestone, the client terminated the contract, with due notice to the contractor. In accordance with another condition of contract related to liquidated damages, the client raised a claim against the contractor based on the delays and their negative impact on the project. Explain, in accordance with the Indian Contract Act (1872) whether.

i) Client is justified in claiming the liquidated damages, arising out of the contract, and

ii) Client is justified in terminating the contract, after the one month delay. Give suitable justification. **[4]**

d) Explain, with examples, the valid excuses for non-performance of the contract by either party, in accordance with the Indian Contract Act (1872). **[4]**

Q4) a) Explain in brief, any 6 reasons, with examples, for occurrence of construction disputes. **[6]**

b) Explain the procedure of DRB, with an example. Mention about the process of formation, the process of position papers and conduct of hearings, process of arriving at the decision and the advantages of the DRB. **[10]**

SECTION - II

Q5) Explain in brief provisions made/meaning of the following under FIDIC conditions with respect to -

a) Plant and contractor's equipments. **[2]**

b) Temporary works and permanent works (give examples for both). **[2]**

c) Which aspects are covered in Interim Payment Certificate, Performance Certificate and Taking Over Certificate. **[4]**

d) List out priority of contract documents and its purpose, Incase of ambiguity, what remedy is available? **[3]**

e) Which are standard forms of FIDIC documents based on design aspect of a contract? By which colour are the documents identified? **[4]**

f) What is "base date" and what is its implication in the context with various aspects of unit rates? **[3]**

Q6) a) Under which circumstances can the Main Contractor request Extention of Time to Project Completion Date? Describe procedural details which must be followed. **[8]**

b) While preparing project programme at the time of commencement of work, which parameters shall be considered by the Main Contractor? When is revised programme to be submitted by the Contractor? **[8]**

Q7) a) Explain in detail the significance of local laws in context with its provision in use of local labour, material and machinery/product selection under FIDIC provision. **[8]**

b) For which aspects detailed information shall be included in progress reports by the Main Contractor of the project? When and how long such reports are to be submitted? **[8]**

Q8) With reference to the Indian Arbitration Act (1996) explain :

a) Objectives of the Act. **[4]**

b) Why arbitration is semi-judicial in nature. **[6]**

c) Grounds for challenge of award. **[3]**

d) Speaking and non-speaking awards. **[3]**

Total No. of Questions :8] **[Total No. of Pages : 4**

P1916

[3765]-678
M.E. (Petroleum Engg.)
PETROLEUM RESERVOIR MANAGEMENT
(2008 & 2002 Course)

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

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate books.***
2) ***Assume suitable data, if necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of graph paper is allowed.***

SECTION - I

Q1) a) Name and describe the rock properties and reservoir characteristics that would be necessary to estimate original hydrocarbons in place. Define the recovery factor of oil and gas. **[10]**

b) How is reservoir heterogeneity classified on different geological representative scales? **[15]**

OR

Q2) a) What is reservoir characterization? What basic information is needed to characterize the reservoir? How is it recognized using seismic and well data? **[10]**

b) What is deterministic, random and stochastic or mixed reservoir? Explain with the help of neat sketches, a multilayered reservoir that shows discrete/ sharp changes and gradual changes in a sand-shale sequence. **[15]**

Q3) a) A Plot of annual production against time for an asset indicates that production will continue for 17 more years before reaching an economic limit of 1,750 bbl/year. The line of extrapolation passes through 15,000 bbl for the last year of available data. However production data shows that the actual production for that year was 14,300 bbl and that some downtime had been experienced.

Calculate the recovery (current reserves), which can be expected over the next 17 years before the production reaches the economic limit of 1,750 bbl / year assuming (i) h = 0 and (ii) h = 0.5.

What would be the value of the reservoir if the oil price is $ 40/barrel throughout the tenure of project? **[15]**

P.T.O.

b) Write a note on reservoir drive mechanism. **[10]**

OR

Q4) a) How do three decline curve methods differ from each other? **[15]**

b) Give an overview of different material balance methods to calculate reserves. **[10]**

SECTION - II

Q5) a) Details of production profile and expenditure required are given in the following table for a field under consideration for procurement.**[15]**

Year	Oil production, Million barrels/ year	Exploration and Development cost, $MM	Production cost, $ Million
1		15	
2		15	
3		15	
4		15	
5		150	
6	4.56	150	13
7	6.84		20
8	9.12		27
9	9.12		27
10	9.12		27
11	9.12		27
12	9.12		27
13	9.12		27
14	9.12		27
15	7.69		23
16	6.49		19
17	5.47		16
18	4.62		14
19	3.90		12
20	3.29	25	10
Total	106.7	385	316

Table 1 for Q, 5 a.

From the above data prepare a tabular form giving details of annual production, cumulative production, gross cash flow, royalty, net cash flow, government share and contractor share, profit for contractor after income tax.

Following are the assumptions for the preparation of spreadsheet and further calculations.

i) Oil price is $ 50 per barrel and will remain constant.
ii) Royalty is 10% of annual revenue/ annual production.
iii) Time value of money is 10%.
iv) Profit petroleum is shared between government and contractor at 50 : 50 proportions respectively.
v) Income tax is 30%.

b) Write notes on **any two** of the following : **[10]**

i) Role of horizontal wells in increasing reservoir recovery.
ii) Integration of seismic and well data using Geostatistics.
iii) 3 D reservoir modeling.
iv) Steps involved in the procedure for determining the hydraulic flow units using Geostatistics and conventional methods.

OR

Q6) a) Consider the following investment opportunities that might be available to a company with a **current priority in "minimum risk involved".** **[10]**

Asset	Opportunity	Total Investment ($M=10^6$ $)
A	Drilling exploration wells in an area with no history of occurrence of hydrocarbons	$ 20 M
B	Exploration project adjacent to producing field	$ 10 M
C	Redevelopment in producing field	$ 15 M

If a budget of $ 20 M is available for allocation of projects for next year, **which is the best way to spend money acknowledging the factors of uncertainty and risk?**

i) 100% allocation in asset C and 50 % allocation in asset B.
ii) 100 % allocation in asset C, 25 % in asset B and 12.5% in asset A.
iii) 80 % allocation in asset C, 40 % in asset B and 20 % in asset A.

Justify your decision with suitable arguments for each alternative.

b) Construct a critical path study to develop a medium size field for which details are given below : **[15]**

i) Sixty development-wells ($ 1.5 MM each) - One third will be injectors.
ii) Three platforms - two for wells, the other for production/injection equipment and pipeline terminus. ($ 310 MM each).

iii) Wells take about one month to drill. Up to two rigs/platform.

iv) Platforms manufactured in one and a half years-two out time one month during weather window in summer. (Two out costs $ 10 MM). Setup time is three months for drilling/well platform, five months for production platform.

v) Pipeline lay time is about 14 months. (Cost $ 180 MM)

vi) Production "commissioning" and final permit take two months. ($ 5 MM).

vii) Overhead and other ongoing costs = $1 MM/month.

The main idea of this exercise is to avoid waste, of time labor and material.

1) Draw a critical path diagram for this project. Assume a starting date of July, 1, 2010.
2) Determine the time length of the critical path.
3) Plot cumulative costs as a function of time.

Q7) a) Discuss commonly used flood patterns with their characteristics. What are the factors that influence the injector/producer pattern? **[10]**

b) How does the mechanism of water flooding differ in oil wet and water wet reservoirs? In what condition is water flooding an imbibition process? Does vertical permeability affect water flood performance? **[15]**

OR

Q8) a) List different types of EOR methods and their specific applications. What are preferred oil viscosity ranges and depth limitations for applying different EOR methods? **[15]**

b) Write notes on **<u>any two</u>** of the following : **[10]**

i) History matching.

ii) Upscaling.

iii) Well testing.

iv) Naturally fractured reservoir.

# # # #

Total No. of Questions : 8] [Total No. of Pages : 4

P1917

[3765]-688
M.E. (Petroleum Engg.)
GIS AND COMPUTER APPLICATIONS IN PETROLEUM INDUSTRY
(2008 Course)

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

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate books.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Use of graph paper is allowed.***

SECTION - I

Q1) a) How are spatial objects classified based on their shape? Give examples of natural and artificial spatial objects. **[15]**

b) What is an expanded raster structure? Explain in brief BSQ and BIP methods of data storage. **[10]**

OR

Q2) a) What are Raster and Vector data structures? What are the advantages and disadvantages of Raster structures as opposed to Vector structure? **[15]**

b) Figure 1 gives information about two objects showing 1 and 0 values. Compress this into BIP type of storage data and reorganize the information. **[5]**

0	0	0	0	0	1	1	0
0	0	0	0	1	1	1	0
0	0	0	1	1	1	1	0
0	0	0	1	1	1	1	0
0	1	1	1	1	1	1	0
0	1	1	1	1	1	1	0
0	0	0	1	1	1	1	0
0	0	0	0	0	1	0	0

Figure 1 for Q.2. b.

c) What are possible sources of errors at different stages of a GIS PROJECT? **[5]**

Q3) a) Discuss how are spatiotemporal changes and their mapping using GIS and remote sensing modelling carried out? Discuss this with suitable examples. **[15]**

b) What are Buffers/Dilation? Explain in brief basic methods of determining buffer distances. Give suitable examples. **[10]**

OR

Q4) a) Write notes on <u>any three</u> of the following : **[15]**

i) Georeferencing.
ii) Standard map projection systems.
iii) SQL operations.
iv) Principal Component Analysis.
v) Autocorrelation.

b) Following quadtree is developed for an image. Please note that square nodes given in figure do not show decomposition of object in next higher order, while circular node reflects continuation in next higher order. **[10]**

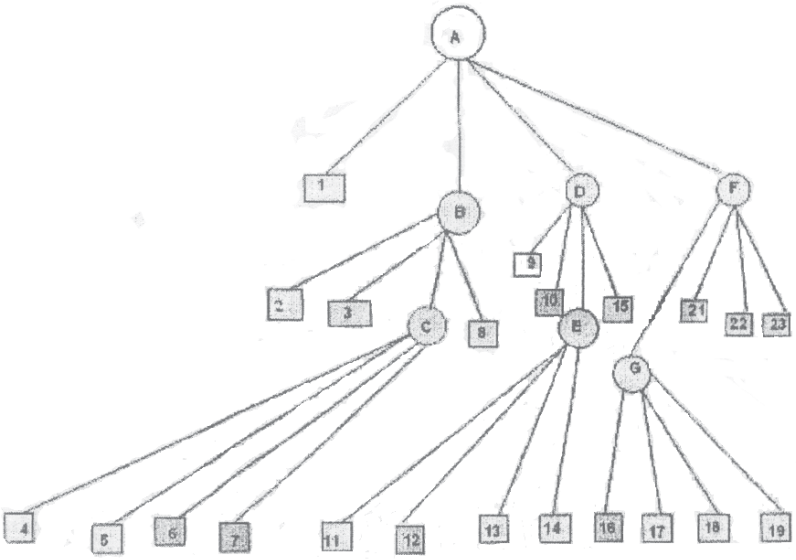

Figure 2 for Q 4.b.

Decompose this into maximal blocks following the concept of Morton order in a matrix of 4 × 4, which is divisible in to higher order.

<u>SECTION - II</u>

Q5) a) Discuss different steps used in the design and implementation of a GIS project. **[15]**

b) Following image is giving land use pattern (forest, dark grey and normal land use, light grey, Figure 3 A) and elevation (figure 3 B) for a particular area. **[10]**

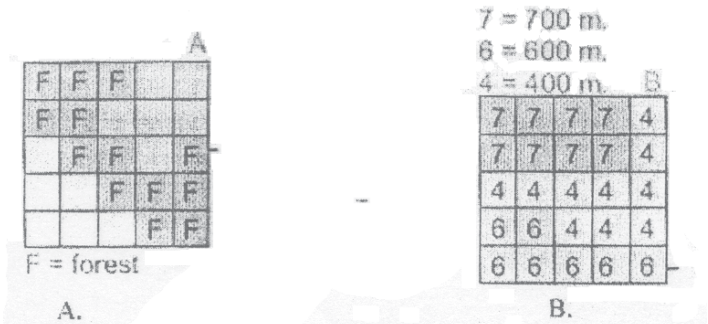

Figure 3 for Q.5.b.

Using operations AND, OR AND NOT, plot the following into new figures.

i) Areas with elevation below 500 m with presence of forest.

ii) Areas that are either forest or elevation less than 500 m (not at the same time).

iii) Forest above 500 m.

iv) Areas below 500 m and forest.

OR

Q6) a) Develop a database model system to monitor oil spills and potential environmental damage to coastlines? Give examples of appropriate spatial objects and associated attributes. **[15]**

b) What data models might be needed in a system to explain a three dimensional reservoir model? Give examples of appropriate spatial objects and associated attributes. **[10]**

Q7) a) A crude oil refinery is in operation for last many years adjacent to a perennial river,which is a major source of water for domestic purposes by many villages in the downstream. This river is joined by many small streams. The company management is responsible for clean environmental conditions. The refinery releases many harmful chemicals. This is contaminating river water, groundwater and soil. These characteristics provide an interesting set of challenges to the environmental risk assessment process. A lot of residential and commercial activity has taken place in last ten years adjacent to refinery particularly along the streams and also in the downstream parts. **[20]**

Develop an approach utilizing GIS and a decision analysis framework as the basis for making risk-based decisions for corrective measure. You are requested to take into consideration following aspects for the design of database.

Sources of contamination, the receptors (both human and ecological), ecological habitats, transport pathways, risks to the identified receptors.

Is it necessary to add temporal component to the project?

b) Write a note on the utility of spatiotemporal database. **[5]**

OR

Q8) a) Design a GIS DATABASE on any two of the following applications. **[16]**

i) Reservoir Evaluation projects.

ii) Selection of potential site for landfill.

iii) Seismic Microzonation.

iv) Pipeline management.

b) What is Digital Elevation Model? What type of database is required for the understanding of subsurface information? **[9]**

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Total No. of Questions : 6] [Total No. of Pages : 3

P1918

[3765]-153

M.E. (Electrical) (Control Systems)

OPTIMIZATION TECHNIQUES AND OPTIMAL CONTROL

(Course2002)

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 wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables and electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Derive from the first principle the 'Fundamental necessary condition of variational calculus' and therefrom the 'Euler-Lagrange Equation'. **[10]**

b) Find the curve with minimum arc length between the point $x(0) = 0$ and the curve $\theta(t) = t^2 - 4t + 10$. **[10]**

c) State and explain the "Transversality Conditions" with reference to calculus of variation. **[5]**

Q2) a) Define Hamiltonian and explain the procedure for solving optimal control problem using Hamiltonian formulation of variational calculus. State its limitations. **[10]**

b) Find the extremal of the functional **[15]**

$$J(x) = \int_0^1 (\dot{x}_1^2 + 2x_1x_2 + \dot{x}_2^2)dt$$

The boundary conditions are $x_1(0) = x_2(0) = 0$ and $x_1(1) = 0.5$; $x_2(1) = -0.5$.

Q3) Attempt any <u>two</u> of the following : **[12]**

a) State and explain the state linear regulator problem and show that for an infinite-time state regulator problem the performance index is,

$$J = \tfrac{1}{2}\int_0^\infty \left[x^T(t)Qx(t) + u^T(t)R\,u(t)\right]dt$$ with usual notations.

P.T.O.

b) State "Pontryagin's Minimum Principle" and discuss step by step the procedure of solving optimal control problem using Pontryagin's Minimum Principle. **[12]**

c) A linear time-invariant system is described by the state equations; **[13]**

$$\dot{x}_1 = u$$

$$\dot{x}_2 = 2x_2 + u$$

With quadratic performance index,

$$J = \tfrac{1}{2}\int_0^{\infty} \left[x^T Q x + u^T R u\right] dt$$

Assume $Q = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$; $R = 1$

i) Find the optimal control law.

ii) Check whether the closed-loop control system is asymptotically stable.

SECTION - II

Q4) a) Explain with neat flow chart the Fibonacci Search method for one-dimensional Optimization problem. **[10]**

b) Compare Fibonacci Method with Golden Section Method for one-dimensional Optimization. **[5]**

c) Locate the minimum point of the function $f(x) = 2x - 3x^2$ in the interval (0, 1) within an accuracy of ± 0.05 by using Fibonacci Search Method. **[10]**

Q5) a) Explain the algorithm and draw the flow chart for any one of the following methods of Optimization : **[10]**

i) Steepest Descent method.

ii) Fletcher-Reeves Conjugate Gradient Method.

b) Minimize the following function, **[15]**

$$f(x_1, x_2) = 4x_1^2 + 3x_2^2 - 7x_1x_2 - 8x_1$$

by using Fletcher-Reeves Conjugate gradient method with starting point $x_1(0) = x_2(0) = 0$.

Q6) a) Explain the algorithm and draw the flow chart of the 'Simplex Method' for solving Linear Programming Problem. **[10]**

b) What do you mean by 'Duality' in linear programming? Prove that the dual of the dual is primal. **[5]**

c) With reference to the Dynamic Programming explain briefly the following: **[10]**

i) Principle of Optimality.

ii) Principle of Invariant Imbedding, and

iii) Principle of Causality.

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Total No. of Questions : 10] [Total No. of Pages :2

P1920

[3765] - 516
M.E. (Mechanical) (Mechatronics)
MICROCONTROLLERS

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

Instructions to the candidates:

1) *Q.1 and Q.6 are compulsory. From Q 2-3, Q 4-5, Q 7-8, Q 9-10 attempt any one question from all mentioned Question pair.*
2) *Figures to the right indicate full marks.*

SECTION - I

Q1) Explain in detail the architecture of 8051 micro controller. Also draw a minimum connection circuit diagram for 89C51. **[18]**

Q2) a) Explain in short timer logic. Also explain in detail all special function registers for timer. **[8]**

b) Write a program to generate a square wave of 72 Hz on $P_{2.5}$. Assume standard values. Show all calculations. **[8]**

OR

Q3) a) Explain and Write a program for Keyboard interfacing with 89C51. **[8]**

b) Assuming that the clock pulses are fed into pin T_1, write a program for counter2 in required mode to count the pulses and display the state of the TL_1 count on P_2. **[8]**

Q4) a) Write down steps to transfer data serially. Explain in short the special function registers for serial data transfer. **[8]**

b) Write a program that continuously gets data from P_1 and sends it to P_2, while simultaneously creating a square wave of 100 us period on $P_{1.5}$. Use timer 1 to create square wave. Assume that XTAL = 15MHz. **[8]**

OR

P.T.O.

Q5) a) Explain in detail why Interrupt logic is required. Also write in short SFR names and their functions for Interrupt. What is the significance of RET_1 instruction. **[8]**

b) Write a program in which 8051 reads data from P_0 and write it to P_2 continuously while giving copy of it to serial COM port to be transferred serially. Assume X'tal = 11.0592 MHz. set the baud rate 2400. **[8]**

SECTION - II

Q6) Explain in detail the architecture of PIC micro controller 16xx. **[18]**

Q7) a) Write a short note on different derivatives of micro-controller. **[8]**

b) Explain in detail interfacing of DAC with 8051. **[8]**

OR

Q8) a) Explain in detail interfacing of ADC with 8051. **[8]**

b) Write a short note on emulator. **[8]**

Q9) a) Write a short note on MODBUS protocol. **[8]**

b) Explain a protocol which is required to be used with lowest complexity in hardware for inter IC serial communication. **[8]**

OR

Q10) a) Write a short note on ARM memory organization. **[8]**

b) Write down applications of all microcontrollers which you have studied. **[8]**

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Total No. of Questions : 12] [Total No. of Pages : 5

P1921

[3765] - 532

M.E. (Electrical) (Control Systems)

MULTIVARIABLE AND OPTIMAL CONTROL SYSTEMS

(2008 Course)

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

Instructions to the candidates:

1) *Answer three questions from Section - I and Three questions from 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) *Use of logarithmic tables and electronic pocket calculator is allowed.*
6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) State the merits and demerits of optimal control. **[4]**

b) Explain the factors to be considered in the formulation of an optimal control problem using quadratic performance criterion. **[4]**

c) State and explain the infinite-time state linear regulator problem. Outline the procedure for obtaining the optimal control law for an infinite-time linear state regulator problem. **[8]**

OR

Q2) a) Discuss the Iterative method for the numerical solution of matrix Riccati Equation. **[6]**

b) A linear time-invariant system is represented by the state equation :

$$\dot{x}(t) = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(t)$$

The performance index to be minimized is

$$J = \frac{1}{2}\int_0^{\infty} \left[x^T(t)Qx(t) + u^T(t)Ru(t)\right]dt$$

Assume : $Q = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$; R = 1

i) Determine the optimal control law $u^*(t) = -kx(t)$.

ii) Check whether the closed-loop control system is asymptotically stable. **[10]**

Q3) a) Define Hamiltonian. Derive the state, co-state and control equations.**[7]**

b) Consider the linear time-invariant first order system

$$\dot{x}(t) = u(t)$$

Using Hamiltonian method, find the optimal control $u^*(t)$ which minimizes the performance index,

$$J = \frac{1}{2}\, x^2(2) + \frac{1}{2}\int_0^2 u^2\, dt$$

Given : $x(0) = 1$; $x(2) = -1$. **[10]**

OR

Q4) a) Outline the procedure for obtaining optimal control using Hamiltonian method. **[6]**

b) Draw the block diagram showing the structure of feedback time-optimal control system and explain in detail the minimum time-optimal control problem. **[7]**

c) What do you mean by singular control solution. **[4]**

Q5) a) State the 'Pontryagin's Minimum Principle'. Outline the procedure for solving optimal control problem using Pontryagin's minimum principle. **[12]**

b) Discuss briefly the relation between the Dynamic Programming and Pontryagin's minimum principle. **[5]**

OR

Q6) a) For the linear time-invariant system described by the state equations :

$$\dot{x}_1(t) = u(t)$$

$$\dot{x}_2(t) = x_1(t)$$

Find the optimal control $u^*(t)$ satisfying the constraint $|\, u(t) \,| \leq 1$.

Which transfers the initial state $x_1 = 1$ and $x_2 = 1$ to a zero final state ($x_1 = x_2 = 0$) in minimum time. **[12]**

b) Explain the Bang-bang control strategy and state the merits of Bang-bang controller. **[5]**

SECTION - II

Q7) a) What are the advantages of representing the multivariable control system into : **[6]**

i) State-space form

ii) Transfer matrix form

b) A multivariable control system is represented in state space form :

$$\dot{x}(t) = \begin{bmatrix} 0 & 3 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \\ x_3(t) \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 1 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} u_1(t) \\ u_2(t) \end{bmatrix}$$

$$y(t) = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \\ x_3(t) \end{bmatrix}$$

obtain the transfer matrix of the system. **[10]**

OR

Q8) a) Obtain the state space representation of the following transfer function matrix

$$M(s) = \frac{Y(s)}{U(s)} = \begin{bmatrix} \frac{1}{S+1} & \frac{1}{S+3} \\ \frac{1}{S+3} & \frac{1}{S+1} \end{bmatrix}$$

Also obtain the characteristic polynomial of the system. **[8]**

b) The simultaneous differential equations relating the two inputs u_1 and u_2 and the two outputs variables y_1 and y_2 are given by,

$$\ddot{y}_1(t) + 2\,\dot{y}_2(t) + y_1(t) = u_1(t)$$

$$\ddot{y}_2(t) + 3\,\dot{y}_2(t) + 2y_1(t) = u_2(t)$$

obtain the state space representation of the above multivariable system.**[8]**

Q9) a) Define the state controllability and explain any one method of testing the controllability of multivariable control system. **[8]**

b) Investigate the full state controllability of the multivariable control system represented in state space form :

$$\dot{x}(t) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 2 \end{bmatrix} x(t) + \begin{bmatrix} 2 & 2 \\ 1 & 1 \\ 0 & 0 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix} x(t).$$ **[10]**

OR

*Q10)*a) Define the term 'complete observability and determine the observability of the multivariable control system represented by the state space form:

$$\dot{x}(t) = \begin{bmatrix} 5 & 4 & 0 \\ 0 & 1 & 0 \\ -4 & 4 & 1 \end{bmatrix} x(t) + \begin{bmatrix} -2 & 0 \\ -1 & 1 \\ -4 & 0 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix} x(t)$$ **[8]**

b) What is an observer? Explain with neat block diagram the nature of state estimation problem using Luenberger Observer. **[10]**

Q11) a) Draw the appropriate block diagram and discuss in detail the pole allocation using Linear State variable Feedback in multivariable control system. **[12]**

b) Explain the relation between controllability, observability and the stability in multivariable control system. **[4]**

OR

Q12) a) Explain clearly the following design specifications for multivariable control systems : **[8]**

i) Model-matching control.

ii) Non-interactive or Decoupling control.

b) Enumerate the different methods extending the classical control theory for the analysis of multivariable control system. What are their limitations? **[4]**

c) With reference to multivariable control system, define the following concepts : **[4]**

i) Stability.

ii) Reproducibility.

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Total No. of Questions :8] [Total No. of Pages : 2

P1922

[3765]-573
M.E. (VLSI & Embedded Systems)
ANALOG & DIGITAL CMOS IC DESIGN
(2008 Course)

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 should be drawn wherever necessary.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) Explore current sink & source. What are the voltage compliances? How to improve them? **[8]**

b) Design CMOS amplifier for voltage gain of 50, band width of 100 MHz. Compute R_{out}. **[8]**

Q2) a) What are the techniques of voltage references? What are their performance parameters. **[8]**

b) What is necessity of Bandgap reference? Brief the concept with mathematical expressions. **[8]**

Q3) a) Design cascode amplifier for voltage gain of 40 dB. Compute R_{out}. Estimate bandwidth. Assume suitable data. **[8]**

b) List and explain the techniques to improve bandwidth. **[8]**

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

a) Output amplifiers.

b) Micropower opamp.

c) Inverters & performance parameters.

d) MOSFET as active resister.

SECTION - II

Q5) Draw FSM diagram & write VHDL code for Tea/Coffee vending machine. Also write test bench assume suitable inputs & outputs. **[16]**

P.T.O.

Q6) a) Why is synchronization needed? What are the methods to achieve? **[8]**

b) What are the sources & elimination techniques of hazards? **[8]**

Q7) a) Derive the expressions for static & dynamic dissipations. Compare them w.r.t technology scaling. **[8]**

b) Design CMOS logic for F= ABCD + E (F + G). Compute area on chip. **[8]**

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

a) MOSFET sizing.

b) Technology scaling & its effects.

c) Transmission gate & its applications.

d) NDRA logic.

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Total No. of Questions : 8] [Total No. of Pages : 3

P1924

[3765] - 629

M.E. (Computer)

APPLIED ALGORITHMS

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

Instructions to candidates:

1) ***Answer any three questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Find the probability that some randomly chosen K digit decimal number is a valid Kdigit binary number. **[8]**

b) Measurements at a computer center on a certain day indicated that the source of incoming jobs is 15 percent from sub center A, 35 percent from sub center B and that from sub center C is 50 percent. Find the probability that a job chosen at computer center is a set up job. Assume that the probabilities that a job initiated from sub-centers are 0.01, 0.05 and 0.02 respectively. Also find the probabilities that a randomly chosen job comes from the sub center C, given that it is a set-up job. **[10]**

Q2) a) Assume that a source code is of 100 statements. Out of these 75 are syntactically correct and 25 statements have syntactically errors. 12 statements are selected at random for checking, find the probability that at least one statement is with syntactical errors. **[8]**

b) Assume that a software project has 5000 user defined functions, of which 1000 are written by project group-A and rest by project group B, Ten percent of the functions written by project group A and 5 percent of the functions written by project group B are having bugs. If a randomly chosen function is found to have the bugs, find the probability that it was written by project group A. **[8]**

Q3) a) What is the major drawback of quick sort algorithm? What are the possible ways in which we can address this issue? Briefly discuss. **[8]**

b) Write an algorithm for finding minimum spanning tree using Prim's algorithm. **[8]**

Q4) a) Compare Kruskal's and Prim's algorithm. **[2]**

b) Prove that the worst case behavior of Kriskal's algorithm is O (| E | log | E |). **[8]**

c) Solve the recurrence relation:

$$f(n) = \begin{cases} n & \text{.....if } n = 0 \text{ or } n = 1 \\ f_{n-1} + f_{n-2} & \text{.....otherwise} \end{cases}$$ **[6]**

SECTION - II

Q5) a) Write a recursive binary search algorithm. Determine its time complexity. **[8]**

b) Consider the following algorithm for vertex cover problem:

```
Alg_Vert_Cov(G)
{
    //G is an input graph
    //E[G] is an edge set of the graph
    //C contains vertex cover being constructed
    //E' is to maintain copy of an edge set

    C=∅; // Null set
    E'=E[G];
    while (E' is not empty)
    {
      let (u,v) be an arbitrary edge of E';
      C=C U {u,v};
      Remove from E' every edge incident on either u or v;
     }
    return (C);
}
```

Prove that this is a polynomial time 2-approximation algorithm. **[8]**

Q6) a) Define the term : Approximation ratio. **[2]**

b) Write an approximation algorithm for graph coloring. Clearly indicate any assumptions made. **[8]**

c) Compare accounting method and potential method of amortized analysis. **[6]**

Q7) a) Define the following terms:

i) Absolute approximation of algorithm.

ii) ε (epsilon) approximation of algorithm.

iii) Polynomial time approximation of algorithm. **[6]**

b) State prefix computation problem. Write parallel algorithm for the same. Find the time complexity of this algorithm. **[10]**

Q8) a) Compare CRCW and EREW algorithms. **[6]**

b) Write short note on: **[12]**

i) Pointer doubling problem.

ii) PRAM model.

Total No. of Questions : 8] [Total No. of Pages : 2

P1925

[3765]-262
M.E. (Chemical)
ADVANCED MASS TRANSFER
(2002 Course)

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

Instructions to the candidates:

1) ***Answer any three questions from each sections.***
2) ***Neat diagrams must be drawn wherevr necessary.***
3) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain the following terms with respect to residue curve maps. **[8]**

i) Nodes and saddles.

ii) Distillation zones and boundaries.

b) What are the topological rules for finding nodes and saddles. **[6]**

c) What are the properties of residual curve maps? **[4]**

Q2) a) Draw the residual map for following system. **[10]**

Component	-	A	B	C	A-C Azeotrope
B.P. , °C	-	61.8	56.1	64.5	53.9

A-B Azeotrope	B-C Azeotrope	Ternary Azeotrope
65.5	56.1	57.6

b) Explain the differences between residual curve and distillation curve. **[6]**

Q3) a) Estimate the minimum reflux ratio for separation of a saturated liquid containing 60% A, 4% B and remaining C. The relative volatility data :

$\alpha_{AC} = 1.7 \;\; \alpha_{BC} = 1.16$ **[8]**

b) Ethanol - water system is to be separated using entrainer. Explain the column sequencing to be used. **[8]**

Q4) Devise the Lewis - Matheson method for finding the minimum number of trays. **[16]**

P.T.O.

SECTION - II

Q5) a) Compare short cut method and tray to tray methods for absorption. **[8]**

b) Explain modified absorption factor & effective adsorption factor. **[4]**

c) Explain how reflux brings about enrichment in extraction. **[6]**

Q6) a) Derive the Kremser Brown equation for multicomponent absorption. **[12]**

b) Explain mass transfer with reaction briefly. **[4]**

Q7) Find number of theoretical stages for the following counter current extraction with reflux. Feed rate (A + C) = 1000kg/hr. Mass fraction of C in feed = 0.25, solvent free compositions of product streams 2% and 90% by weight. Reflux ratio = 4.5. Equilibrium data in wt%. **[16]**

A	63	57	52	46	40	31	27	14	8	4	2	1.9	1.8
B	37	38	39	40	41	43	44	48	52	55	98	97.3	97.0
C	0	05	09	14	19	26	29	38	40	41	0	0.76	1.2

1.5	1.36	1.20	1.0	0.8	0.7	0.4
96.6	95.9	95.0	93.9	93.1	92.1	93.5
1.9	2.73	3.8	5.1	6.1	7.2	6.1

Q8) a) Explain a process for recovering NH_3 from waste water. **[8]**

b) Explain distillation with membrane permeation. **[8]**

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Total No. of Questions :10] **[Total No. of Pages : 3**

P1926

[3765]-508
M.E. (Mechanical) (Mechatronics)
APPLIED NUMERICAL METHODS & COMPUTATIONAL TECHNIQUES
(2008 Course) (Part - I)

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

Instructions to the candidates:

1) ***Attempt any three questions from Section I and three from Section II.***
2) ***Answers to each section should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, wherever necessary but mention it clearly.***
5) ***Use of scientific calculator is allowed.***

SECTION - I

Q1) a) Given

Weights	0.5555	0.8888	0.5555
Function Arguments	-0.7745	0.0	0.7745

Calculate the integral value $\int_0^3 xe^x\,dx$ using Gauss Quadrature three point formulae. **[10]**

b) Write a short note on Shooting method algorithm used in solution of boundary value problems. **[8]**

Q2) a) Using Eular's method, find approximate value of y at x = 0.3. Given $\frac{dy}{dx}=2x+y$ and $x=0, y=1$. **[8]**

b) Write a short note of Linear Regression. **[8]**

Q3) a) Use Thomas algorithm to obtain solution of tridiagonal matrix. **[10]**

$$\begin{bmatrix} 0.8 & -0.4 & 0.0 \\ -0.4 & 0.8 & -0.4 \\ 0.0 & -0.4 & 0.8 \end{bmatrix} . \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \end{Bmatrix} = \begin{Bmatrix} 41 \\ 25 \\ 105 \end{Bmatrix}$$

b) Discuss Given's Method with significant steps of algorithm. **[6]**

P.T.O.

Q4) a) Using linear regression, find the *t* straight line that fits the following data. **[8]**

x	1	2	3	4
y	0.17	0.18	0.23	0.32

b) Calculate L and U matrices using procedures used in LU decomposition **[8]**

$$\begin{bmatrix} 3.0 & -0.1 & -0.2 \\ 0.1 & 7.0 & -0.3 \\ 0.3 & -0.2 & 10.0 \end{bmatrix}$$

Q5) Write short notes on (Any Two) : **[16]**

a) Hermite Interpolation Polynomial.

b) Gauss Quadrature for Double Integration.

c) Regression analysis for Quadratic Curve fitting.

SECTION - II

Q6) a) Integrate $y = 4e^{0.8x} - 0.5y$ from $x = 0$ to $x = 2$, using $h = 1$ with initial conditions as $x = 0$, $y = 2$, using Eular's Method. **[6]**

b) Using Classical 4th order RK method, integrate $\frac{dy}{dx} = xy + y^2$. The initial conditions are $y = 1$ at $x = 0$ and $h = 0.5$. **[10]**

Q7) Figure shows a square plate. The temperature of the edges is as shown in Figure (i). Using Laplace Equation $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$ and Libmann's method obtain the temperatures of inside nodes. Compute four iterations and tabulate the result. **[18]**

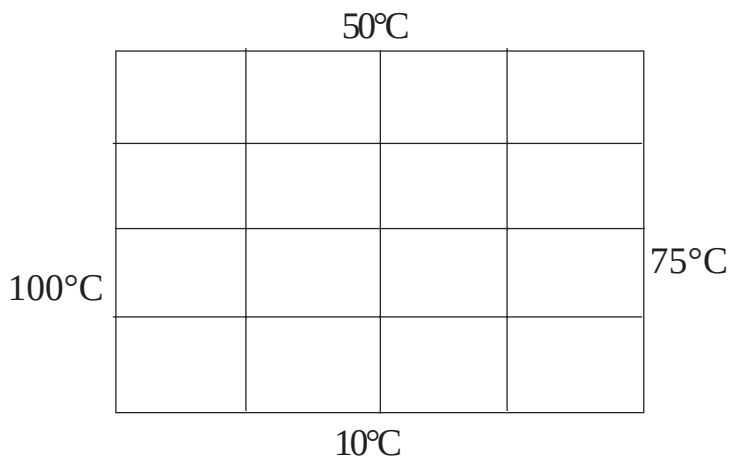

Figure (i)

Q8) a) Discuss Steepest Decent Algorithm. **[8]**

b) Applications of Fourier Transforms in Vibration Analysis. **[8]**

Q9) a) Use Predictor Corrector Method to calculate y at $x = 4$ with step size $h = 0.5$ and initial conditions as $y = 0$ at $x = 0$ for the differential equation $\frac{dy}{dx} = 12x^2 - 20x + 8.5$. **[10]**

b) Write a short note on Weighted Residual Methods. **[6]**

Q10) Write short notes on (Any Two) : **[16]**

a) Implicit method to solve partial differential equations.

b) Write short note on "Averages of $\pm 3\sigma$.

c) Steps and their significance in Finite Element Method.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1927

[3765]-659
M.E. (Chemical)
MANAGEMENT OF RESEARCH & DEVELOPMENT IN CHEMICAL INDUSTRIES
(2008 Course)

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

Instructions to the candidates:

1) ***Answer any three questions from each section.***
2) ***Your answers will be valued as a whole.***
3) ***Figures to the right indicate full marks.***

SECTION - I

Q1) Why management of research is needed? How it is important in the survival of industry in the long term? **[17]**

Q2) Discuss symbiotic nature of developments in research in various disciplines of technology, with particular reference to chemical engineering. Give suitable examples. **[17]**

Q3) Give industrial examples of research thriving in chemical industry which has been put directly to practise. How the role of management is important in transfer of technology from laboratory to plant. **[17]**

Q4) Financial management plays important role in every sphere of life. How it plays crucial role in managing research? **[16]**

SECTION - II

Q5) What is PERT & CPM? Discuss with example application of these techniques in managing research. **[17]**

Q6) What are the factors on which diversification of funds for research & development depends? Discuss in details by taking a case study **[17]**

Q7) Discuss the role and responsibility of R & D Manager. What are legal aspects related to development of a process and product? **[17]**

Q8) Discuss about the types of manpower needed in R & D set up for a typical chemical unit. How manpower management is important in making R & D cell successful. **[16]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1928

[3765] - 239

M.E. CSE (Information Technology)

MOBILE COMPUTING

(Revised Course 2002) (510125)

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

Instructions to the candidates:

1) ***Answer any three questions from Section - I and three questions from Section - II.***
2) ***Answers to the both sections should be written in separate answer sheets.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of non-programmable pocket calculator is allowed.***

SECTION - I

Q1) a) What is SIM? What facilities are provided by the SIM to user? Explain the purpose storing of LAI, IMSI, PIN.PUK in SIM card. **[8]**

b) Explain the DECT with respect to frequency, channels, duplex, mechanism, multiplexing scheme, modulation, power, and range. **[8]**

Q2) a) Which are the various effects of the device portability? What are the various reasons for higher delays, higher jitter and low transmission rates in mobile communication? **[8]**

b) Compare between directed antennas and sectorized antennas. Why sectorized antennas are used in cell? **[8]**

Q3) a) What is the principal difference between Slow and Fast FHSS? Generally fast FHSS gives improved performance in noise or jamming. Justify the statement. **[8]**

b) How Handoff management makes the use of Measurements, Decision and Execution to carry out the seamless and lossless handoff? Explain how network and mobile device contribute in handoff process. **[8]**

P.T.O.

Q4) a) Show through manual calculations how GSM provides speech coding rate 13 Kbps and FEC coded speech rate 22.8 Kbps for the speech of 20 ms. **[10]**

b) If the 50 MHz frequency band is allocated to GSM network, calculate how many users it can support at give time with its full capacity? Support your answer with manual calculations. **[8]**

SECTION - II

Q5) a) Explain the architecture of ad-hoc wireless LAN. How it can be extended for infrastructure network? **[8]**

b) What is standard mechanism to calculate the cluster size? Why cluster size has standard selected values like N = 3, 4, 7, 9, 12, 13? **[8]**

Q6) a) Explain the procedure for location update from the mobile. What are the functions of RACH, AGCH, SDCCH channels? **[8]**

b) What is WAP? Give and explain WAP programming model. **[8]**

Q7) a) How GSM technology is different from AMPS Technology with respect to access method, band allocated and number of channels? **[8]**

b) How authorization. Authentication and Accounting is carried out in mobile network? **[8]**

Q8) a) What is GPRS? Explain the architecture of GPRS. What additional support is required in GSM/CDMA to implement GPRS? **[8]**

b) List the logical channels of GSM network. Give at least one function of each channel. **[10]**

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Total No. of Questions : 6] [Total No. of Pages :2

P1930

[3765] - 462
M.E. (Civil/Structures)
THEORY OF PLATES AND SHELLS
(2008 Course) (501408)

Time : 4 Hours] *[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) Differentiate between thin plate theories for small and large deflections. **[5]**

b) For isotropic plates, under the action of lateral loading, determine the stress-strain relations and hence the moment curvature relations in Cartesian co-ordinate system. **[8]**

c) A rectangular plate of size a x b with four edges simply supported carries a patch loading spread over an area u x v. Derive the expression for the deflection of the plate. **[12]**

Q2) a) Derive Levy's solution for a rectangular plate with two opposite edges simply supported and the other two edges clamped, 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) Derive the governing differential equation in polar coordinates for circular plates. A clamped circular plate of radius 'a' carries uniform loading of intensity q. Find the maximum values of radial and tangential moments. **[25]**

P.T.O.

SECTION - II

Q4) a) A thin spherical tank is supported on cylindrical rim along a parallel circle. The tank is completely filled with liquid of density w. Derive the expression for the membrane stresses N_θ and $N_ø$. **[20]**

b) Explain how membrane theory fails at the supporting ring in the above problem. **[5]**

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 Beam theory of cylindrical shells. Discuss the advantages and limitations of the theory. **[10]**

b) For a cantilever cylindrical open shell of length L, radius a, and half angle $ø_0$ subjected to self weight, obtain the expression for membrane stresses N_x, $N_ø$ and $N_{xø}$. **[15]**

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Total No. of Questions : 10] **[Total No. of Pages : 2**

P1931

[3765] - 517

M.E. (Mechanical) Mechatronics

INDUSTRIALAUTOMATION

(2008 Course) (502809) (Part - II)

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

Instructions to candidates:

1) ***Attempt any three questions from each section.***
2) ***Answers to the Two sections should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data wherever necessary but mention it clearly.***
5) ***Use of scientific calculator is allowed.***

SECTION - I

Q1) Answer any two of the following: **[16]**

a) Explain Examine ON and Examine OFF conditions used in "Start" and "Stop" button in ladder logic program.

b) Compare Contactor Logic and Ladder (PLC) logic with suitable example.

c) Explain the discrete input devices and standard ratings for discrete inputs used in PLC.

d) Types of switches used in PLC applications.

Q2) a) Explain Ring and Bus Topologies used in Networking. **[8]**

b) Explain Block format and ladder format counter instructions. Enlist various counter instructions with the help of symbol used in ladder programming and brief description. **[8]**

Q3) Develop ladder program for the following industrial objective. **[16]**

A DC motor is to be programmed for direction reversal with unipolar power supply. Four push to on buttons PB_1-PB_4, with two relays R_1 and R_2 are to be used along with PLC. The objectives are

a) The motor shall start running in either direction only after PB_1 for process "Start" is pushed.

b) The motor shall continue running until PB_2 for process "Stop" is pushed.

c) When PB_3 is pushed, the motor shall start moving in cw direction.

d) When PB_4 is pushed, the motor shall start moving in ccw direction.

P.T.O.

Q4) a) Compare ON Delay and OFF Delay timers used in ladder program with illustrative example. **[8]**

b) Compare Function Block Diagrams and Ladder Diagrams for logic AND and Logic OR. **[8]**

Q5) a) Two push to on buttons PB_1 and PB_2, for input and RED and GREEN light as output are given. Develop a ladder diagram to accomplish following objectives. **[9]**

i) When PB_1 is pushed & PB_2 is not pushed RED light glows.

ii) When PB_1 is not pushed & PB_2 is pushed GREEN light glows.

b) Explain ladder diagram for AND, OR, and NOT logic with Examine ON and Examine OFF instructions used PLC programming. **[9]**

SECTION - II

Q6) Attempt any two of the following: **[18]**

a) Explain Machine Zero and Work Zero in CNC program.

b) Position and velocity sensors used in CNC machines.

c) Discuss Transfer lines with respect to components, applications, and benefits.

Q7) a) Explain any four geometry statements in part programming with APT. **[8]**

b) Explain the term Distributed Numerical Control. **[8]**

Q8) a) Explain closed loop positioning system in NC systems. **[8]**

b) Discuss Cutter compensation and tool length compensation with definition and application. **[8]**

Q9) a) Explain G02 and G03 commands blocks used in CNC turning with all details. **[8]**

b) Discuss the difference and applications of using speed per revolution and speed per minute in NC part program for turning. **[8]**

Q10) a) Explain concept of Sourcing and Sinking in PLC i/o with suitable circuit. **[8]**

b) Incremental positioning in NC part programming with suitable job profile. **[8]**

Total No. of Questions :6] **[Total No. of Pages : 4**

P1932

[3765]-12
M.E. (Civil) (Const. & Mgmt.)
HUMAN RESOURCE DEVELOPMENT IN CONSTRUCTION
(2002 Course) (Elective - I)

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

Instructions to the candidates:

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

SECTION - I

Q1) a) Highlight the historical progress of the HRD and HRM with examples, explain the efforts you would take as an HR manager to develop. **[10]**

i) Masons.

ii) Watchman.

iii) Site supervisor.

iv) Site engineer.

v) Project manager.

b) Elaborate the HR objective set by NTPC and explain the various efforts taken by their top management to achieve these objectives. **[4]**

c) What qualities are required to become a good HR manager? Explain. **[4]**

Q2) As a result of conducting the training needs assessment of site engineers executing nuclear power projects, on behalf of the contractor, the following findings emerged **[16]**

a) 70% of the personnel were not proficient in understanding the intricacies associated with such projects and 40% of theses personnel did not have any field experience associated with such execution.

P.T.O.

b) 30% personnel were unable to interprete the working drawings properly.

c) The execution required preparation of "Mockups" for very special items and getting them approved by the client, but no engineer was exposed to such a system, in their previous work experience.

d) 80% engineers were very good in execution of a specified work through use of a method control statement, nevertheless they lacked the co-ordination skills with various agencies involved.

e) 50% personnel were very poor in reporting systematically and promptly and hence the planning department was frequently under pressure.

f) 25% staff were not conversant with the use of latest construction materials, technique and machineries.

g) Site documentation was proper in general, but was not in accordance with the ISO 9001 : 2000 procedures.

h) 15% engineers were unable to use existing soft wares related to procurement, billing and MIS.

i) 65% of the staff faced a linguistic communication problem while dealing with the sub-contractors, labours and vendors because of multi-linguistic communications required.

j) Safety policies, procedures and techniques were not being implemented effectively on the site.

The client-contractor relationships were strained due to the above scenario. Also the progress of the site was very slow. As a result, the interim billing of the contractor was drastically affected.

The total number of site engineers associated were 20. The average yearly package of each engineer was Rs. 4 lakhs. The project packages, together value Rs. 3000 crores, expected to be completed within a period of 36 calendar months.

You are the HR manager of the contracting firm.

Design and develop a cost effective, training programme, taking due consideration of the various requirement of the training programs, traines and the trainees, in order to generate profit and credit worthiness from the site execution team. Make relevant, necessary assumptions.

Also prepare a feedback form for evaluating the training given.

Q3) a) Explain with examples, the various skills required by construction project leaders, Explain how the relative importance index is worked out. **[6]**

b) Explain the 3 leadership styles with proper examples. Which style is the best why. **[10]**

SECTION - II

Q4) a) Explain competency mapping w.r.t **[1+2+3+4]**

i) Concept.

ii) Advantages.

iii) Overall process.

iv) Benchmarking requirements for any one generic or functional competency.

b) Explain with examples, how the human resource function and the project quality get inter-related. How would you build the quality aspects in a HR programme. **[4+2]**

Q5) a) It was decided to evaluate the functional competencies of the project managers working company for the following functions. **[12]**

i) Project Management (PM).

ii) Cost Management (CM).

iii) Contracts Management (CTM).

iv) ISO systems Management (ISOM).

On a 10 point scale, the required proficiences for each of the above functions were benchmarked as follows.

i)	PM	-	10
ii)	CM	-	8
iii)	CTM	-	7
iv)	ISOM	-	9

As a result of the 360º feedback appraisal system, the following data was generated as regards a particular project managers available proficiency.

Function	Self Appraisal	Appraisal by General Manager	Appraisal by works managers				Appraisal by peer group			Appraisal by project Controller
			1	**2**	**3**	**4**	**1**	**2**	**3**	
PM	6	6	5.5	6	4	6	5	9	5.5	7
CM	7	6	6.5	6	4	7	6	9	7	6
CTM	8	7	7.5	9	4	8.5	7	8	7.5	7
ISOM	6	5.5	6	7	4	5.5	7	9	5	6

Your are the HR manager. Study the above 360º feedback carefully, and determine the (AP) for each function. Determine the gaps, suggest developmental programme for the project manager. Also try to analyse the possibilities of the human relations between the various personnel. Make your comments, based on certain assumptions, perceptions. Justify your action plan.

b) Draft the charter for benchmarking the responsibilities of either. **[6]**

i) Site engineer of an infrastructure project.

OR

ii) Faculty member at senior lecturer level associated with Civil Engineering. Make relevant assumptions.

Q6) a) With examples, explain the basic principles of learning. When, during any training programme there are variety of learners, what strategy you would adopt? **[4+2]**

b) You represent the Board of Governors of a MNC associated with Construction of infrastructure projects. Draft a **[6]**

i) Balanced Score Card and

ii) Personal Score Card for, evaluating performance of the Managing Director of the company. Assume relevant data.

c) Explain the procedure of training needs assessment and its importance in HRM. **[4]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1933

[3765] - 30
M.E. (Civil) (Hydraulics)
OPEN CHANNEL HYDRAULICS
(2002 Course)

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.*

SECTION - I

Q1) a) Define Uniform flow. Derive Chezy's formula for uniform flow in an open channel. **[6]**

b) What is a channel transition? State the various types of the channel transitions and their applications. **[6]**

c) Explain the various factors affecting the value of Manning's roughness coefficient n. **[6]**

Q2) a) Obtain, from the first principles, the expression for the loss of energy due to hydraulic jump in terms of depths before and after the jump. **[7]**

b) A rectangular channel 6 m wide conveys water at 11.50 m^3/s at a depth of 0.3 m. If a hydraulic jump occurs, find : **[5]**

i) Depth of flow after the jump.
ii) Power dissipated in the jump.
iii) Length of the jump.
iv) Height of the jump.
v) Froud number before and after the jump.

c) Define Hydraulic Jump and explain jump classification based on Froude Number. What are the practical applications of the jump? **[4]**

Q3) a) A rectangular channel 16 m wide carries a discharge at a normal depth of 3.2 m. The bed slope of the channel is 1 in 3600. If at a certain section the depth of flow is to be raised to 4 m by constructing a weir across the channel, determine how far upstream of this section the depth of flow would be within 10% of the normal depth. Use step method or graphical integration method and take only two steps. Take n = 0.016. Classify and sketch the profile. **[8]**

P.T.O.

b) Draw the flow profile when: **[8]**

i) Mild slope followed by a milder slope followed by a steep slope.

ii) Mild slope followed by a steep slop followed by mild slope.

Q4) a) A wide rectangular channel carries discharge of $5m^3$/Sec./m width, with a bed slope of 1 in 3600. If the depth of flow at a section in 3.5 m, determine how far upstream or downstream the depth of flow would be within 5% of the normal depth. Use step method & solve the problem by taking a single step. **[8]**

b) Explain the graphical integration method of varied flow equation for determining length of profile in open channel. **[8]**

SECTION - II

Q5) a) Write and explain the differential equation for spatial varied flow. **[8]**

b) Explain the various methods of profile computation in spatially varied flow. **[8]**

Q6) Write short notes on any 2 : **[16]**

a) Muskingham method of flood routing.

b) Differential form of momentum equation.

c) Standing progressive wave.

Q7) a) Explain in brief the equation of motion for stratified flow. **[8]**

b) Write short note on Turbulence theory. **[8]**

Q8) a) Write short notes on : **[8]**

i) Mach cone, Mach line, Shock waves

ii) Energy Equation for compressible fluid

b) Find the sonic velocity for the following fluids : **[10]**

i) Crude oil of specific gravity 0.8 and bulk modulus of 1530 MN/m^2.

ii) Mercury having a bulk modulus of 26487 MN/m^2.

iii) A schlieren photograph showing the wave formed by a bullet moving in air gave a Mach angle of 40°. Find the speed of the bullet if the pressure and temperature of the atmosphere are 88.3 KN/m^2 and -2°C respectively.

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Total No. of Questions : 10] [Total No. of Pages :3

P1934

[3765] - 67
M.E. (Mechanical) (Design Engg.)
PROCESS EQUIPMENT DESIGN
(2002 Course) (Elective - I) (Theory)

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 is allowed.***
7) ***Assume suitable data, if necessary giving reasons.***

SECTION - I

Q1) a) Calculate thickness of a torrispherical head (100-6) and elliptical head (2:1) and hemispherical head for a pressure vessel having design pressure of 6Kg/cm^2. Diameter of vessel 1.5 m and the permissible pressure 1200 kg/cm^2, weld joint efficiency is 90%. **[8]**

b) Discuss the deign considerations of pressure vessel. **[8]**

Q2) a) Describe construction and working for any one type of storage tank for volatile liquids. How the thickness of tank is determines? **[8]**

b) What are different type materials preferred for elevated and very low temperatures for process equipment and Why? **[6]**

c) Name the various types of losses in fixed volume tanks? **[2]**

Q3) a) Discuss the step by step procedure for design of tall vessels. **[6]**

b) Explain following aspects related to design of flanged joint for pressure vessel. i) Design considerations ii) Effective gasket width iii) Gasket seating force iv) Flange thickness determination v) Bolt design. **[10]**

P.T.O.

Q4) a) Explain saddle support and its design. **[6]**

b) A pressure vessel is to be designed for an internal pressure of 0.5N/mm^2. The vessel has nominal diameter of 1.5 m. The material used for vessel has permissible stress of 140N/mm^2. If the weight of vessel and its content is 3200kg and torque due to offset piping is 600 N.m. Find stresses due to combined loading. **[10]**

Q5) Explain with neat sketches (any three) : **[18]**

a) Different types of heads for pressure vessels.

b) Theories of failure.

c) Nozzle reinforcement.

d) Protective coatings and their applications.

SECTION - II

Q6) a) What is a high pressure vessel? Explain various types of constructions used in high pressure vessels. **[8]**

b) A high pressure vessel is to be operated al 120 MN/m^2. The inside diameter of vessel is 30 cm. The material for vessel is steelwith yield stress of 450 MN/m^2. Estimate the all thickness using maximum shear stress theory with factor of safety of 1.6. **[4]**

c) What are leaf filters? What are design its design considerations? **[4]**

Q7) a) Explain following with respect to columns. i) Column reflux ii) Bottom product iii) Stripping. **[6]**

b) Sketch and explain various types of shell and tube heat exchangers.**[10]**

Q8) a) Explain functions of evaporators, dryers and crystallizers. Give classification of crystallizers. **[6]**

b) Differentiate between vacuum filters and centrifugal filters. **[4]**

c) Explain principal of film drum dryer. State its applications. **[4]**

d) What is a reboiler? **[2]**

Q9) a) Classify agitators giving their sketches and applications. How the power requirement of agitator is calculated? **[8]**

b) What are integral, fabricated and formed nozzles? **[6]**

c) What are different types of entrainment separators? **[2]**

Q10) Explain with sketches (any three) : **[18]**

a) Sources of hazards in process industry and safety measures.

b) Optimization techniques.

c) Process Flow Diagrams.

d) Cyclone separators.

e) Testing and inspection of pressure vessels.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1935

[3765] - 268

M.E. (Chemical)

CATALYSIS AND SURFACE PHENOMENON

(2002 Course)

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

Instructions to 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.***

SECTION - I

Q1) Define catalysis & give its classification and discuss the preparation of Catalysis using Industrial method. **[16]**

Q2) Derive the equation for surface area determination using BET method. **[16]**

Q3) Discuss the characterization of catalysis using
a) NMR method. **[8]**
b) XPS method. **[8]**

Q4) Write short notes on: **[18]**
a) Raman and Masbauar spectroscopies.
b) Kinetics of deactivation.
c) Zeolites.

SECTION - II

Q5) Discuss the chemistry & thermodynamics of adsorption. **[16]**

Q6) What are the different types of adsorption? Discuss any 4 types. Write all necessary equations and draw the nature of plots. **[16]**

P.T.O.

Q7) Derive the equation for Effectiveness factor and Thiele modulus in catalysis. **[16]**

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

a) Catalyst regeneration.

b) Fluidized bed reactor.

c) Heat & Mass Transfer in catalysis.

Total No. of Questions : 6] [Total No. of Pages : 2

P1936

[3765] - 404

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

NEW CONSTRUCTION MATERIALS

(2008 Course) (Elective)

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

Instructions to the candidates:

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

SECTION - I

Q1) What is FRP? Which are the various types of fibres used? What are advantages of steel fibres over other types? Which are the various applications where FRP is easily used? **[18]**

Q2) What are the characteristics of nuclear radiations? What are their effects? How can these be attenuated? Explain with a detail experimental programme. **[16]**

Q3) Which are the various eco-friendly materials? What are their advantages? How is the leed rating decided? How the Government is promoting use of green construction? Explain. **[16]**

SECTION - II

Q4) With neat labelled sketches explain. **[18]**

a) L box test.

b) J Ring Test.

c) Flow table test.

d) All in one test for SCC.

P.T.O.

Q5) Explain the production process of flyash clearly indicating its characterization. Discuss any 3 practical applications where flyash is significantly used. What are problems involving use of flyash? Explain. **[16]**

Q6) Explain in brief. **[16]**

a) Types of silica-fume products.

b) GFRC applications in Civil Engineering.

c) Smart materials applications in construction.

d) Various construction chemicals with their applications (Any 4).

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Total No. of Questions :8] **[Total No. of Pages : 2**

P1937

[3765]-491
M.E. (Mechanical Engg.) (Heat Power)
COMPUTATIONAL FLUID DYNAMICS
(2008 Course)

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

Instructions to candidates:

1) ***Answer any three questions from each section.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic tables, slide rule and non-programmable calculator is allowed.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) Consider a developing flow between two parallel plates. The flow can be assumed to be two dimensional.

a) What are the governing equations in discretised form? **[6]**

b) Present the algorithm for determining pressure (SIMPLE). **[12]**

Q2) Consider quasi-one dimensional compressible flow in a nozzle.

a) Write the simplified governing equations for this case. **[8]**

b) Solve the continuity equation using the MacCormack method. **[8]**

Q3) For supersonic flow over a flat plate.

a) Write the full governing equations. **[6]**

b) Present the algorithm for updating u, the x-component velocity. **[10]**

Q4) a) When is relaxation method used. Outline the method with an example. **[6]**

b) What are numerical dissipation and dispersion. Give one example for each. **[6]**

c) If there is a wave with a sudden jump in its amplitude, how will numerical dissipation and dispersion distort the solution. **[4]**

P.T.O.

SECTION - II

Q5) Consider a square ABCD of length L as the control volume in a flow domain:

a) Apply mass conservation. **[6]**

b) Apply momentum equation in terms of momentum flux and shear stress.
Assume face and cell centre values are known. **[12]**

Q6) Consider one dimensional transient conduction equation :

a) Write the expression for the explicit method. Derive the stability criterion. **[10]**

b) Present the implicit algorithm. What is the stability criterion? **[6]**

Q7) Write the equation for two-dimensional transient conduction. Present the algorithm for solving it using the Alternating Direction Implicit (ADI) scheme. What is the main advantage of this scheme? **[16]**

Q8) Consider the linear wave equation.

$$u_t = au_x$$

a) Outline the Lax-Wendroff method to solve this equation. **[6]**

b) What is the order of accuracy? **[6]**

c) What is the stability criterion? **[4]**

# # # #

Total No. of Questions : 6] [Total No. of Pages : 2

P1938

[3765] - 545

M.E. (Electrical-Power Systems)

ARTIFICIAL INTELLIGENCE AND ITS APPLICATIONS IN POWER SYSTEMS

(2008 Course) (Elective - I)

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 wherever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) Explain 'Predictive Logic' with reference to following points giving examples : **[25]**

a) Syntax of PL(2).

b) Semantics of PL(2).

c) Properties of semantic.

d) Basic derivations.

e) Resolution.

Q2) a) What is Artificial Intelligence? Explain key components of AI. **[7]**

b) Explain any three learning tasks performed by neural network. **[8]**

c) Explain how fuzzy logic and Artificial Neural Network can be used for power system operation, planning and protection. **[10]**

Q3) a) Explain with mathematical formulae the method of generation of membership function. **[12]**

b) Explain fuzzy relations. Also explain different operations on fuzzy relations. **[13]**

P.T.O.

SECTION - II

Q4) a) Define artificial neural network. Explain with neat diagram, working of artificial neuron. **[10]**

b) Explain the role of 'activation function'. Explain following activation functions with mathematical expression : **[8]**

i) Linear function.

ii) Sigmoid function.

iii) Threshold function.

c) Explain different properties of artificial Neural network. **[7]**

Q5) a) Explain following learning methods : **[20]**

i) Learning with a teacher.

ii) Learning without a teacher.

iii) Error correction learning.

iv) Competitive learning.

b) What is the 'concept of generalization'? **[5]**

Q6) Differentiate between single layer perceptron and multilayer perceptron. Describe the structure of MLP. Explain in detail; 'Error back-propagation algorithm'. **[25]**

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Total No. of Questions : 6] [Total No. of Pages : 2

P1939

[3765] - 553

M.E. (Electrical) (Power System)

PARTIAL DISCHARGES IN ELECTRICAL POWER APPARATUS

(2008 Course)(503212)

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 wherever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Define following terms : **[8]**

i) Partial Discharges.

ii) Partial Discharge Intensity.

iii) Apparent Charge.

iv) Repetition Rate.

b) Draw an equivalent circuit diagram of a simple insulation arrangement, indicating formation of partial discharges. Clearly indicate the capacitance of the cavity in the dielectric, capacitance which takes into consideration those field lines that emanate from the electrodes and end in the cavity and capacitance of the fault-free component of the test object. **[12]**

c) Explain internal discharges in composite insulation system. **[5]**

Q2) a) Draw a neat sketch of straight detection method used for partial discharge measurement. Explain function of each component. **[15]**

b) Discuss basic principle of operation of calibration of PD measuring setup. **[10]**

P.T.O.

Q3) Write short notes on :

a) Screening and Filtering problems during partial discharge measurements. **[15]**

b) Surface discharges and corona discharges in electrical insulation system. **[10]**

SECTION - II

Q4) a) Discuss effects of partial discharges on gaseous insulating materials. **[10]**

b) Explain effects of partial discharges on mixed dielectrics. Enlist various factors which affect partial discharge inception voltage magnitude in case of mixed dielectrics. **[15]**

Q5) a) Derive an expression for relation between measured and actual charge developed in composite insulation system subjected to partial discharge. **[12]**

b) Explain clearly the relation between the time dependent occurrence of partial discharges and the extent of damage due to it. **[13]**

Q6) Write short notes on :

a) Partial discharge location according to pulse spacing method. **[13]**

b) Reflection and superposition effects in measurement and location of partial discharges developed in insulation system. **[12]**

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Total No. of Questions : 8] [Total No. of Pages : 3

P1940

[3765]-666
M.E. (Chemical)
PROCESS OPTIMIZATION
(2008 Course) (Open Elective)

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

Instructions to the candidates:

1) *Answer any three questions from each section.*
2) *Assume data wherever necessary.*

SECTION - I

Q1) a) Formulate a suitable objective function that minimizes the capital cost of a cylindrical pressure vessel. **[8]**

Data :

i) Heads are ellipsoidal 2:1 ratio with area of one end = 1.21 D^2.

ii) The cost of fabrication for ends in higher than the sides by a factor of 1.2.

iii) Thickness, t = 0.011 D + 0.195. By suitable assumptions get (L/D) optimum.

b) The rate of heat loss from a large insulated cylinder, is given as under,

$$Q = \frac{A\,\Delta T}{x / k + 1/h_c}$$

where, ΔT is average temp. difference between pipe fluid and surrounding temperature, A surface area of pipe, x thickness of insulation, h_c outside h.t.c., k thermal conductivity of insulation, Q rate of heat loss.

The cost of installed insulation per unit area is represented by $C_0 + C_1 x$, where C_0 and C_1 are constants (C_0 = fixed, C_1 = incremental). The insulation has a lifetime of 10 years and must be replaced at that time. The borrowed funds are to be repaid in 10 equal installments.

Formulate the objective function to maximize savings in operating costs and obtain optimal solution for x. (Do not consider interest component in returning borrowed funds). **[9]**

Q2) Get the local minimum of the function $f(x) = x^2 - 2x$ in the range [–1, 3] with tolerance $\in = 0.001$ by any of the following methods. **[17]**

a) Exhaustive search method or

b) Golden section search method.

Write neat algorithm and demonstrate at least 2 iterations.

P.T.O.

Q3) Get the minimum of the function $f(x) = x^4 + 3x^3 - x^2 + 6$ in the range [–4, +2] with tolerance $\in = 0.001$ by any of the following methods. **[17]**

a) Newton Raphson Method or

b) Cubic search method.

Write neat algorithm and demonstrate at least 2 iterations, for the method of your choice.

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

a) Optimality criteria.

b) Objective function.

c) Constraints.

d) Degree of freedom.

SECTION - II

Q5) Minimize the function

$f(x) = \left(x_1^2 + x_2 + 20\right)^2 + \left(x_1 + x_2^2 - 12\right)^2$ by using

a) Evolutionary optimization method.

Given : start point = $x^0 = (1, 1)^T$

Tolerance = $\in = 0.001$

Size reduction parameter = $\Delta = (2, 2)^T$

OR

b) Simplex method

Given : $\gamma = 1.5$, $\beta = 0.5$

Tolerance = $\in = 0.001$

Initial simplex at $(0, 0)^T$, $(4, 0)^T$, $(2, 2)^T$

Demonstrate at least 2 iterations for any method you choose and write algorithm for the same. **[17]**

Q6) Minimize the function $f(x) = \left(x_1^2 + 2x_2 + 15\right)^2 + \left(x_1 + 2x_2^2 - 14\right)^2$

subject to $g_1(x) = 16 - (x_1 - 3)^2 - x_2^2 \geq 0$

$g_2(x) = 10 - 2x_1 - 3x_2 \geq 0$

$x_1, x_2 \geq 0$

Choose four points $x^{(1)}, x^{(2)}, x^{(3)}, x^{(4)}$ of your choice to initiate. Find u vectors to check Kuhn Tucker conditions. Explain Kuhn Tucker's Necessity Theorem based on above example. **[17]**

Q7) a) Objective function, $f(x) = (x_1 - 7)^2 + (x_2 - 3)^2 + 2$ find minima of the function by any method and demonstrate that the point satisfies necessary and sufficient condition for the minimum. **[9]**

b) Objective function, $f(x) = 5x_1^2 + 2x_2^3 + 3x_2^2 + 6x_1 x_2 + 9x_1 + 3x_2$ find the stationary points and classify them using Hessian Matrix. **[8]**

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

a) Kuhn Tucker conditions.

b) Steepest Descent methods.

c) Convexity of a function.

d) Local V_s Global optima.

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Total No. of Questions : 8] [Total No. of Pages : 3

P1941

[3765] - 673

M.E. (Chemical)

ADVANCED REACTION ENGINEERING

(2008 Course)

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

Instructions to the candidates:

1) ***Answer any three questions from each section.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Your answers will be valued as a whole.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) Explain langmuir Hinshelwood model in details. How the mechanism of solid catalyzed gas phase reaction be guessed based on reaction rate expression? Explain it for a kinetically controlled mechanism. **[17]**

Q2) Catalytic oxidation of ethanol over a solid catalyst takes place as under,

$$C_2H_5OH + \frac{1}{2}O_2 \rightarrow CH_3CHO + H_2O$$

Following mechanism is proposed

Step (1) Ethanol gets adsorbed on one type of site S. O_2 gets adsorbed on different type of site S'. Ethanol undergoes dissociative adsorption on two types of S sites.

$$C_2H_5OH + 2S \rightleftharpoons C_2H_5O.S + H.S$$

Step (2) O_2 undergoes dissociative adsorption on two types of S' sites.

$$O_2 + 2S' \rightleftharpoons 2O.S'$$

Following assumptions are done.

a) Rate Determining step is

$C_2H_5O.S + O.S' \rightarrow C_2H_5OH.S' + S$

b) $OH.S' + H.S \rightleftharpoons H_2O + S + S'$

Show that Initial Rate Law is

$$-r_{Ao} = \frac{K\, P_A^{1/2}\, P_{o_2}^{1/2}}{(1+K_{o_2}^{1/2}\, P_{o_2}^{1/2}) + (1+2K_A^{1/2}\, P_A^{1/2})}$$

where, $A = C_2H_5OH$ **[17]**

Q3) What are the relative rates of transport of A through stagnant gas and equal molar counter diffusion for the same concentration boundary conditions. Obtain equation of flux through stagnant film. Explain both analytically and with help of plot of y_A (mole fraction of solute in film) Vs z/δ (dimensionless distance in film) where δ = film thickness, in what regions of z/δ does diffusive flux dominates bulk flux. Why? **[17]**

Q4) Write short notes (any 3) : **[16]**

a) Rideal Eiley Model.

b) Internal Diffusion Controlled Reaction.

c) Two parameter model.

d) Scale Up of a reactor.

SECTION - II

Q5) Define Thiele modulus. What is its significance in catalytic reaction engineering? Discuss at length by deriving equation for Thiele modulus.**[17]**

Q6) What is effectiveness factor, η? How its value influences design of reactor?

Derive the relation $\eta = \frac{3}{\phi_1^2}[\phi_1 \coth \phi_1 - 1]$.

What is a characteristic length of a catalyst pellet? **[17]**

Q7) Show that E(t) for two CSTRs in series having different volumes is,

$$E(t) = \frac{1}{\tau(2m-1)}\left\{\exp\left(\frac{-t}{\tau\, m}\right) - \exp\left(\frac{-t}{(1-m)\tau}\right)\right\}$$

Where, $\tau = \frac{v_1 + v_2}{\vartheta_0} = \frac{v}{\vartheta_0}$

$$m = \frac{v_1}{v_1 + v_2}$$

Make a plot of E(t) Vs t/τ for m = 0.1 for τ = 10 min. **[17]**

Q8) Write short notes on (any 3) : **[16]**

a) Diffusion through stagnant gas.

b) Weisz Prater Number.

c) RTD in PFR.

d) Rate Law Equation.

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Total No. of Questions :8] **[Total No. of Pages : 2**

P1942

[3765]-579

M.E. (E & TC/ Electronics) (VLSI & Embedded Systems)

MEMORY TECHNOLOGIES

(Elective - II) (2008 Course) (Sem. - I)

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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Compare DCTL and ECL bipolar SRAM technologies. **[8]**

b) What is SOI technology? Enlist different SOI technologies. Hence draw and explain cross section of thin film SOI CMOS inverter. **[10]**

Q2) a) Compare and Contrast bipolar and CMOS PROMs. **[8]**

b) What is FLOTOX technology? Draw schematic of FLOTOX transistor structure and explain its operation with an energy band diagram. **[8]**

Q3) a) Explain pattern sensitive faults. Support your answer with a suitable schematic. **[8]**

b) Draw basic scheme for pseudo random testing and explain. **[8]**

Q4) a) Explain stack capacitor cell. What are its advantages over trench capacitor cell? **[8]**

b) Write a short note on flash memory cell. **[8]**

P.T.O.

SECTION - II

Q5) a) Comment on semiconductor dielectric interface failures. **[8]**

b) Explain the following charge loss mechanisms for EPROMs.

i) DC Erase.

ii) Program Disturb.

iii) DC Programming.

iv) Charge loss due to bake stressing. **[8]**

Q6) a) Explain total dose effect. **[8]**

b) Discuss radiation hardening process issues. **[10]**

Q7) a) Explain principle, construction and operation of FRAM cell. **[8]**

b) Write a short note on MRAM (Magneto-resistive RAM) **[8]**

Q8) a) Compare insertion mount and surface mount technology with reference to memory packaging technology. **[8]**

b) Explain 3-D memory cube technology. **[8]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1944

[3765]-636
M.E. (Computer Engineering)
INFORMATION AND NETWORK SECURITY
(2008 Course) (510105)

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 table is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Enlist and discuss steps necessary for creating information security policy. **[8]**

b) Explain, what are the principles of Data Security Architecture? **[6]**

c) Describe the various types of passive and active security attacks. **[4]**

Q2) a) Explain the principles of Public Key Cryptography. Explain RSA Public Key Encryption algorithm. **[8]**

b) Explain in brief any method for key management in public-Key encryption. **[8]**

Q3) a) Why do some block cipher modes of operation only use encryption while others use both encryption and decryption? **[8]**

b) What is the difference between differential and linear cryptanalysis? **[8]**

Q4) Write Short Notes on (Any Three) : **[16]**

a) Security aspects of Biometric devices.

b) Security mechanisms.

c) Internet security models.

d) ARP Attacks.

SECTION - II

Q5) a) Show and explain two ways in which the IPSec authentication service can be used. **[8]**

b) What are the basic approaches to bundling SAs? **[6]**

c) What is a reply attack? **[4]**

Q6) a) What is the difference between a packet-filtering router and a stateful inspection firewall? **[8]**

b) What is reference monitor concept? What properties are required of a reference monitor? **[8]**

Q7) a) An electronic mail system could be used to leak information. First, explain how the leakage could occur. Then, identify controls that could be applied to detect or prevent the leakage. **[8]**

b) What is the difference between direct and arbitrated digital signature? **[8]**

Q8) Write Short Notes on (Any Three) : **[16]**

a) Session key management.

b) PKI components.

c) Byzantine generals.

d) Issues in wireless networks security.

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Total No. of Questions : 8] [Total No. of Pages : 3

P1947

[3765]-52
M.E. (Mech. Engg.) (Heat Power)
ADVANCED HEAT TRANSFER
(2002 Course)

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) Derive three dimensional heat conduction differential equation with heat generation in cylindrical co-ordinates. **[8]**

b) A refrigerant suction having outer diameter 30 mm is required to be thermally insulated. The outside airfilms coefficient of heat transfer is 12 W/m^2K. Thermal conductivity of insulation is 0.3 W/mK. **[8]**

i) Determine whether the insulation is effective.

ii) Estimate the maximum value of thermal conductivity of insulating material to reduce heat transfer.

iii) Determine the thickness of cork insulation to reduce the heat transfer to 22% if K value of cork is 0.038 W/mK.

Q2) a) Sketch the profiles of velocity boundary layer and thermal boundary layer for a Prandtl no. values of **[8]**

i) $P_r = 1.0$

ii) $P_r << 1.0$

iii) $P_r >> 1.0$

Explain the physical phenomenon involved.

b) A steel tube carries steam at a temperature of 320ºC. A thermometer pocket of iron (K = 52.3 W/mK) of inside diameter 15 mm and 1 mm thick is used to measure the temperature, the error to be tolerated is 1.5% of maximum. Estimate the length of the pocket necessary to measure the temperature with in this error. The diameter of steel tube is 95 mm.

Assume h = 93 W/m^2K and tube wall temperature is 120ºC. Suggest a suitable method of locating the thermometer pocket. **[8]**

Q3) a) A cylindrical ingot 10 cm diameter and 30 cm long passes through a heat treatment furnace which is 6 meter in length. The ingot must reach a temperature of 800ºC before it comes out of the furnace. The furnace gas is at 1250ºC and ingot initial temperature is 90ºC. What is the maximum speed with which the ingot should move in the furnace to attain the required temperature? **[10]**

Take h = 100 W/m^2K
K (steel) = 40 W/m^2K and
$\alpha = 1.16 \times 10^{-5}\ m^2/s$

b) Explain : **[8]**

i) Reynolds Analogy.
ii) Coleburn Analogy.
iii) Nusselt Number & Stanton No.

Q4) Write notes on any three : **[16]**

a) Heisler-Grober charts.

b) Blasius method for flow over a flat plate.

c) Crank-Nicholson Scheme.

d) Fin-efficiency & fin effectiveness.

SECTION - II

Q5) a) Show from first principles **[11]**

$$\text{Grashof number} = \frac{(\text{Buoyancy force})(\text{Inertia force})}{(\text{Viscous force})^2}$$

Explain the physical meaning of G_r, P_r and N_u.

b) Develop the Integral equation for the problem of Heated Vertical plate. **[7]**

Q6) Write notes on (any four) : **[16]**

a) Nucleate pool boiling.

b) Dropwise condensation promotors.

c) Correlations for heated vertical plate and horizontal cylinder under natural convection.

d) Heat pipe applications.

e) Ablation phenomenon.

Q7) a) Explain the quantum and classical theory of Thermal radiation. State and explain the Planck's law and Rayleigh-Jeans law. **[10]**

b) What is a radiation shield? Discuss two important applications of radiation Shields. **[6]**

Q8) a) Calculate the radiation equilibrium temperature of the roof of a house exposed to a solar flux of 300 W/m^2 and a surrounding temperature of 25ºC if the roof is (i) made of white marble (α = 0.46, ε = 0.95) or (ii) coated with black paint. (α = 0.97, ε = 0.97). Neglect convection. **[10]**

b) Explain the electrical analogy for solving radiation heat transfer problems. **[6]**

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Total No. of Questions : 8] [Total No. of Pages : 5

P1948

[3765]-477
M.E. (Mechanical Engg.) (Heat Power Engg.)
REFRIGERATION TECHNOLOGY
(2008 Course) (Elective - I) (502104 - B)

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

Instructions to the candidates:

1) *Q. No. 1 is compulsory.*
2) *Solve any two questions from Q. No. 2, Q. No. 3 and Q. No. 4.*
3) *Q. No. 5 is compulsory.*
4) *Solve any two questions from Q. No. 6, Q. No. 7 and Q. No. 8.*
5) *Use of refrigerant property tables, thermodynamic charts, psychrometric charts, calculator and log table are allowed.*
6) *If required, assume suitable data, cases, conditions, etc. with supportive justifications.*
7) *Use dark graphite pencils, ball point pens to mark the cycles, etc. on the thermodynamic charts.*

SECTION - I

Q1) a) Explain the effect of following properties of refrigerant on the performance of refrigeration system. **[8]**

i) Volumetric heat capacity.
ii) Viscosity.
iii) Surface tension, and
iv) Vapour density.

b) Evaluate the thermo-electric refrigeration technology with its pros and cons and mention few of its applications. **[6]**

Q2) Evaluate the performance of the refrigeration system with R22 refrigerant for the cycle layout in Fig.0 1. **[18]**

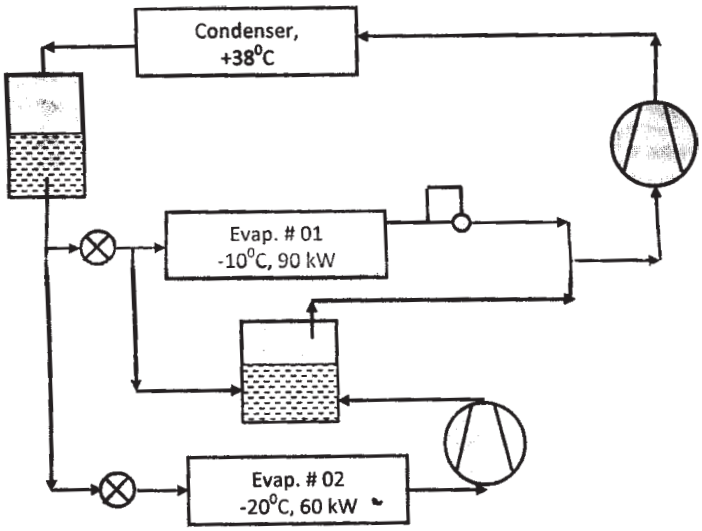

Fig. 01

P.T.O.

Find :

a) Specific refrigeration capacity of each evaporator.

b) Theoretical discharge temperature of compressor.

c) Theoretical COP of the system.

d) Sketch the cycle on the P-h diagram.

Q3) Find actual COP and actual refrigeration capacity in kW for the refrigeration plant in Fig.02 with R717 as refrigerant. **[18]**

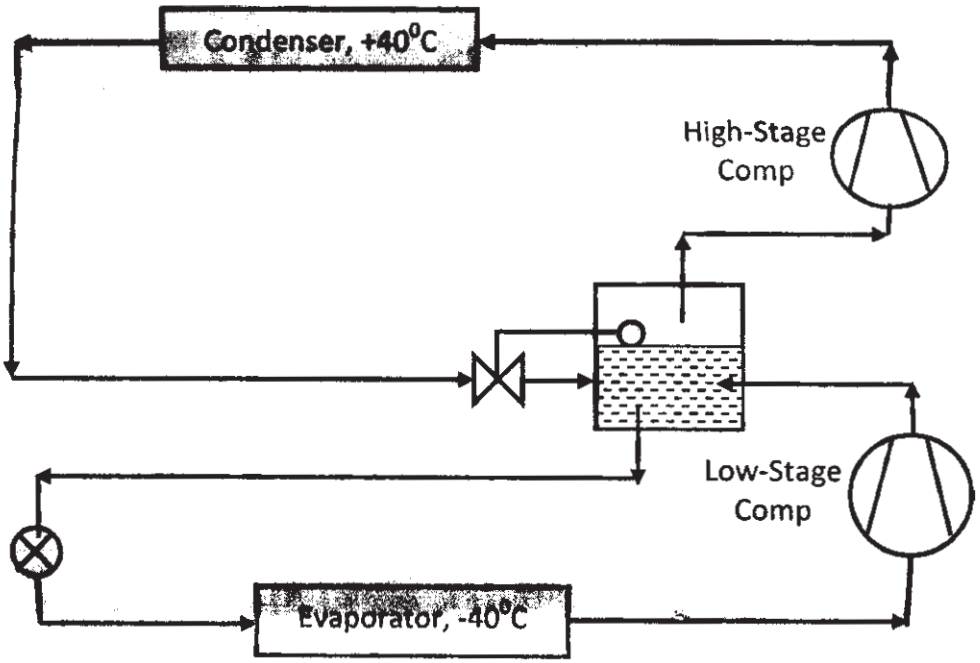

Fig. 02

Assume :

a) Isentropic efficiency : 78% for high stage compressor and 70% for low stage compressor.

b) Volumetric efficiency is 85% of both the compressors.

c) Refrigerant is subcooled to 36°C at condenser exit.

d) Speed of low stage compressor is 1500 rpm and high stage compressor is 2000 rpm.

e) Displacement capacity is 150 CC of low stage compressor and 200 CC of high stage compressor.

f) Superheat setting of TXV of evaporator is 8°C.

Q4) A refrigeration plant is required for multi-temperature chamber cold storage located in Solapur. The weather design conditions are DBT 40°C, WBT 28°C. The other details of the refrigeration plants are as follows : **[18]**

a) Positive temperature chamber # 01 = DBT (+) 5°C, RH 80%, 150 TR.

b) Negative temperature chamber # 02 = DBT (–) 10°C, RH 40%, 100 TR.

c) Electrical motor efficiency = 98%.

d) Transmission efficiency = 90%.

e) Volumetric efficiency of the high and low stage compressor = 72%.

f) Displacement capacity of LP compressor = 400 CC.

g) Displacement capacity of HP compressor = 350 CC.

It is recommended to use DX evaporators and air cooled condensers for the refrigeration plant. Recommend the system with emphasis on energy efficiency. Further evaluate the system for actual COP, total electrical motor power consumption and discharge temperature at the high pressure compressor exit. Give the break-up of number of LP and HP compressors are required for the plant.

SECTION - II

Q5) a) Classify the electrical motors. Explain the variable speed electrical motor with its load characteristics and benefits. **[8]**

b) Discuss the following terms in short with thermodynamic charts, etc. **[6]**

i) Approach temperature.

ii) Temperature range.

iii) Temperature glide.

Q6) A food processing plant in Mumbai has requirement of hot and cold utilities at the following conditions : **[18]**

a) Chilled water 500kg/hr at outlet 5°C and inlet 10°C.

b) Brine solution 350kg/hr at outlet-10°C and inlet-3°C.

c) Hot water 200kg/hr at outlet 60°C and inlet 45°C.

Enlist the strategies considered for the maximum energy savings in the refrigeration plant. Assume following data. Clean water is available at the plant locations.

i) Motor efficiency = 97%.

ii) Transmission efficiency = 89%.

iii) Isentropic efficiency of the compressors = 86%.

iv) Volumetric efficiency of the compressor = 72%.

v) Volumetric capacities of the available compressors are in range 200 CC, 250 CC, 300 CC and 350 CC for high and low pressures.

Consider the following weather data for the Mumbai city.

Month	Jan	Feb	Mar	April	May	June
DBT, °C	20	25	31	36	39.4	35
WBT, °C	17	20	28	34	32	33
Month	July	August	Sept	Oct	Nov	Dec
DBT, °C	33	29	28	29	27	23
WBT, °C	29	24	23	24	25	19

Q7) Design the refrigeration plant for producing chilled water 4000 kg/min at supply temperature 5°C for ready mix concrete manufacturing plant. It is necessary to design the projects. Design ambient conditions are DBT 45°C and WBT 32°C. Justify the cycle layout of the plant with its P-h chart for energy saving. Assume the data : compressor volumetric capacity 150 CC at 2000 rpm. Isentropic efficiency of the compressor is 79% and volumetric is 85%, mechanical efficiency 89% and transmission efficiency 92%.

Draw the P-h chart and plant layout. Summarize the design for the actual COP, evaporator capacity and power consumption of the electrical motor. **[18]**

Q8) Write key applications of cascade refrigeration system. Evaluate cascade refrigeration system in Fig. 03 for its actual combined COP, high cycle evaporator capacity, power consumption of the low and high cycle compressors and number of compressors required in stage. Recommend the speeds of the compressors of low and high cycle. **[18]**

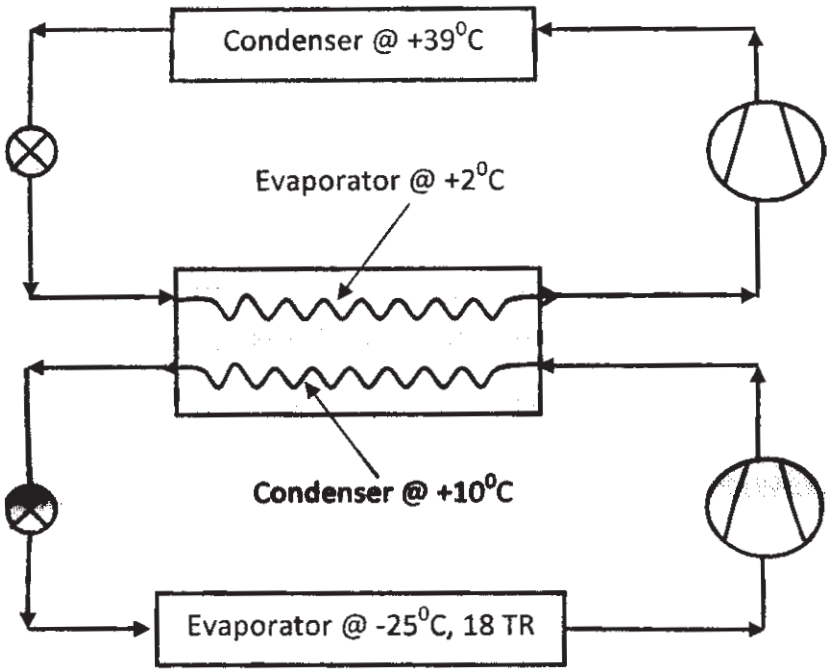

Fig. 03

Assume following data :

- Low cycle compressor
  a) Isentropic efficiency : 65%.
  b) Volumetric efficiency : 75%.
  c) Displacement : 200 CC.
- High cycle compressor
  a) Isentropic efficiency : 64%.
  b) Volumetric efficiency : 70%.
  c) Displacement : 250 CC
- Refrigerant in low cycle : R717
- Refrigerant in low cycle : R22

Check the possibility of generation of hot water and report mass flow and temperature of hot water possible from the plant. Plot the cycle on P-h and P-s chart.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1949

[3765]-50
M.E. (Mech.) (Heat Power)
ADVANCED THERMODYNAMICS
(2002 Course)

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) Write vander Waal's equation of state and explain all the terms included in it. **[3]**

b) Describe the generalized compressibility chart and state why it is constructed on the basis of reduced properties. **[6]**

c) Define second law efficiency. How it is different from first law efficiency in case of steam turbine? **[7]**

Q2) a) 10kg of water at 80°C is mixed with 5kg of water 55°C. Determine the change in entropy. Also find the loss of availability when the surrounding temperature is 30°C. **[9]**

b) State and explain Helmholtz and Gibb's functions. **[7]**

Q3) a) Discuss the significance of Maxwell relations in thermodynamic studies. **[6]**

b) Starting from fundamentals derive Clausius Clayperon's equation. **[6]**

c) Write a note on Inversion curve. **[4]**

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

a) Enthalpy departure.

b) PVT-surface of water.

c) Availability and irreversibility.

d) T-ds equations.

P.T.O.

SECTION - II

Q5) a) An insuated chamber is divided into two compartments by a thin partition, the size of each one is $0.125m^3$ and $0.1m^3$ respectively. Larger compartment contains oxygen at 350 kPa and 40^oC while the smaller one contains Nitrogen at 700 kPa and 100^oC. The partition is removed and gases are allowed to mix. Calculate : **[12]**

i) Sp. gas constant C_v and final temp. of mixture.

ii) Change of entropy. Take the values of C_v for O_2 and N_2 as 0.65 and 0.743 kJ/kg K respectively.

b) Explain the concept of heat of reaction. **[4]**

Q6) a) Explain with a suitable sketch, the model proposed in Bose-Einstein statistics. **[9]**

b) Write a note on adiabatic flame temperature. **[7]**

Q7) a) What is fugacity and activity? Explain. **[6]**

b) Explain : **[10]**

i) Amagat's law.

ii) Kay's rule.

iii) Dalton's law of partial pressure.

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

a) Gibb's phase rule.

b) Bose-Einstein statistics.

c) Thermal death of universe.

d) Fermi-Dirac statistics.

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Total No. of Questions : 8] [Total No. of Pages :2

P1950

[3765] - 113

M.E. (Electronics / E & TC) (Micro Wave Columon)

MICRO ELECTRONICS

(2002 Course)

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

Instructions to the candidates:

1) *Answer any 3 questions from each section.*
2) *Assume suitable data, if necessary.*

SECTION - I

Q1) What are the various regions of CMOS Inverter, explain through suitable diagram. Discuss in detail device state in each region and VI characteristics. What is effect of B_n/B_p ratio on transfer characteristics. Draw a structural diagram. **[16]**

Q2) a) Write VHDL code for 8 : 1 Mux using different WHEN, SELECT, statements. **[8]**

b) What is Domino Logic? Explain Domino AND gate in detail, comment on inverter at the O/P of Domino gate. **[8]**

Q3) a) Design CMOS Logic gates for the following functions. **[10]**

i) $f = \bar{x}_1 + \overline{X}_2 . \overline{X}_3$

ii) $f = \overline{X}_1 + (\bar{x}_2 + \bar{x}_3)\overline{X}_2$

iii) $f = \overline{y_1 \; y_2 \; y_3 + y_4}$

b) Compare synchronous & asynchronous machine in detail. **[8]**

Q4) a) Design a Moore Machine (synchronous) to detect over lapped 1010 sequence. **[8]**

b) What is transistor sizing? Derive the relationship between the width of n & p banks of MOSFETs. **[8]**

P.T.O.

SECTION - II

Q5) a) Draw state diagram & VHDL code for traffic light controller. **[8]**

b) Describe about the transmission gates, explain and draw AND gate using transmission gates. **[8]**

Q6) a) Draw and explain about the architecture of CPLD. **[8]**

b) Explain the following attributes with suitable examples.

i) EVENT ii) DELAYED **[8]**

Q7) a) Draw a transistor schematic of 2 i/p Nand gate and its respective stick diagram. **[8]**

b) What are the limitation of silicon logic? List the features of material used to design ultra fast VLSI circuits. **[8]**

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

a) Clock distribution.

b) Test Bench, their types.

c) Non synthasizable VHDL constructs.

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Total No. of Questions : 6] [Total No. of Pages : 2

P1951

[3765]-121
M.E. (VLSI & Embedded System)
FAULT TOLERANT SYSTEM DESIGN
(2002 Course)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data if necessary.***

SECTION - I

Q1) a) Explain Binary Decision Diagram and construct a model for Ex-Nor function of two variables. **[8]**

b) Explain in detail the serial fault simulation algorithm. State its advantages & disadvantages? **[8]**

Q2) a) Prove that in a combinational ckt if two faults dominate each other than they are functionally equivalent. **[8]**

b) Show that the existence of a static hazard is necessary condition for the creation of a dynamic hazard. **[8]**

Q3) Explain the terms in detail : **[18]**

a) Fault Sampling and Critical Path Tracing.

b) Logic Simulation.

c) Fault Models.

SECTION - II

Q4) a) Define Boundary scan. Show and explain a design for the boundary scan cell circuitary for a Bi-directional I/o pin in the IEEE 1149.1 methodology. **[8]**

b) Explain with neat diagram how parallel scan based test technique is implemented. **[8]**

P.T.O.

Q5) a) Explain structural model of RTL. Assuming an RTL does not access past values of signals. Write RTL models for a positive edge Triggered T flip-flop. **[10]**

b) What is unknown logic value. Construct a Truth Table for 3 valued logic for the following gates : **[8]**

i) AND
ii) OR
iii) NOT

Q6) a) Find a minimal Test set that detects all single stuck faults for the fig (1). **[8]**

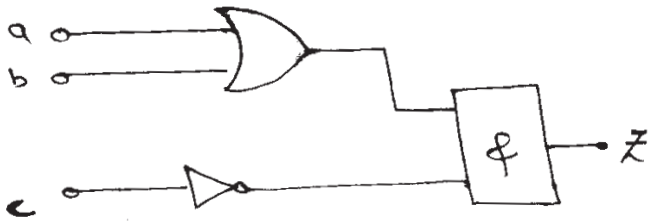

Fig (1)

b) Define error and classify them. Explain in detail the causes of observed errors. **[8]**

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Total No. of Questions : 6] [Total No. of Pages : 2

P1952

[3765]-124
M.E. (VLSI & Embedded)
ASIC DESIGN AND MODELING
(2002 Course)

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

Instructions to the candidates:

1) ***Answer 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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Give detail classification of ASIC. Explain in detail various steps required to design an semi-custom ASIC. **[10]**

b) Differentiate standard integrated circuit and application specific integrated circuit. **[6]**

Q2) a) Write a VHDL code for half adder using structural architecture and behavioural model. **[8]**

b) Classify routing algorithm. Explain in detail one algorithm with their objectives. **[8]**

Q3) Write short notes on : **[18]**

a) Power Grid Analysis.

b) Layout verification.

c) Clock buffering.

SECTION - II

Q4) a) Explain in detail with neat diagram the scan path arrangement for testing of sequential circuit with timing diagram. **[8]**

b) Find a test set to determine fault coverage of various stuck at '0' and stuck at '1' faults for the ckt shown in Fig (1) for all possible test vectors. **[8]**

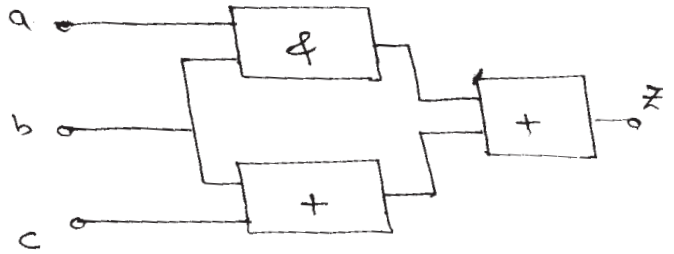

Fig (1)

P.T.O.

Q5) a) Explain the following terms : **[8]**

i) Controllability.
ii) Observability.
iii) Predictability.
iv) Fault coverage.

b) Explain in detail the synthesis process with neat block diagram. Define the terms objects and attributes. **[8]**

Q6) Write short notes on : **[18]**

a) Design Rule Check.
b) Formal Verification.
c) Static Timing analysis.

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Total No. of Questions : 8] [Total No. of Pages :2

P1953

[3765] - 125
M.E. (VLSI & Embedded Systems)
RFIC DESIGN
(2002 Course)

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

Instructions to the candidates:

1) ***Answer any 3 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) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What is SPICE model of MOSFET? What information is obtained from it? Draw HF model & explore bandwidth sensitive parasitics. **[8]**

b) What is short ckt time constant method? What are its applications & limitations? **[8]**

Q2) Design cascaded RF amplifier for Av = 100, bandwidth = 100 MHz and R_{out} = 75Ω, source resistance of 50Ω. Assume suitable data. **[16]**

Q3) a) Explain thermal & shot noise in RF amplifier. **[8]**

b) Compare common source, common drain & common gate configurations of MOSFET for RF amplifier. Which is best suitable? What kind of degeneration is applicable? **[8]**

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

a) W_τ of MOSFET.

b) Weak inversion & its applications.

c) Assumptions in OC_τ method.

d) Risetime, delay & bandwidth.

P.T.O.

SECTION - II

Q5) a) Why are S parameters preferred in HF design? Give S matrix for two port amplifier. **[8]**

b) Derive relationship among gain bandwidth product, rise time & bandwidth. How are they affected in cascading? **[8]**

Q6) What is EMI? Why is it important in RFIC design? What are the sources & solutions? Discuss in detail. **[16]**

Q7) a) Design single ended LNA for voltage gain of 40 dB. What care will you take for noise? **[8]**

b) What are the advantage of balanced mixer? Explore double balanced mixer. **[8]**

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

a) Tuned amplifiers.

b) Linearity issues in LNA.

c) Spurious free dynamic range.

d) Conversion gain in mixers.

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Total No. of Questions : 8] [Total No. of Pages : 3

P1954

[3765] - 132

M.E. (Electronics) (Digital Systems & Computer)

DSP & APPLICATIONS

(2002) (504302)

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, electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) State and prove the following properties of Z-Transform. **[8]**

i) Convolution in Time Domain.

ii) Scaling in *Z*-Domain.

b) Determine the inverse Z Transform of following. **[10]**

i) $X(z) = \dfrac{z}{3z^2 - 4z + 1}$, for ROC $|z| > |$.

ii) $X(z) = \dfrac{z^{-1}}{(1 - 0.25z^{-1} - 0.375z^{-2})}$, for ROC $|z| > |0.75|$.

Q2) a) A Low Pass Filter is characterised by the following: **[8]**

Passband edge frequency 1.5 kHz.

Sampling frequency 10 kHz.

Number of coefficients 15.

i) Obtain the coefficients of the Low Pass Filter using the Hamming window.

ii) Write the specifications for an equivalent HPF & use these to obtain its coefficients.

P.T.O.

iii) Obtain the coefficients of the equivalent HPF by using the transformation above.

b) A simple RLC notch filter has the following normalized s-plane transfer function. **[8]**

$$H(s) = \frac{(s^2+1)}{(s^2+s+1)}.$$

Determine the transfer function of an equivalent discrete time filter using the Bilinear Z Transform Method. Assume a Notch frequency of 50 Hz and a sampling frequency of 500 Hz.

Q3) a) Explain forward linear prediction for predicting a future value of a stationary random process. **[8]**

b) Given $x(n)$ = (4, 3, 2, 1, 1, 2, 3, 4). **[8]**

find X(k) using Decimation in time FFT algorithm. Give the steps clearly. Show the Flowgraph.

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

a) Power Spectrum Estimation.

b) Wavelet Transform.

c) Two Channel QMF.

SECTION - II

Q5) a) Explain how ARMA Mode is used for power spectrum estimation. **[8]**

b) Implement a Two-stage decimator for the following specifications,

Sampling rate of input signal = 20 KHz

M = 100.

Passband = 0 to 80 Hz

Transition band = 80 to 100 Hz

Passband ripple = 0.01

Stopband ripple = 0.02 **[10]**

Q6) a) Explain design steps of least square filter design of predictive Deconvolution. **[8]**

b) Obtain the Power Density Spectrum of the data sequence. **[8]**

$x(n)$ = (1, 1, 1, 1, 0, 1, 0, 1) using Blackman Tukey method.

Q7) a) Draw the architecture of ADSP 21XX Series of DSP processor & explain at least two instructions. **[8]**

b) Explain in detail, the steps performed by DSP Processor to execute convolution equation? **[8]**

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

a) Voice compression and coding techniques.

b) DTMF Generation.

c) Jury's Stability Criteria.

Total No. of Questions : 8] [Total No. of Pages : 2

P1955

[3765] - 137

M.E. (Electronics) (Digital Systems)

RECONFIGURABLE COMPUTING

(2002 Course)

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) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What are the issues in general purpose computing? Why do present computing engines lag behind? **[8]**

b) What do you mean by functional & hence yielded capacity? Explore in detail with example. **[8]**

Q2) a) Compare general purpose computing architectures in detail. **[8]**

b) Explain with suitable diagrams & necessary expressions the RP space area model. **[8]**

Q3) a) Why is multiplier considered as standard test ckt? Compare the performances of different architectures for multiplying operation. **[8]**

b) List the issues in reconfigurable network design. What are ways to deal with them? **[8]**

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

a) Switch growth hierarchy model.

b) Network utilization efficiency.

c) Instruction broadcast on chip.

d) Fine & course grained structures.

P.T.O.

SECTION - II

Q5) a) Why is instruction compression so important? What are the techniques? **[8]**

b) What are the effects of interconnect granularity? **[8]**

Q6) List the features of TSFPGA. Draw the primitive architectural block diagram. Explore the blocks in detail. What are its merits & limitations? **[16]**

Q7) a) What are the software challenges in reconfigurable device development? **[8]**

b) Draw & explain switching node in hierarchical interconnect. **[8]**

Q8) Write short notes on any three. **[18]**

a) Reconfigurable devices developed yet.

b) Crossbars.

c) Minimization of overheads.

d) Pdes & Pnet.

Total No. of Questions : 10] [Total No. of Pages : 3

P1956

[3765]-180
M.E. (Production)
ADVANCE MACHINE TOOL DESIGN
(Revised Course 2002) (511103)

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) ***Figures to the right indicate full marks.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Use of non-programmable electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Discuss with suitable example the modern trends in the design of machine tools. **[6]**

b) What is the criterion for selecting the best ray diagram for a speed gear box? **[6]**

c) Write a note on speed deviation diagram. **[4]**

Q2) a) Design the gear box with the following data : **[12]**

Number of speed steps : 8
Number of transmission stages : 3
Geometric progression ratio (θ) : 1.55
Minimum speed : 45 rpm
Power of motor : 2 kW
Speed of motor : 1440 rpm

Draw the structural diagram, speed chart and layout of the gear box.

b) What are the basic considerations in design of drives? **[6]**

Q3) a) Explain with suitable example how rigidity can be improved in an existing machine tool? **[8]**

b) Analyze the different forces acting on arbor of a horizontal milling machine and explain the design procedure. **[8]**

Q4) a) Give the comparative evaluation of machine tool structures on the basis of : **[8]**

i) Profiles of machine tool structures.

ii) Static and dynamic stiffness.

b) Explain graphically the optimum design criterion for selection of mild steel and cast iron as material for machine tool structures, based on strength and rigidity. **[8]**

Q5) a) Show that the rigidity of the hydro-dynamically lubricated slides is always less than that of hydro-static slide way. **[8]**

b) Calculate the average pressure, maximum shearing stress and pitch error in the lead screw of a lathe. Given : **[8]**

Outer diameter	70 mm
Pitch	10 mm
Effective diameter	65 mm
Length of nut	100 mm
P_Z	150 kgf
P_Y	50 kgf
P_X	45 kgf
Coefficient of sliding friction between the carriage and guideways	0.2
Weight of the carriage	50 kgf

The lead screw has standard, single-start acme thread.

SECTION - II

Q6) a) Sketch and explain unit supports and spindle ends in a high speed machine tools? **[6]**

b) Why it is essential to preload the bearings of spindle mountage **[6]**

c) Explain the working principle of recirculating ball screw used in modern machine tools. **[6]**

Q7) a) Comment on the selection of antifriction bearing as spindle support. **[4]**

b) Describe the various elements of a spindle unit used in drilling machine. Draw the neat sketch of the arrangement. **[6]**

c) Give the comparative evaluation of hydrostatic and hydrodynamic bearings in machine tools. **[6]**

Q8) a) What is stick-slip phenomenon? Explain with a suitable example in relation to machine tools. **[8]**

b) Outline the different elements in hydraulic power pack used in machine tools. **[8]**

Q9) a) With the help of schematic diagram explain the working principle of adaptive control system in CNC machines. **[8]**

b) State the advantages and limitations of hydraulic devices and hydraulic control system in machine tools? **[8]**

Q10) a) Compare NC, CNC and conventional machine tools on the basis of performance, reliability, rate of production, maintenance and economical considerations. **[8]**

b) Write brief note on "Retrofitting of Machine Tools". **[8]**

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Total No. of Questions : 8] [Total No. of Pages : 3

P1957

[3765] - 185

M.E. (Production)

PRECISION ENGINEERING

(Revised Course 2002) (Elective - II)

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

Instructions to the candidates:

1) ***Attempt any three questions from each section.***
2) ***Answers 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 electronic pocket calculator and statistical tables is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain the essential differences between surface metrology and other forms of dimensional metrology. **[8]**

b) Explain in brief with suitable example the role of amplification in measurement. **[8]**

Q2) a) Illustrate with a suitable example the purpose of performing the selective assembly. **[8]**

b) Hole $40^{+0.027}$ mm is assembled with shaft $40^{+0.035}_{+0.018}$ mm using selective assembly after dividing the tolerance zones into three groups. Find out the tolerance of the fit without and with selective assembly. **[8]**

Q3) a) State the reason why power amplification makes a radical departure from mechanical instruments. **[8]**

b) Describe with a suitable example the concept of form factor and bearing area curves in relation to surface roughness. **[8]**

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

a) Laser interferometers.

b) Tool Maker's Microscope.

c) Universal dividing head.

d) Co-ordinate Measurement Machine (CMM).

SECTION - II

Q5) a) State the principles which govern the design of limit gauges giving examples of such gauges to check: **[8]**

i) Length.

ii) Diameter.

iii) Depth.

iv) Distance between an internal and an external face.

b) Discuss the rational subgroup concept. What part does it play in control chart analysis? **[8]**

Q6) a) Describe in detail what is meant by automated inspection. Why is it becoming an important part of manufacturing engineering? **[8]**

b) Enumerate your thoughts on the merits and limitations of analog vs. digital measuring equipment. Give specific examples. **[8]**

Q7) a) Describe in brief: **[8]**

i) Total Quality Control.

ii) Just in Time (JIT)

b) A company uses the following acceptance sampling procedure. A sample equal to 10% of the lot is taken. If 2% or less of the items in the sample are defective, the lot is accepted; otherwise, it is rejected. If submitted lots vary in size from 5000 to 10,000 units, what can you say about the protection by this plan? If 0.05 is the desired LTPD, does this scheme offer reasonable protection to the consumer? **[8]**

Q8) a) The viscosity of a polymer is measured hourly. Measurements for the last 20 hours are shown as follows: **[10]**

Test	Viscosity	Test	Viscosity
1	2838	11	3174
2	2785	12	3102
3	3058	13	2762
4	3064	14	2975
5	2996	15	2719
6	2882	16	2861
7	2878	17	2797
8	2920	18	3078
9	3050	19	2964
10	2870	20	2805

i) Does viscosity follow a normal distribution?

ii) Set up a control chart on viscosity and a moving range chart. Does the process exhibit statistical control?

iii) Estimate the process mean and standard deviation.

b) Discuss in brief the importance of acceptance tests for machine tools and its influence in precision manufacturing. **[8]**

Total No. of Questions : 8] [Total No. of Pages :2

P1958

[3765] - 197
M.E. (Computer)
INTELLIGENT SYSTEMS
(Revised Course 2002)

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 on separate answer books.*
3) *Assume suitable data if necessary.*
4) *Draw sketches wherever necessary.*
5) *Figures to the right indicate full marks.*

SECTION - I

Q1) a) Explain the model of rational agent with diagram. **[8]**

b) Define in your own words : i) Intelligence ii) Artificial Intelligence, iii) Intelligent Agent with suitable example. **[8]**

Q2) a) Explain A* algorithm with suitable example. **[8]**

b) Explain the difference between Hill Climbing Search and Best first search strategy with suitable example. Also explain the problems associated with hill climbing. **[8]**

Q3) a) Solve following problem using any of the Search technique. "You have to color a planar map using only four colors, in such a way that no two adjacent regions have the same color". **[10]**

b) What is memory bounded search? Explain SMA* with suitable example. **[8]**

Q4) a) Prove that if a heuristic is consistent, it must be admissible. Construct an admissible heuristic that is not consistent. **[8]**

b) What do you mean by Contingency Problems? Explain with suitable example. **[8]**

P.T.O.

SECTION - II

Q5) a) What is partial order planning? Explain partial order planning with blocks world problem. Also explain the concept of least commitment and causal links related to partial order planning. (Assume any initial and Goal state for the said problem) **[8]**

b) Using the axioms of probability, prove that any probability distribution on a discrete random variable must sum to 1. **[8]**

Q6) a) Explain the constraints or axioms of utility theory. **[8]**

b) Describe the differences and similarities between problem solving and planning. **[8]**

Q7) a) Explain Conditional Planning in fully observable environments. **[8]**

b) Compare and contrast between simple replanning agent vs. Unbounded indeterminacy. **[8]**

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

(a) First order logic.

(b) Uncertainty.

(c) Probabilistic Reasoning.

(d) Hierarchical Task Network Planning.

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Total No. of Questions : 6] [Total No. of Pages :1

P1959

[3765] - 209

M.E. (Petroleum Engineering)

ADVANCED NATURAL GAS ENGINEERING AND TECHNOLOGY

(Revised 2002 Course)

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

Instructions to the candidates:

1) *Answers to the two sections must be written in separate answer books.*
2) *Answer any two questions from each section.*
3) *Figures to the right indicate full marks.*
4) *Neat diagrams should be drawn wherever necessary.*
5) *Use of a non-programmable calculator is allowed.*
6) *Assume suitable data if necessary and clearly state it.*

SECTION - I

Q1) Explain how Bg, cg, ug vary with pressure. Define the properties Bg, z, μg, Ppc, Tpc, EOS, H and explain how these properties are obtained by some suitable correlation. **[25]**

Q2) Derive the pipe line flow equation for series and parallel flow. **[25]**

Q3) Distinguish between reciprocating and centrifugal compressors. Explain the design consideration using Molier charts. **[25]**

SECTION - II

Q4) Explain phase behavior of a gas reservoir and material balance equation. Explain methods for gas deliquification. **[25]**

Q5) Draw a process flow diagram to show two methods how CO_2 is removed from a natural gas stream. **[25]**

OR

Explain Gas well testing.

Q6) Derive the equation used to calculate flow rate in a orifice meter. Explain all the constants. **[25]**

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Total No. of Questions : 8] [Total No. of Pages :2

P1960

[3765] - 244

M.E. CSE (IT)

INTELLIGENT SYSTEMS

(Revised Course 2002) (510128)

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 on separate answer books.***
3) ***Assume suitable data, if necessary.***
4) ***Draw sketches wherever necessary.***
5) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Why would evolution tend to result in systems that act rationally? What goals are such systems designed to achieve? **[8]**

b) Define in your own words the following terms. **[10]**

i) Reflex Agent

ii) Model Based Agent

iii) Goal based Agent

iv) Utility based Agent

v) Learning Agent

Q2) a) Prove that if a heuristic is consistent, it must be admissible. Construct an admissible heuristic that is not consistent. **[8]**

b) Explain A* algorithm with the help of suitable example. **[8]**

Q3) a) What is memory bounded search? Explain IDA* with suitable example. **[8]**

b) Consider a state space where the start state is number 1 and the successor function for state n returns two states, numbers 2n and 2n + 1. **[8]**

i) Draw the portion of the state space for states 1 to 15.

ii) Suppose the goal state is 11. List the order in which nodes will be visited for breadth first search, depth limited search with limit 3, and iterative deepening search.

iii) Would bidirectional search be appropriate for this problem? If so, describe in detail how it would work.

P.T.O.

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

a) Problem-Solving Performance.

b) Simulated annealing.

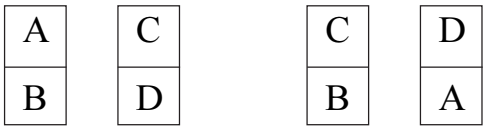
c) Arc consistency.

d) Backjumping.

SECTION - II

Q5) a) Explain four planning methods for handling indeterminacy. **[8]**

b) What is planning? Solve following blocks world problem using STRIPS notation. **[8]**



Start State Goal State

Q6) a) Describe the differences and similarities between problem solving and planning. **[8]**

b) What is Hierarchical Task Network (HTN) Planning? Explain with algorithm, the basic HTN procedure. **[8]**

Q7) a) Explain why the axioms of probability are reasonable. **[8]**

b) Explain conditional planning in fully observable environment. **[8]**

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

a) Uncertainty.

b) First order logic.

c) Probabilistic Reasoning.

d) Bay's Theorem.

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Total No. of Questions : 8] [Total No. of Pages :5

P1961

[3765] - 413
M.E. (Civil) (Const & Mgmt)
PROJECT ECONOMICS AND FINANCIAL MANAGEMENT
(2008 Course)

Time : 4 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) The expected cash flows from 2 alternatives are as follows :-

Year	Project A Rs. in lakhs	Project B Rs. in lakhs
0	(100)	(160)
1	(120)	20
2	(60)	40
3	(25)	50
4	(200)	60
5	400	80
6	600	100

For each alternative, determine

i) Pay-back period.

ii) NPV at 14% interest rate.

iii) IRR for Project 'A'. (Approximate value)

Which investment alternative you would prefer and why? Justify. **[12]**

b) Explain the methodology adopted for the capital budgeting under risk.**[4]**

P.T.O.

Q2) A tenderer has to take a decision on whether to bid for a construction project or not, based on the NPV. The project worth is 1000 crores and is to be completed in 5 years. Various terms of the contract are as follows :-

a) Mobilization advance is payable at 6% of the project worth and will be deducted in two equal installments during the 2nd and 3rd year.

b) Construction equipment advance is payable at 4% of the project worth in 2 equal installments starting from the 1st year. The entire amount will be deducted from the running bill, during the 5th year.

c) Material cost component is 50% of the project worth. Secured advance is payable at 50% of the materials brought to site in each year. Secured advance will be deducted in 3 equal installments in the 3rd, 4th and 5th year respectively, from the running bills.

d) Contractor has to pay 5% of project worth as performance security and 5% amount retention money will be deducted in each running bill.

e) Defects liability period is one year.

f) Performance security will be released on satisfactory completion of the project during the 5th year, whereas the retention money will be released on satisfactory completion of defects, near the end of the 6th year.

g) Yearly bills payable to the contractor including the retention amount are as follows :-

Year 1 = Rs 100 crores
Year 2 = Rs 200 crores
Year 3 = Rs 350 crores
Year 4 = Rs 300 crores
Year 5 = Rs 50 crores

h) Estimated cost of the defects arising during the defects liability period is 4% of the project worth.

i) Profit expected from the project before taxes is at 8% of project worth.

j) Working capital required to be raised is estimated at 12% of project worth. The interest rate on the working capital is 14%. Working capital available may be divided in the proportion of the amount of work required to be done each year. Repayment of working capital with interest is to be considered in the 6th year.

k) Income tax is considered as 30% of the annual income.

l) The profit is to be accounted yearly, in proportion to the yearly bill amount.

m) Consider the cost of capital at 16%.

Determine :

i) Cash flow statement for a period of 6 years.

ii) Represent the cash flows graphically and determine, whether when and how much additional funds are required.

iii) Based on the NPV, determine whether the tenderer should bid in the above project or not. **[18]**

Q3) A construction company manufacturing and selling fly-ash blocks has made the following yearly purchases :-

a) Flyash worth Rs 15 lakhs.

b) Cement worth Rs 105 lakhs.

c) Sand worth Rs 40 lakhs.

Out of these materials, the present day consumption is as follows :-

i) Flyash worth 5 lakhs

ii) Cement worth 40 lakhs

iii) Sand worth 13 lakhs.

The annual average investment in inventory including all materials, spares, supplies etc is Rs. 120 lakhs.

The company has sold blocks worth a total of 100 lakhs in the current financial year. For sales promotion, 10% discount was given to the customers. An amount of 40 lakhs is yet to be received from the customers.

The company has paid 40% of the raw materials procured by cash. Remaining amount is on a credit period of 4 months. Out of this amount, company has paid Rs. 15 lakhs uptill how. The company has also paid its sub-contractors bills.

Company has current assets worth 60 lakhs in which, cash is 15 lakhs and readily marketable securities are worth 5 lakhs. Averagely, the amount of daily cash required by the company is Rs. 50,000/-

Determine the following financial ratios. Comment on the present financial status of the company with justification. Suggest recommendations for improvements.

1) Current Ratio.
2) NWC.
3) Acid Test Ratio.
4) Inventory turnover ratio.
5) Raw materials turnover ratio.
6) Debtor's turnover ratio.
7) Creditor's turnover ratio.
8) Defensive Interval ratio. **[16]**

Q4) a) Compare preference shares with debentures on the following points :**[6]**

i) Issuing costs.

ii) Servicing costs.

iii) Obligation to pay dividends.

iv) Obligation to redeem investment.

v) Tax deductability.

vi) Effect on control and on freedom of action.

b) With respect to the financial management aspects of the Konkan Railway Project explain : -

i) The various means of finance which were used to suffice the funds required for completing the entire project, from its inception.

ii) Financial ups-downs in the project phase and how they were tackled.

iii) Your opinion, with justification as regards whether the financial aspects represent a success story or a failure one. **[10]**

SECTION - II

Q5) With suitable examples, by assuming relevant data, create **[16]**

a) Balance sheet and

b) Profit and Loss A/C statement for a construction company. Explain the utility of the above statements.

Q6) a) What is a portfolio? What is its significance? Explain how risk and return of a portfolio are evaluated, giving a suitable example. **[8]**

b) A portfolio consists of two investments, one, in a real estate project and the other in an infrastructure development project costing 300 crores and 400 crores respectively. Returns expected from the first project are at 20% with a std. deviation of 25% for risk. The returns from the infrastructure project are at 18% with a standard deviation of risk at 16%. Assuming a perfect positive co-relation coefficient between the assets, determine the risk-return characteristics of the portfolio. What change will occur for a perfect negative co-relation? Determine. **[10]**

Q7) a) Differentiate between joint venture and acquisition with an example. What are advantages of a joint-venture? Explain with an example. **[6]**

b) Explain in detail the role of a lender's engineer in financing the projects. **[6]**

c) Explain with examples, the basic objectives of financial management. **[4]**

Q8) Explain in brief the following : - **[16]**

a) Cash flow cycle.

b) Basic principles of accounting.

c) Estimation of the working capital for a construction project.

d) Auditor's report.

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Total No. of Questions : 8] [Total No. of Pages : 2

P1963

[3765]-476

M.E. (Mech.) (Heat Power)

PERFORMANCE ASSESSMENT OF MECHANICAL EQUIPMENT

(2008 Course)

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

Instructions to the candidates:

1) ***Answer three questions from section-I and three questions from 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) ***Use of logarithmic tables, slide rule steam tables, mollier charts, electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain any two high pressure boilers in details. **[8]**

b) Discuss the different methods of blow down system. State the merit of continuous type over intermittent. Why continuous type is preferred over intermittent. **[8]**

Q2) a) Illustrate in details factor affecting the boiler performance. **[8]**

b) The following data refers to a boiler plant of an economizer, a boiler and super heater. **[8]**

Mass of feed water evaporated per hour = 6940kg

Mass of coal burnt per hour = 650kg

L.C.V of coal = 32500KJ/kg

Pressure of steam at boiler stop valve = 16 bar

Temperature of feed water entering the economizer = 120°C

Dryness fraction of steam leaving the boiler and entering the super heater is 0.94

Temperature of steam leaving the super heater 380°C

Specific heat of superheated steam = 2.4KJ/kg-K

Determine :

i) Percentage of heat in coal utilized in economizer, boiler and super heater.

ii) Overall efficiency of boiler plant.

Q3) a) Explain different draft control methods used in furnaces. **[8]**

b) Explain how temperatures are controlled in furnaces? **[8]**

Q4) a) Explain necessity of cogeneration in industries. **[9]**

b) Describe in details factors affecting selection of diesel generating system. **[8]**

SECTION - II

Q5) a) Explain in details field testing procedure for fans and blowers. **[8]**

b) Explain different performance terms used in fans and blowers. **[8]**

Q6) a) Describe pumping system components in detail. **[8]**

b) Explain flow control strategies used in pumps. **[8]**

Q7) a) Illustrate in detail capacity controls methods for rotary compressors. **[8]**

b) Explain different leak test techniques used in compressors. **[8]**

Q8) a) Explain the role of waste heat recovery in energy conservation. **[9]**

b) Describe energy conservation using heat pumps in details? **[8]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1964

[3765]-494
M.E. (Mechanical) (Design Engg.)
INSTRUMENTATION & AUTOMATIC CONTROL
(2008 Course)

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) Explain different techniques of measurement. **[8]**

b) Compute the median from the following data. **[8]**

Mid value	115	125	135	145	155	165	175	185	195
Frequency	6	25	48	72	116	60	38	22	3

Q2) a) The mean & S.D. of a set of 100 observations were worked out as 40 and 5 respectively. But by mistake the value 50 was taken in place of 40 for one observation. Find out correct mean & standard deviation. **[8]**

b) For certain X and Y series which are correlated, the two lines of regression equations are **[10]**

$$5x - 6y + 90 = 0$$
$$15x - 8y - 130 = 0$$

Find the means of two series and correlation co-efficient.

Q3) a) Explain with a neat sketch the working of humidity measuring instrument. **[8]**

b) A platinum thermometer has a resistance of $100\,\Omega$ at 25ºC

i) Find its resistance at 65ºC if the platinum has a resistance temperature co-efficient of 0.00392/ºC.

ii) If the thermometer has a resistance of $150\,\Omega$, find temperature. **[8]**

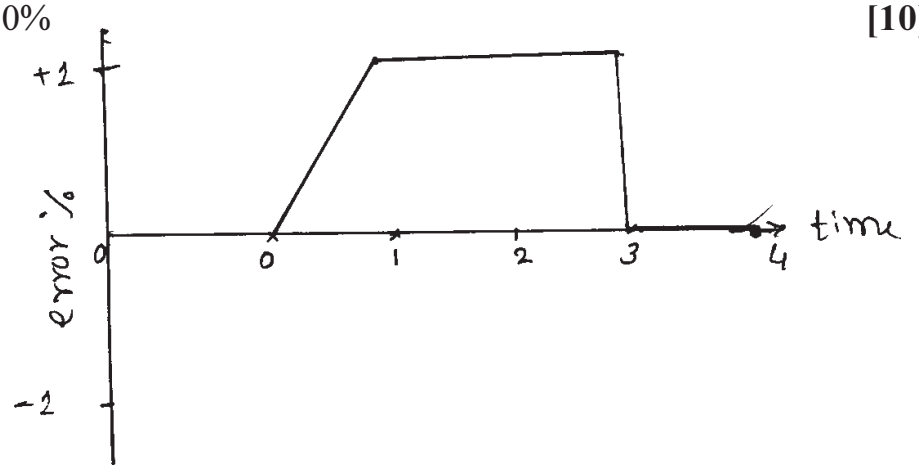
P.T.O.

Q4) a) Explain the salient features of thermistors. **[8]**

b) Explain the working of thermal conductivity gauges stating its merits and demerits. **[8]**

SECTION - II

Q5) a) Given the error as shown in figure 1, plot a graph of Proportional + Integral controller output as function of time $K_p = 5$, $K_I = 2s^{-1}$, $P_i(0) = 20\%$ **[10]**



b) Explain working of Electromagnetic flow meter stating its advantages & limitations. **[8]**

Q6) a) The sound pressure level of a pure tone is 104 dB. What is the corresponding rms sound pressure. **[6]**

b) Explain any one method of measurement of speed by noncontact method. **[6]**

c) State various thermophysical properties of a substance. **[4]**

Q7) a) Explain with a neat sketch the working of UV-spectrophotometer. **[10]**

b) Explain Beer-Lambart's law. **[6]**

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

a) Chromatograph.

b) Mass spectrometry.

c) Piezoelectric accelerometer.

d) Difference between regression & correlation.

e) Pneumatic controller.

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Total No. of Questions : 8] [Total No. of Pages : 3

P1965

[3765]-513
M.E. (Mechatronics)
CONTROL SYSTEMS
(2008 Course) (502805)

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 books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data, wherever necessary.***

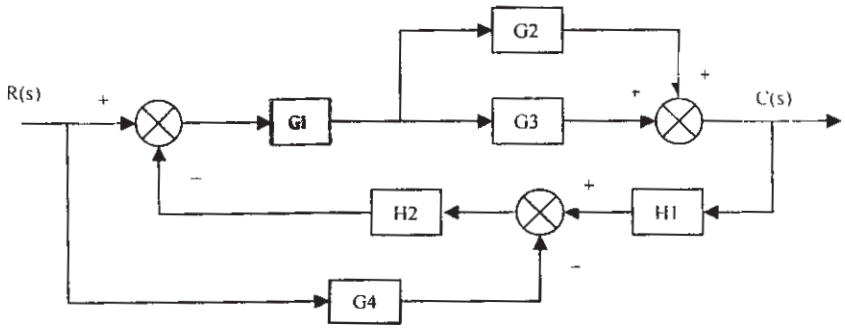
SECTION - I

Q1) a) Distinguish between the following : **[8]**

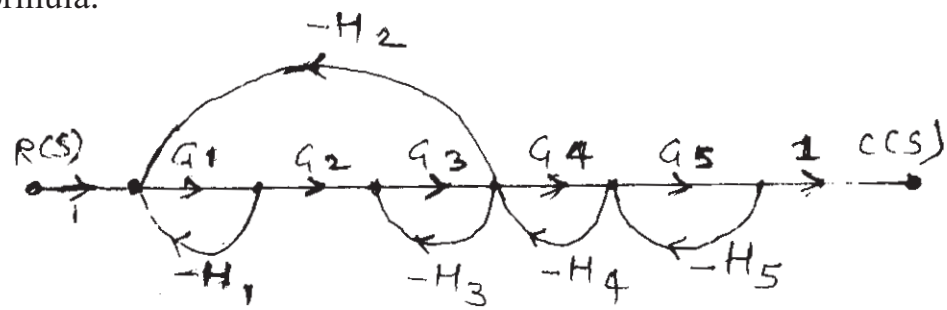
i) Linear and nonlinear control systems.

ii) Time varying and time invariant control systems.

b) Reduce the following block diagram of the system shown in following figure into a single equivalent block by block diagram reduction technique. **[10]**



Q2) a) Obtain the closed loop transfer function C(S)/ R(S) using Mason's gain formula. **[8]**



P.T.O.

b) What are static error coefficients. Derive the values of static error coefficient and steady state error for type 1 system for **[8]**

i) Unit step input.
ii) Unit ramp input.
iii) Unit parabolic input.

Q3) a) Explain standard test signals and state clearly the difference between steady state and transient response of a system. **[6]**

b) A system has open loop transfer function as $G(S)\,H(S) = \dfrac{25}{S^2 + 6S + 25}$.

Find the underdamped natural frequency, the damping ratio, the damped natural frequency, rise time, peak time, peak overshoot, and settling time if subjected to unit step input. **[10]**

Q4) a) Examine the stability by Routh's criterion for the characteristics equation. **[6]**

$S^6 + 3S^5 + 4S^4 + 6S^3 + 5S^2 + 3S + 2 = 0.$

b) The loop transfer function of a unity feedback control system is $G(S)\,H(S) = \dfrac{k}{S\,(S+4)(S+2)}$ sketch the root locus of the system. Comment on stability of the system. **[10]**

SECTION -II

Q5) a) Write short note on comparison on time domain and frequency domain analysis. **[6]**

b) A unity feedback control system has $G(S)\,H(S) = \dfrac{80}{S\,(S+2)(S+20)}$

sketch bode plot. Determine from it.

i) Gain crossover frequency.
ii) Phase crossover frequency.
iii) Gain margin.
iv) Phase margin.

v) Stability of system. **[12]**

Q6) a) Write short note on : **[8]**

i) Adaptive control.
ii) Inferential control.

b) For a certain control system $G(S)\,H(S) = \dfrac{K}{S\,(S+1)(S+2)}$ sketch the Nyquist plot. And determine the value of K for stability. **[8]**

Q7) a) Explain the following terms : **[8]**

i) State.
ii) State variable.
iii) State space.
iv) State vector.

b) Define the term 'Transfer function' of a system. State the advantages and limitations of transfer function approach in study of control system. **[4]**

c) State advantages of state variable analysis over conventional control system. **[4]**

Q8) a) Give the classification of controllers and explain the characteristics of on-off, P, I, D, PID controllers. **[8]**

b) Sketch and comment on the outputs of P, PI, PD and PID controllers for a step input. **[8]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1966

[3765]-518
M.E. (Mechanical) (Mechatronics)
DRIVES AND ACTUATORS
(2008 Course)

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

Instructions to the candidates:

1) ***Answers to the two sections must be written in separate answer papers.***
2) ***Answer any three questions from each sections.***
3) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Explain any four types of thyristors. **[8]**

b) Describe the following ratings of SCR **[8]**

i) Surge current rating.
ii) i^2t rating.
iii) di/dt rating.
iv) dv/dt rating.

Q2) a) The bipolar transistor have β_F in the range of 8 to 40. The load resistance is $R_C = 11\,\Omega$. The dc supply voltage is $V_{CC} = 200V$ and the input voltage to the base circuit is $V_B = 10V$. If $V_{CE\ (sat)} = 1$ V and $V_{BS\ (sat)} = 1.5V$ find :

i) The value of R_B that results in saturation with an ODF of 5. **[8]**
ii) The β_{forced} and
iii) The power loss P_T in the transistor.

b) Explain the characteristics of MOSFET. **[8]**

Q3) a) Five thyristors are used in a string to withstand a dc voltage of Vs = 10KV. The maximum leakage current and recovery charge differences of thyristors are 5mA and $100\,\mu C$ respectively. Each thyristor has a voltage sharing resistance of $R = 100k\Omega$ and capacitance of $C1 = 0.5\,\mu F$. Determine. **[8]**

i) Maximum steady state voltage sharing $V_{DS\ (max)}$.
ii) The steady state voltage derating factor.
iii) The maximum transient voltage sharing $V_{DT\ (,max)}$ and
iv) The transient voltage derating factor.

b) Explain how speed of DC motor is controlled using converters. **[8]**

P.T.O.

Q4) a) The speed of 20 - HP, 300V, 1800 rpm separately excited dc motor is controlled by three phase full-converter drive. The field current is also controlled by a three phase full converter and is set to the maximum possible value. The AC input is a three phase Y connected, 208 V, 60Hz supply. The armature resistance is $R_a = 0.25\Omega$, the field resistance is $R_f = 245\Omega$ and the motor voltage constant is $K_v = 1.2$ V/A rad/s. The armature and field currents can be assumed to be continuous and ripple free. The viscous friction is negligible. Determine :

i) The dealy angle of the armature converter α_a, if the motor supplies the rated power at the rated speed.

ii) The no-load speed if the delay angles are the same as in (1) and the armature current at no load is 10% of the rated value and

iii) The speed regulation. **[10]**

b) Write short notes on : **[8]**

i) Four quadrant choppers.

ii) Cycloconverters.

SECTION - II

Q5) Explain the general features of induction motor on a current source inverter. Draw a closed loop block schematic diagram of a slip controlled drive using CSI. **[16]**

Q6) a) A pressure difference is 1.1 psi occurs a constriction in 5-cm-diameter pipe. The constriction constant is $0.009 m^3/s$ per $kPa^{1/2}$. Find i) the flow rate in m^3/s and ii) the flow velocity in m/s. **[8]**

b) Explain different types of control valves used in final control. **[8]**

Q7) a) Explain with suitable block diagram the various types of VSI controlled induction motor drive. **[8]**

b) Find the working force resulting from 200 N applied to a 1-cm-radius forcing piston if the working piston has a radius of 6cm and also find the hydraulic pressure. **[8]**

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

a) Pneumatic Actuators.

b) Hydraulic Actuators.

c) Driver circuit for control of stepper motor.

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Total No. of Questions : 6] **[Total No. of Pages : 1**

P1967

[3765] - 531

M.E. Electrical Engineering (Control System)

SCADA SYSTEM & APPLICATION

(2008 Course)

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 wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) Draw Block diagram of SCADA System. Explain each block in details. Give advantages & disadvantages of SCADA System. **[25]**

Q2) Write short note on:

a) Modbus RTU.

b) Distributed SCADA System. **[25]**

Q3) a) Draw block diagram of PLC and explain each block in details. Also give specifications of any one Industrial PLC. **[15]**

b) Compare PLC and SCADA Systems in details. **[10]**

SECTION - II

Q4) a) Write short note on SCADA System communication Technologies. **[10]**

b) Explain wired & Fibre optic method of communication in details. **[15]**

Q5) Explain application of SCADA System in Automatic substation control in details. **[25]**

Q6) Explain Energy management system and its configuration by using SCADA System. **[25]**

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Total No. of Questions : 6] [Total No. of Pages : 2

P1969

[3765]-542
M.E. (Electrical) (Power Systems)
POWER SYSTEM MODELLING
(2008 Course) (503203)

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 answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary and state clearly the same.***
5) ***Use of pocket electronic calculator is allowed.***

SECTION - I

Q1) a) Draw a block schematic diagram of an excitation control system with alternator; and describe the function of each block. **[12]**

b) Stating clearly the assumptions made. Show that the classical transfer function of the hydraulic turbine is given by **[13]**

$$\frac{\Delta \overline{P}_m}{\Delta \overline{G}} = \left(\frac{1 - S\ T_W}{1 + 0.5\ S\ T_W} \right)$$

Q2) a) Develop a mathematical model for a long, 3 phase, loss less transmission line. Therefrom obtain the ABCD parameters of the line. **[15]**

b) A 83 km long, 275 kV, 3-phase transmission line has the following parameter per km length of the line :- **[10]**

$r = 0.078$ ohm; series inductive reactance, $x = 0.33$ ohm; shunt capacitive reactance, $y = 9.53\ \mu S$; $g = 0$.

Determine the ABCD parameters of the line.

Q3) Attempt any THREE of the following :-

a) Simplified model of a boiler; **[8]**

b) Alternator excitation configurations; **[9]**

c) Need for modelling a power system; **[8]**

d) Induction motor model in power system studies. **[8]**

P.T.O.

SECTION - II

Q4) a) Develop the expressions for direct axis synchronous inductance (*ld*), quadrature axis synchronous inductance (*lq*) and zero sequence inductance (*lo*) of a 3-phase salient pole alternator with damper windings, in terms of the self and mutual inductances of the windings in the machine. State all the assumptions made. **[15]**

b) Write the equations for the flux linkages ψ_d, ψ_q and ψ_o for a 3-phase salient pole alternator. Using these equations obtain the *d*-axis equivalent circuit for the alternator. Draw the equivalent circuit with all the values shown therein. **[10]**

Q5) a) Develop a simplified mathematical model for an alternator under transient conditions. **[13]**

b) A salient pole alternator is working under steadystate conditions. Draw the phasor diagram and therefrom obtain the expression for the internal load angle in terms of x_d, x_q, r_a, I_a, v_t and power-factor angle ϕ. **[12]**

Q6) Write short notes on any THREE of the following :-

a) Model for phase-shifting transformer; **[9]**

b) Per unit system in power systems; **[8]**

c) Desirable features in the modelling of power system components; **[8]**

d) SVC model. **[8]**

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Total No. of Questions : 6] [Total No. of Pages : 2

P1970

[3765]-549
M.E. (Electrical) (Power Systems)
HIGH VOLTAGE POWER TRANSMISSION
(2008 Course) (503210)

Time : 3 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 answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary and state clearly the same.***
5) ***Use of pocket electronic calculator is allowed.***

SECTION - I

Q1) a) Compare HVDC transmission with EHVAC transmission, bringing out the advantages and limitations of the former. **[13]**

b) A direct current transmission link connects two a.c. systems via 3-phase bridge converters, the line voltages at the transformer converter junctions being 100kV and 90kV respectively. At the 100kV end, the converter operates with a delay angle of 10°; and at the 90kV end, the converter operates with an extinction angle of 15°. The effective reactance per phase of each converter is 15 ohm and the d.c. link resistance is 10 ohm. Determine the magnitude and direction of the power delivered, if the inverter operates at constant r control. Calculate the percentage change required in the voltage of the transformer which was originally at 90kV, to produce a transmitted current of 800A other controls being unchanged. **[12]**

Q2) a) With a schematic of d.c.link, derive an expression for the d.c.link current interms of delay angle (α), extinction angle (r), number of converter bridges connected in series (n_b), rectifier voltage (E_{dr}), inverter voltage (E_{di}), line voltages at the converter ends (E_{vr}, E_{vi}) and the turns-ratio of converter transformers. On the basis of this equation, explain the principles of d.c.link current control. **[13]**

b) Show that the fundamental power factor for the converter operating in rectifier mode is given by **[6]**

$$\cos \phi = \frac{1}{2} [\cos \alpha + \cos (\alpha + \mu)]$$

where ϕ = fundamental p.f. angle;

α = delay angle of the rectifier; and

μ = overlap angle.

P.T.O.

c) It is required to obtain a d.c. voltage of 100 kV for a rectifier (3 phase, bridge connected) operating with $\alpha = 30^o$ and $\mu = 15^o$. Calculate the necessary secondary line voltage of the rectifier transformer which is nominally rated at 345kV/150kV and calculate the tap-ratio required. **[6]**

Q3) Write short notes on any three of the following :

a) Multi-terminal HVDC systems; **[8]**

b) Harmonics in HVDC systems; **[8]**

c) HVDC converter control characteristics; **[8]**

d) Twelve pulse converter bridge. **[9]**

SECTION - II

Q4) a) A loss-less transmission line of length L metre (> 400 km) has distributed series inductance of '*l*' H/m and shunt capacitance of 'c' F/m. The sending end and receiving end voltages are V_S and V_R respectively at a frequency 'f' Hz. Derive expressions for the voltage and current at a distance '*x*' metre from the receiving end. Interpret the equations so obtained in terms of standing waves and travelling waves. **[15]**

b) Obtain the step response of a loss-less transmission line which is open circuited. Sketch the wave form of voltage (at the open end) Vs T where

$$T = \frac{\text{Length of line}}{(\text{velocity of travelling wave})}$$ **[10]**

Q5) a) Describe the biological effects of electric fields due to EHVAC lines and state the measures of safety to be taken. **[12]**

b) With reference to a EHVAC line, discuss the following factors : **[13]**

i) Right of way;
ii) Clearances in tower;
iii) Location of ground wire; and
iv) Power transferability.

Q6) Write short notes on any three of the following :

a) Bewley's lattice diagram; **[8]**

b) Corona and its effects; **[9]**

c) Overvoltages in EHVAC lines; and **[8]**

d) Shunt compensation in EHVAC lines. **[8]**

Total No. of Questions :8] [Total No. of Pages : 2

P1971

[3765]-574
M.E. (E & TC) (VLSI & Embedded Systems)
EMBEDDED SYSTEM DESIGN
(2008 Course)

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 books.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) How to characterize an embedded system using various design metrics? **[10]**

b) How PLDs play important role in the design of an embedded system? **[6]**

Q2) a) Why selection of memory is critical in an embedded system design? Justify the answer using typical application? **[8]**

b) How to select the processor for an Embedded system? Specify typical selection criteria? **[8]**

Q3) a) What are various programming technologies used in FPGA? **[10]**

b) How receiver is synchronized with transmitter in case of asynchronous serial communication (UART)? **[6]**

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

a) IEEE 802.11

b) Scatter-net in Bluetooth protocol.

c) IEEE 802.15

P.T.O.

SECTION - II

Q5) a) Why ARM processor is called as perfect embedded processor. **[10]**

b) What benefits the designer is getting due to hardwired MAC unit provided in the ARM 7 processor? **[8]**

Q6) a) How two status registers are beneficial while changing the operating mode in ARM 7 processor? Justify the answer with suitable example. **[8]**

b) How the performance of ARM 7 processor is improved? Justify the answer using data flow model of the ARM 7 processor? **[8]**

Q7) a) What are the typical features of the ARM 7 instruction set? Justify the answer by giving suitable example? **[12]**

b) Why ARM- 7 processor is not a perfect RISC processor? **[4]**

Q8) a) What are the architectural features of the ARM 9 processor? Justify the answer using block diagram of the ARM 9 processor? **[10]**

b) Write assembly language program for block transfer for ARM 7 processor. **[6]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1972

[3765] - 578

M.E. (E & T/C) (VLSI & Embedded Systems)

RECONFIGURABLE COMPUTING

(2008 Course)

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) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What are the research challenges in general purpose computing architecture's hardware & Software development. **[8]**

b) Give the performance comparison of various computing architectures. **[8]**

Q2) a) How the growth of switch requirement varies in FPGA? Explore with necessary expressions & examples. **[8]**

b) What is meant by overheads? How do they play role in development of Reconfigurable Devices. **[8]**

Q3) a) What are the effects of interconnect granularity? **[8]**

b) Why is weak upper bound so important? Give example. **[8]**

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

a) Fine & coarse grained structures.

b) Peak performance density.

c) Key relations among areas cosumed by net, logic & configuration.

d) Reconfigurable ALUS.

P.T.O.

SECTION - II

Q5) a) What is network utilization efficiency? Give mathematical analysis & example. **[8]**

b) Explain in detail Rent's rule based hierarchical interconnect model. **[8]**

Q6) Draw architectural block diagram of DPGA in detail. Explore each block. What are the merits & limitations of DPGA? **[16]**

Q7) a) "Instruction compression & distribution is the key task in development of Reconfigurable device". Explain. **[8]**

b) Suggest best suitable architecture for Reconfigurable device. Explain with block diagram. **[8]**

Q8) Write short notes on any three. **[18]**

a) Reconfiguration timing & latency.

b) LUT based architecture.

c) Granularity.

d) Locally configured instructions.

Total No. of Questions : 8] [Total No. of Pages : 2

P1973

[3765]-583
M.E. (E & T/C) (VLSI & Embedded Systems)
RFIC DESIGN
(2008 Course)

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) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What is Open Ckt Time constant method? Explore with example & mathematical analysis in detail. What are its limitations? **[8]**

b) Why S parameters are needed to analyse RF amplifiers? Give S matrix of two port RF amp^r & its meaning. **[8]**

Q2) a) What is shunt series amplifier? What are the effects on gain & bandwidth? **[8]**

b) Explore the bandwidth enhancement with f_T doublers. **[8]**

Q3) List the sources of RFI/EMI & cross talk. What are the mitigation techniques? How to achieve them? **[16]**

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

a) Neutralization & unilateralization.

b) Poles & Zeros in RF amplifiers.

c) RF model of MOSFET

d) Short channel effects of MOSFET.

SECTION - II

Q5) a) Design RF amplifier for voltage gain of 60 dB and Bandwidth of 400 MHz. Use source followers at input and output to improve bandwidth.**[12]**

b) What is AM-PM conversion? **[4]**

P.T.O.

Q6) a) Why is degeneration required in LNA? Explain inductive source degeneration with necessary expressions. **[8]**

b) Differentiate single ended & differential LNA. Draw the schematics. **[8]**

Q7) a) Explore different types of mixers with the concepts & mathematical expressions. **[8]**

b) Give RF ASIC design flow in detail. **[8]**

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

a) Noise in RF amplifiers.

b) Requirements of LNA.

c) Spurs.

d) Power constrained noise optimization.

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Total No. of Questions : 8] [Total No. of Pages :4

P1974

[3765] - 584

M.E. (VLSI & Embedded System)

FAULT TOLERANT SYSTEM DESIGN

(2008 Course)

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

Instructions to the candidates:

1) ***Answer any 3 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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Differentiate between single and multiple fault models.
For the combinational circuit shown in Fig. 1 determine the test vectors that detect the Irredundant faults. **[8]**

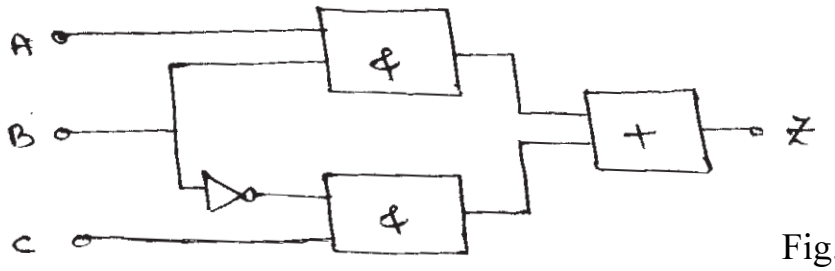

Fig. 1

b) Explain in detail the multiple stuck fault model. Prove that fault 'a' s-a-l masks fault 'c' s-a-o for the circuit shown in Fig. 2. Determine the test vector for the same. **[8]**

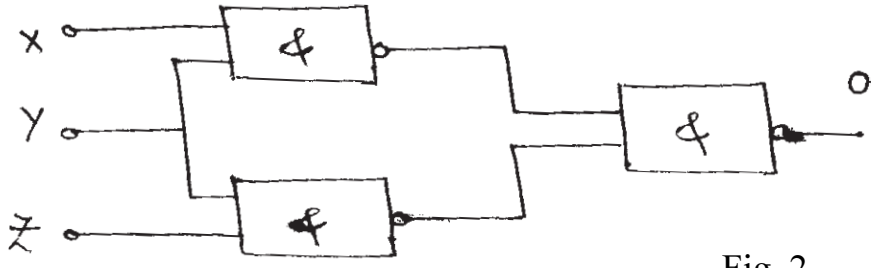

Fig. 2

P.T.O.

Q2) a) With the help of block diagram explain in detail the process response compacting and classify them in brief. **[8]**

b) Explain with block diagram the application of self checking system for error detection and error correction.
Design a self checking system to realize a combinational function $Z_1\ (x_1 \oplus x_2)$ and $Z_2\ (\overline{x_1 - x_2})$ for fault detection $f_1 = f_2 = 1$. **[10]**

Q3) a) What is logic simulation? Explain step by step process the use of 3 valued logic in the detection of static Hazard for the Fig 3. **[8]**

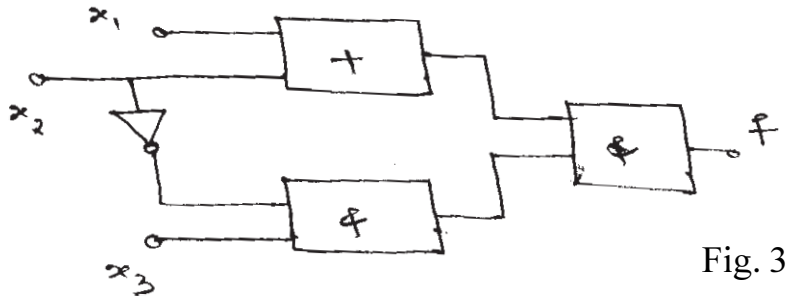

Fig. 3

b) Construct a Zoom Table for evaluating AND. OR, NAND and NOR gates with two inputs binary values. **[8]**

Q4) a) Define fault equivalence for a sequential ckts.

b) Define fault Dominance Theorem for a combinational ckts.

c) For the Fig 4 shown, determine collapse ratio by applying fault equivalence and fault dominance theorem in detail

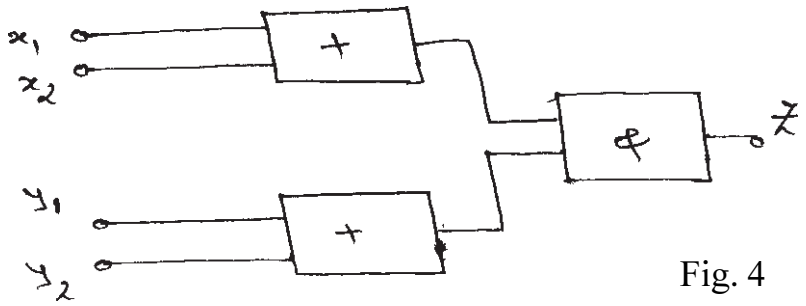

Fig. 4

d) Explain what is path sensitization. Construct a Truth table for a Two input NAND gate using 6 - valued logic. **[18]**

SECTION - II

Q5) a) Why to model faults? Explain in detail the Deductive fault simulation algorithm with reference to the ckt shown in Fig 5. **[8]**

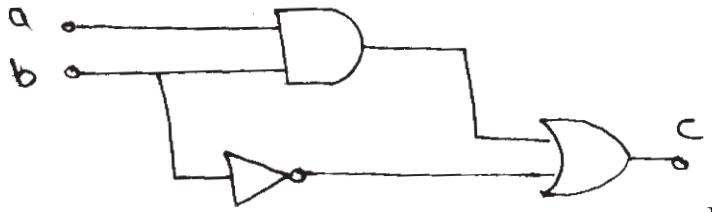

Fig. 5

b) Define the following terms in brief :

i) Fault Efficiency

ii) Fault Propagation

iii) Fault Justification

iv) Fault Location. **[8]**

Q6) a) Differentiate between On-line and Off-line BIST. Explain in detail the Off-line BIST architecture at the board level. **[8]**

b) Determine the signature of the C.U.T shown in Fig. 6 for the pseudo random pattern function $f(x) = x^3 + x + 1$ initialized at 110. **[10]**

f → s-a-1

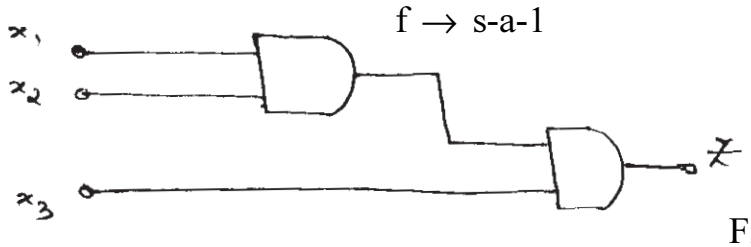

Fig. 6

Q7) Write short notes on : **[18]**

a) A T G systems.

b) Bridging Fault Model.

c) Testing of PLAs.

Q8) a) Explain in brief the concepts with respect to DFT : **[8]**

i) Test points.

ii) Partitioning large circuits.

iii) Initialisation.

iv) Oscillators and clocks.

b) Generate a Test set for the fault ‘f’ s-a-o for the Fig. 7 using D-algorithm for Testing of single stuck faults. **[8]**

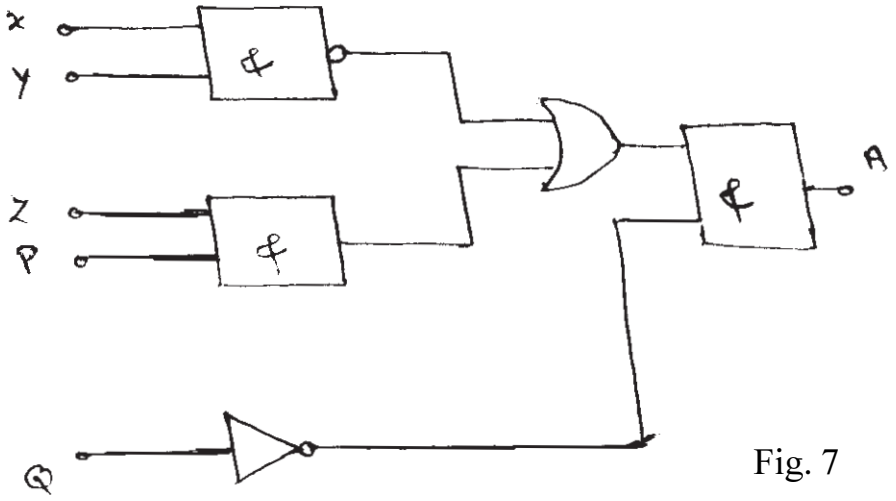

Fig. 7

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Total No. of Questions : 8] [Total No. of Pages : 2

P1975

[3765]-600

M.E. (Electronics) (Digital System)

IMAGE PROCESSING AND PATTERN RECOGNITION

(Revised 2008 Course)

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 books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Use of scientific calculator is allowed.***

SECTION - I

Q1) a) Explain the method of convolving a 3 × 3 mask with the image. How a centre pixel is modified? **[4]**

b) Explain the effect of logarithmic transformation on the image. **[4]**

c) Draw a transformation that will highlight range of intensity values between A & B and will preserve all other levels. **[4]**

d) Explain how to draw a histogram for a given image. **[4]**

Q2) a) Explain what is edge detection? Draw sobel edge operators for horizontal and vertical direction. Explain how this operator will detect the edge? **[8]**

b) What is a Laplacian operator? What is the advantage of using LOG filter? Why to detect zero crossings? **[8]**

c) Explain how to detect the direction of the gradient using sobel operator. **[2]**

Q3) a) Explain the method of histogram equalization for image enhancement. Write the algorithm. **[8]**

b) Explain how will you select a probability distribution for a given random variable. **[4]**

c) Find the expected value of a uniform random variable existing between 3 to 12. **[4]**

Q4) a) Explain the maximum likelihood estimate for a mean. What is unbiased estimate? **[8]**

b) Suppose the sample values x = 2, 3, 5, 6, 8, 9, 11 and 12 come from a uniform distribution. Find the estimate of range of x using the method of moments. What is the disadvantage of using this method. **[8]**

SECTION - II

Q5) a) What is a risk? Explain the method of minimum risk estimation? **[8]**

b) How to draw a decision boundary that gives optimal decision. Explain with the help of simple example. **[8]**

Q6) a) Consider two classes A and B both with bivariate normal distribution with equal prior probabilities. The parameters for conditional densities of class A are $\mu_x = 0$ $\mu_y = 0$ $\sigma_x = 1$ $\sigma_y = 2$ $\rho_{xy} = 0$ and for class B $\mu_x = 2$ $\mu_y = 0$ $\sigma_x = 1$ $\sigma_y = 2$ $\rho_{xy} = 0$. Find the equation for a decision boundary. **[10]**

b) When there are unequal costs of errors, how to select a class that minimizes a risk? Explain with one simple example. **[8]**

Q7) a) Explain the method of simple counting for estimation of error rates. **[6]**

b) Explain the leaving one out technique for error estimation. **[6]**

c) What are characteristic curves? **[4]**

Q8) a) Explain the nearest neighbour classification technique. Why Bayesian classifier performs better? **[8]**

b) Explain single linkage algorithm for hierarchical clustering. Explain Forgy's method for partitional clustering. **[8]**

OR

Explain sequential mean square error algorithm. What are Hopfield Nets.

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Total No. of Questions : 8] [Total No. of Pages :2

P1976

[3765] - 601

M.E. (Electronics) (Digital System Design)

DIGITAL SYSTEM DESIGN USING PLD'S

(2008 Course) (Elective - III)

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

Instructions to the candidates:

1) ***Answer any three questions from each section.***
2) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What is difference between logic implementated in CPLD & FPGA, compare their features in detail. **[8]**

b) What are the types of PLD's. **[8]**

Q2) a) Draw and explain about the architecture of CPLD in detail. **[8]**

b) Give the details and feature of 5200 FPGA family. **[8]**

Q3) a) Differentiate between the general purpose processor & digital signal processor. **[8]**

b) List out the Advanced VLSI tools for synthesis, discuss any one in detail. **[8]**

Q4) a) What are the various parameters to optimize power and area of CPLD and FPGA. **[8]**

b) Write VHDL code for ominidirectional Robot with four wheel, give proper interfacing diagram. **[10]**

SECTION - II

Q5) a) Discuss about the sparatan-3FPGA. **[8]**

b) Explain about the physical design for FPGA w.r. to placement and routing. **[8]**

P.T.O.

Q6) a) Draw state diagram and write VHDL code for traffic light controller. **[8]**

b) Give overview and discuss features about the Cool Runner - II CPLD. **[8]**

Q7) a) Discuss about the Design methodologies w.r. to

i) Design Process.

ii) Design Standards.

iii) Design Verification. **[8]**

b) What are the different FPGA programming techniques? Discuss any one in brief. **[8]**

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

a) ASICS.

b) In system programming.

c) Methodology for evaluating FPGA fabrics.

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Total No. of Questions :8] **[Total No. of Pages : 2**

P1977

[3765]-604
M.E. (Electronics) (Digital Systems)
RECONFIGURABLE COMPUTING
(2008 Course)

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

Instructions to 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) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explore in detail the evolution of general purpose computing with VLSI technology. **[8]**

b) List and explain in brief the characteristics of Reconfigurable device. **[8]**

Q2) a) What is meant by configurable, programmable and fixed function devices? Give suitable examples. **[8]**

b) What is partial reconfigurability? Are such devices being used commercially? Give examples. **[8]**

Q3) a) Define density & diversity. Give mathematical expressions. **[8]**

b) List various reconfigurable devices developed yet. Brief their characteristics/features. **[8]**

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

a) Interconnects.

b) General purpose computing issues.

c) Crossbars.

d) Area consumption by different architectural building blocks in reconfigurable device.

P.T.O.

SECTION - II

Q5) Give empirical view of general purpose computing architectures in the age of MOS VLSI. Compare their performances. **[16]**

Q6) Explore the architectural building blocks of iDPGA & DPGA. What is difference between them? **[16]**

Q7) a) What are the problems with simple networks? Suggest best option for reconfigurable device. **[8]**

b) Give the mathematical model for Rent's rule based channel & wire growth. **[8]**

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

a) Instruction compression.

b) Resources in reconfigurable devices.

c) Contexts.

d) MATRIX.

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Total No. of Questions : 12] [Total No. of Pages : 3

P1978

[3765]-613
M.E. (Production)
ADVANCE MACHINE TOOL DESIGN
(Revised Course 2008) (Elective - I)

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

Instructions to the candidates:

1) ***Attempt one question from each unit of Section I and Section II.***
2) ***Answers 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 electronic pocket calculator and statistical tables is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

UNIT - I

Q1) a) What is meant by high efficiency machining range? Explain in brief. **[8]**

b) Deduce the expression for power in milling machine and show diagrammatically the forces acting on milling cutter during machining.**[10]**

OR

Q2) a) What do you understand by kinematic structures in machine tools? **[6]**

b) What are the distinctive features of machining and turning centers? Why are they so versatile? **[6]**

c) Illustrate with a neat sketch the kinematic structure for a broaching machine. **[6]**

UNIT - II

Q3) a) Why is the stiffness of machine tools so important in machining operation? **[8]**

b) During the drilling operation on a radial drilling machine, analyze the different forces acting on the radial arm. Explain the procedure to design the radial arm. **[8]**

OR

Q4) a) Discuss the common requirements of spindle support. **[6]**

b) Why it is essential to preload the bearings of spindle mountage? **[4]**

c) Explain with sketches the methods of preloading a ball screw. **[6]**

UNIT - III

Q5) a) What is meant by regenerative chatter? Explain it with reference to any one type of machine tool. **[8]**

b) What do you understand by Hydraulic Power Pack in machine tool? Explain the factors used for selecting fluids for hydraulic system. **[8]**

OR

Q6) a) A nine speed gear box is to be designed for the minimum speed of 100 rpm and maximum speed of 1600 rpm. It is to be driven by an induction motor rotating at 1500 rpm. Draw best structural diagram, optimum ray diagram and gear box layout. **[10]**

b) With the help of schematic diagram explain the working principle of any one type of electrical control system incorporated in machine tool. **[6]**

SECTION - II

UNIT - IV

Q7) a) How does a 180º rotation tool changer work? How does a pivot insertion tool changer work in CNC machine? **[6]**

b) Explain the working principle of recirculating ball screws commonly used in CNC versions. What are its special advantages? **[6]**

c) Would it be possible to design and build machining and turning centers without the use of computer controls? Explain. **[6]**

OR

Q8) a) Explain with a block diagram the working principle of CNC machine. **[6]**

b) What procedure is used by the operator to determine the tool length offsets? **[6]**

c) What are the five basic types of tool changers? **[6]**

UNIT - V

Q9) a) Why is damping of machine tools important? How is it accomplished? **[6]**

b) Write a note on dynamic characteristic of the cutting process. **[6]**

c) Why is thermal expansion of machine tool components important? **[4]**

OR

Q10) a) What do you understand by stick-slip motion? Explain with a suitable example. **[8]**

b) Describe the procedure followed in performing acceptance tests for machine tools. **[8]**

UNIT - VI

Q11) a) Discuss the modern trends in design of machine tools. **[8]**

b) Describe how CAD techniques can be applied in design of machine tool structures. **[8]**

OR

Q12) a) Explain the importance of aesthetics as a requirement in machine tool design with a suitable example. **[8]**

b) Explain the concept of ergonomics as applied to different parts of machine tool. **[8]**

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Total No. of Questions : 12] [Total No. of Pages : 3

P1979

[3765] - 617

M.E. (Production)

ENGINEERING ECONOMICS & ACCOUNTING

(Elective - II) (2008 Course) (511105)

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

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate books.***
2) ***Figures to the right indicate full marks.***
3) ***Use of electronic pocket calculator is allowed.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Differentiate between Micro Economics and Macro Economics. State the utility of these. **[8]**

b) How will you utilize the knowledge of Economics in Production Management? **[8]**

OR

Q2) a) Discuss any two important Macro Economical happenings affecting the industry during the recent past. **[8]**

b) In your opinion, is shortage of material and price rise due to it, a micro economical aspect or macro economical? Justify. **[8]**

Q3) a) Explain the concept of Elasticity of Demand giving any two suitable examples. **[8]**

b) How can one measure the elasticity of demand? What are the assumptions in deciding this? **[8]**

OR

Q4) a) Mention any two techniques of demand forecasting, highlighting the assumptions and limitations. **[8]**

b) Mention the factors affecting the elasticity of demand with brief description for these. **[8]**

P.T.O.

Q5) a) Mention the benefits of Monopoly, Oligopoly and Perfect Competition. **[9]**

b) What are the differences between the Public Sector and Co-operative sector undertakings? **[9]**

OR

Q6) Write short notes on any three of the following:- **[18]**

a) Characteristics of Human Needs.

b) Inelastic demand – reasons with examples.

c) Law of Demand.

d) Characteristics of Oligopoly with examples.

SECTION - II

Q7) a) Enumerate the costs and benefits you will consider for taking decision on plant expansion. **[8]**

b) A company purchases 6,000 components per annum @ 60 Rs. Each. The management decides to install a machine to manufacture the components.

The cost of the machine is Rs. 3,00,000 and has capacity of producing 10,000 components per annum. Expected life of the machine is 5 years. Variable cost of the components to be manufactured is Rs. 48 per component and a sum of Rs. 20,000per annum is general factory overhead.

Should the company make or buy this component?

If an offer to buy 2,500 components per piece is received from another customer, should it be accepted? **[8]**

OR

Q8) a) How does infrastructure investment made by the Government helps in improvement in industrial productivity? **[8]**

b) What are the steps involved in Cost-Benefit analysis? **[8]**

Q9) a) Mention the assumptions made in Break-Even-Analysis. **[6]**

b) Differentiate between Absorption Costing and Marginal Costing. **[6]**

c) Cost classification – purpose. **[6]**

OR

Q10) a) Mention the application of Marginal Costing. **[6]**

b) Differentiate between Direct Cost and Indirect Cost with suitable examples. **[6]**

c) What is the meaning of the term 'contribution'? Explain in brief. **[6]**

Q11) a) Mention the major considerations for investment decisions. **[8]**

b) What is meant by 'depreciation'? Is it a cost? Justify. **[8]**

OR

Q12) a) Discuss any two methods of depreciation highlighting the benefits and limitations. **[8]**

b) Why is it essential to consider discounting of cash flows in accounting? Which are the factors determining the rate of discounting. **[8]**

Total No. of Questions : 12] [Total No. of Pages : 3

P1980

[3765]-627

M.E. (Production)

INTELLECTUAL PROPERTY RIGHTS AND PRODUCT DESIGN

(Revised Course 2008) (511112) (Elective - IV)

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

Instructions to the candidates:

1) ***Attempt one question from each unit of section-I and section-II.***
2) ***Answers 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 electronic pocket calculator and statistical tables is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

UNIT - I

Q1) a) What is 'Intellectual Property' and what rights can the owner of IPRs secure for himself/herself? **[6]**

b) What are the macro-economics roles of trademark? **[6]**

c) Discuss the limitations and exceptions applicable to copyright protection. **[6]**

OR

Q2) a) Discuss the rationale behind 'Intellectual Property (IP)'. **[6]**

b) Discuss the role of trademark in corporate valuation, licensing and franchising. **[6]**

c) Why and how is copyright different from patent rights? **[6]**

UNIT - II

Q3) a) What is a utility model or a petty patent? How does it differ from the normal patent? **[5]**

b) What are the basic criteria of patentability? **[5]**

c) Discuss the issues related to enforcements of IPRs in developing countries. **[6]**

OR

P.T.O.

Q4) a) What are the exclusive rights granted to a patent holder? **[5]**

b) What are the challenges faced by the developing countries in enforcing IPRs? **[5]**

c) Discuss the consequences of a disregards of IPRs in a country for its economy and the society in general. **[6]**

UNIT - III

Q5) a) When did the Geographical Indications of Goods (Registration and Protection) Act, 1999, come in to force? Where in India is the Geographical Indication Registry located. **[6]**

b) Distinguish between trade secret and patent. Under what circumstances would you advise to make use of trade secret protection? **[5]**

c) Show by flow diagram the progress of a patent application from the date of filing to the grant and sealing of patent. **[5]**

OR

Q6) a) What do you understand by *Unfair Competition*? Why there is a need for protection against it under intellectual property regime? **[5]**

b) Why is it necessary to provide protection to databases under IPR laws? **[6]**

c) What are the legal instruments for technology transfer? **[5]**

SECTION - II

UNIT - IV

Q7) a) What is meant by the term 'Defendant' in a case of infringement? **[6]**

b) What provisions have been made in the TRIPS Agreement in respect of Industrial Designs? **[6]**

c) Explain briefly the current international developments in the protection of traditional knowledge. **[6]**

OR

Q8) a) Discuss the technological challenges to IP with reference to computer software industry. **[6]**

b) What are the tools of technology transfer? **[6]**

c) Explain briefly the factors considered in valuation of technology. **[6]**

UNIT - V

Q9) a) Outline the factors affecting product design. **[6]**

b) Classify the methodolgy and techniques in product design. **[5]**

c) Describe how a designer would use ergonomics when designing a product with suitable example. **[5]**

OR

Q10) a) "A designer should always consider **Health** and **Safety** when designing a product". Comment. **[6]**

b) State the principle requirements of good product design. **[5]**

c) List the important considerations affecting product design. **[5]**

UNIT - VI

Q11) a) Discuss the extent to which advances in technology influence the design of graphic products. **[5]**

b) Explain the benefits of manufacturing products using standard components. **[5]**

c) Discuss the implications of the increasing use of plastics in the production of automobile parts. **[6]**

OR

Q12) a) Discuss the factors to be considered when deciding upon the most appropriate manufacturing process for any engineering product of your choice. **[6]**

b) State different ways in which packaging can be made more environmentally friendly. **[5]**

c) Give different reasons why product should be packaged. **[5]**

Total No. of Questions : 12] [Total No. of Pages :2

P1981

[3765] - 623
M.E. (Production)
WELDING AND JOINING
(2008 Course) (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 logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***
7) ***Your answer will be valued as a whole.***

SECTION - I

UNIT - I

Q1) a) Explain what do you understand the term weldability and what are the effects of alloying elements on weldability. **[8]**

b) What are the thermal effects of welding on parent metal and its mechanical properties? Explain. **[8]**

OR

Q2) a) With the help of figure explain cellular and dentritic growth patterns and the manner of solute distribution (i,e . segregate pattern) in case of weld solidification. **[8]**

b) Explain different methods of weldability testing in brief. **[8]**

UNIT - II

Q3) a) Explain different types of welding arcs in brief. **[8]**

b) With the help of graph explain different electrical characteristics of welding arc. **[8]**

OR

Q4) a) Explain the role of electrode polarity in welding arc. **[8]**

b) "The electrode coating depends on electrical, physical and metallurgical control in welding operation" Explain this in brief. **[8]**

P.T.O.

UNIT - III

Q5) a) Discuss on Arc instability caused by DC component in AC TIG welding. **[9]**

b) Explain different process parameters in GMAW welding. **[9]**

OR

Q6) a) Explain the effect of electrode angle on weld size and penetration in case of SAW process. **[9]**

b) Explain the methods to improve metallurgical properties of electroslag welds. **[9]**

SECTION - II

UNIT - IV

Q7) a) Explain the constant current characteristics of arc welding power source. **[8]**

b) Explain what is Duty Cycle in brief? **[8]**

OR

Q8) a) With the help of block diagram explain Solid State Inverter System used in welding. **[8]**

b) What are the different types of rectifiers used in welding? Explain any one in brief. **[8]**

UNIT - V

Q9) a) Explain different forces affecting metal transfer during welding. **[9]**

b) Explain metal transfer in SMA W process. **[9]**

OR

Q10) a) What are the different modes of Metal Transfer? Explain at least three in brief. **[9]**

b) Explain in brief effect of metal transfer on weld characteristics. **[9]**

UNIT - VI

Q11) a) Explain principle of operation of Ultrasonic Welding with its equipments. **[8]**

b) What is explosive welding? Explain its advantages and limitations. **[8]**

OR

Q12) a) Explain operational steps of friction welding and also explain welding variables in friction welding. **[8]**

b) Explain principle of operation of Electron Beam Welding **[8]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1982

[3765] - 685
M.E. (Petroleum)
WELL PLANNING AND DESIGN
(Elective - II) (2008 Course) (512105)

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

Instructions to the candidates:

1) ***Q.No.1 and Q.No.5 are compulsory. Out of the remaining attempt two questions from Section - 1 and two 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 Mollier charts, non-programmable electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) What is Geo-Technical Order (GTO)? How it is different for various types of well trajectories? Explain in brief, how will you obtain or calculate various parameters for any typical GTO. **[18]**

Q2) a) Discuss the graphical method to determine, 'casing seat position' for a well in brief. Draw a typical pressure Vs depth graph and show formation pressure, mud pressure, fracture pressure along with casing seat for number of casing pipes. Indicate all the features of this diagram. **[10]**

b) Explain the signification of formation integrity test in brief. **[6]**

Q3) a) Describe various factors to be considered in well cost estimation and explain, AFE preparation in brief. **[10]**

b) Write the various reservoir aspects to be considered in selection of type of well. Explain any two in brief. **[6]**

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

a) Drilling fluid selection and planning for a well.
b) Bit selection criteria.
c) Types of wells.
d) Rig selection.
e) Methods of well cementation.

P.T.O.

SECTION - II

Q5) a) Draw a typical layout for an on-shore drilling rig-site. Indicate various features and explain important aspects from the point of highest operational efficiency and safety. **[10]**

b) Explain any one method to determine fracture gradient in brief. **[8]**

Q6) a) Write various parameters affecting rate of penetration during drilling. How will you optimize weight on bit and rpm to get highest ROP? Draw the necessary graph. **[10]**

b) What is the basis for design of well completion program? Explain. **[6]**

Q7) Write short note on: **[16]**

a) Well completion for multilateral well.

b) Offshore rig design considerations.

c) Optimization of rig hydraulies.

d) Well report.

Q8) Describe in detail any one case study pertaining to well planning of horizontal or directional well. Discuss various factors considered, in the design and planning of this well. Write various equations and show graphs to explain the planning measures. **[16]**

Total No. of Questions :6] **[Total No. of Pages : 3**

P1983

[3765]-690

M.E. (Petroleum Engineering)

ADVANCED NATURAL GAS ENGINEERING & TECHNOLOGY

(New 2008 Course)

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

Instructions to candidates:

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

SECTION - I

Q1) Define the properties Bg, z, µg, Ppc,Tpc, EOS, H and explain how these properties are obtained by some suitable correlation. Explain how Bg, cg, µg, vary with pressure. **[25]**

OR

Following surface conditions are given :

a) API gravity of condensate = 52
b) GOR in the first separator = 10,000 scf / stb
c) Pressure in the first separator = 550 psi
d) Temperature in the first separator = 90 deg F
e) Specific gravity of gas in the first separator = 0.7

Calculate the wellstream specific gravity, and critical properties of gas.

Q2) Derive the pipe line flow equation. **[25]**

OR

The following data are provided for air-water flow. Estimate the slip and no-slip mixture properties. Estimate the gravitational and frictional pressure gradients using both slip and no-slip properties.

a) Q1 = 0.1 ft3/sec
b) Qg = 0.2 ft3/sec

P.T.O.

c) Rho-l= 62.4 lbs/ft3
d) Rho-g = 1.5 lbs/ft3
e) Mu-l = 1 cp
f) Mu-g = 0.015 cp
g) D = 3.5 inches
h) H1 = 0.45
i) Theta = 90 degrees
j) Roughness = 0.00006 ft

Q3) Distinguish between reciprocating and centrifugal compressors. Explain how any one of the design formulas is obtained. **[25]**

OR

Natural gas with the following properties and conditions is to be compressed by a centrifugal compressor

a) Gamma-g = 0.62
b) Ps = 256 psia
c) Pd = 665 psia
d) k = 1.26
e) ts = 99 deg F

If the desired flow rate is 45 MMSCFD, what horsepower is required to compress the gas assuming 75% adiabatic efficiency and 95% mechanical efficiency?

SECTION - II

Q4) Explain phase behaviour of a gas reservoir and material balance equation. **[25]**

OR

For water drive reservoirs (with no water production at the wells), derive the following equation.

P/Z = (Pi / Zi) [(1 – (Gp/Gi))] / [(1–(WeBw/GiBgi))]

Q5) Draw a process flow diagram to show two methods how CO_2 is removed from a natural gas stream. **[25]**

OR

Draw and explain process flow sheet for H_2S removal.

Q6) Derive the equation used to calculate flow rate in a orifice meter. Explain all the constants. **[25]**

OR

Following data were provided for a multi-rate isochronal test. Generate inflow performance relationship using the analytical m(p) method and the empirical m(p) method.

a) Pr = 352.4 psia

b) $M(p) = m(Pr) = 9.9714 \times 10\,\hat{}\,6 \text{psia}\,\hat{}\,2/\text{cp}$

Time (hours)	Qg (MMSCF/D)	Pwf (psia)	M(pwf)
0.5	0.983	344.7	$9.6386 \times 10\hat{}6$
0.5	2.631	329.5	$9.0027 \times 10\hat{}6$
0.5	3.654	318.7	$8.5674 \times 10\hat{}6$
0.5	4.782	305.5	$8.0534 \times 10\hat{}6$
1	0.977	342.4	$9.5406 \times 10\hat{}6$
1	2.588	322.9	$8.7351 \times 10\hat{}6$
1	3.565	309.5	$8.2071 \times 10\hat{}6$
1	4.625	293.6	$7.6136 \times 10\hat{}6$
2	0.97	339.5	$9.4179 \times 10\hat{}6$
2	2.533	315.4	$8.4371 \times 10\hat{}6$
2	3.453	298.6	$7.7922 \times 10\hat{}6$
2	4.438	279.6	$7.0990 \times 10\hat{}6$
3	0.965	337.6	$9.3381 \times 10\hat{}6$
3	2.5	310.5	$8.2458 \times 10\hat{}6$
3	3.39	291.9	$7.5435 \times 10\hat{}6$
3	4.318	270.5	$6.7797 \times 10\hat{}6$

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Total No. of Questions :8] **[Total No. of Pages : 2**

P1984

[3765]-696
M.E. (Petroleum)
ADVANCED OFFSHORE TECHNOLOGY
(512111) (2008 Course) (Elective - III)

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

Instructions to the candidates:

1) ***Q. No. 1 and Q. No. 7 are compulsory. Out of the remaining attempt two questions from Section - I and two 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 Mollier charts, non-programmable electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Describe the well design considerations for high pressure, high temperature deep drilling program. Write the possible challenges and solution in brief. **[6]**

b) Discuss the step by step operation of lowering TGB and drilling 30º hole and lowering structural casing and cementation in deep water drilling with suitable sketches. **[12]**

Q2) a) Calculate new kG if rig displacement of 21000 Tons and kG of 58 feet. A weight of 180 tons with VCG of 11 ft is moved to VCG of 167 ft. **[4]**

b) Describe various mathematical equations to calculate wind, wave and current forces acting on offshore structures. State and explain assumptions and parameters of these equations. **[12]**

Q3) a) Describe Lower Marine Riser Pack (LMRP). Draw a typical subsea BOP stack with LMRP. **[8]**

b) Discuss Dynamic Positioning System of station keeping in detail. **[8]**

P.T.O.

Q4) a) Write short notes on : **[10]**

i) Subsea Diving System.

ii) Riser design considerations.

b) Draw neat schematic sketch of a, 'typical subsea well completion system.' Indicate all the features. **[6]**

SECTION - II

Q5) a) What is tension leg platform? Discuss design considerations in brief, for the same. **[8]**

b) Discuss tubular joint classification in brief with suitable sketch. **[8]**

Q6) a) What is well cementation? Explain a typical well cementation programme for deep water (offshore) well. **[8]**

b) Discuss types of subsea horizontal trees in detail. **[8]**

Q7) Write short notes on : **[18]**

a) Marine terminals and transport.

b) Offshore safety.

c) Forces and motions acting on fixed platform.

Q8) a) Describe in detail productive formation testing methods, in brief. **[8]**

b) Discuss design consideration in oil and gas pipeline. **[8]**

# # # #

Total No. of Questions :10] **[Total No. of Pages : 3**

P1985

[3765]-701
M.E. (IT)
REAL - TIME & EMBEDDED SYSTEMS
(2008 Course) (Elective - I)

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

Instructions to candidates:

1) ***Answer any three question 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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Elaborate on challenges of design and development of embedded system. **[8]**

b) Briefly describe the difference between waterfall and spiral development module. Explain the suitability wrt embedded system. **[8]**

Q2) a) Explain ARM thumb mode and discuss the advantages of the same with suitable examples. **[8]**

b) Explain the branching and pipelining function in SHARC processor with suitable examples. **[8]**

Q3) a) Draw the functional diagram of SHARC processor. Explain the functionality of each of the peripheral therein in brief. **[8]**

b) Explain the Dual port memory architecture of the SHARC processor along with the role of DMA channels. **[8]**

Q4) Design a cash register system for small hotel serving about 100 items.**[18]**

a) The cash register is a stand alone system to issue cash bills on the counter. The list of items is pre stored format and accessible through two character code. The cost of each item is also pre stored. The device maintains daily sales account downloadable through serial port in CSV format file.

P.T.O.

b) The device has 64 × 220 LCD screen interface displaying 8 × 40 character format display. It has alphanumeric keyboard interface to input item code and quantity of item.

c) The final bill is printed with alphanumeric printer with necessary details.

Expected Design level :

i) Customer requirement specifications.

ii) System level block diagram.

iii) Behavioural functionality of the device.

iv) Display and bill formats.

v) Data base of storage of item code, item description and cost.

vi) Item code, item description, item cost upload file format and daily account record download file format.

Q5) Write short notes on any four : **[16]**

a) Pipelining in processors.

b) List ARM CPU modes of operations with brief description of each.

c) Shadow write in SHARC processor.

d) Debugging tools in embedded system.

e) Exception handling in ARM processor.

f) Control oriented specification language symbols.

SECTION - II

Q6) a) Compare and contrast I2C, CAN serial buses with respect to features, data rates, wire length and no of devices it can connect. **[8]**

b) Explain bus arbitration algorithm for Ethernet bus. **[8]**

Q7) a) Discuss the assumption for clock driven scheduling and explain cyclic scheduler in detail. **[8]**

b) What is CAN? Discuss the functional operation of CAN bus in brief with suitable diagrams where ever necessary. **[8]**

Q8) a) Explain top down approach and bottom up approach in the embedded system design process with major levels of abstraction in design process with suitable diagrams where ever necessary. **[10]**

b) What is a design flow model? Explain any one with suitable diagram. **[8]**

Q9) a) What are assumptions for priority driven scheduling of periodic tasks explain with suitable scheduler. **[8]**

b) Give the classification of the scheduling algorithms, compare and contrast static vs. dynamic algorithms with examples. **[8]**

Q10) Write short notes on any four : **[16]**

a) Weighted round-robin approach.

b) Schedulable set of jobs and optimal scheduling.

c) Key features of SHARC processor.

d) OSI model.

e) Periodic Task notations and there significance.

f) 7 bit and 10 bit Address format of I2C bus.

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Total No. of Questions :8] **[Total No. of Pages : 2**

P1986

[3765]-739
M.E. (Instrumentation & Control)
ANALYTICAL INSTRUMENTATION
(5061104) (2008 Course)

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

Instructions to 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.***

SECTION - I

Q1) Give significance of 'Chromatography' in chemical analysis. How the chromatography is classified? What are the applications of gas chromatography and liquid chromatography? **[18]**

Q2) Differentiate UV-VIS spectrometry and IR spectrometry. Also discuss advantages of FTIR spectrophotometer over conventional IR spectrophotometer. **[16]**

Q3) Discuss principle, construction and working of Quadrupole Mass spectrometer. **[16]**

Q4) Discuss principle, construction and working of NMR spectrometer. **[16]**

SECTION - II

Q5) Differentiate Absorption spectrometry and Emission spectrometry with illustrations. Also discuss Absorption spectra and Emission spectra. **[18]**

Q6) Explain 'Raman Effect'. Also explain Instrumentation for Raman spectrophotometer and its applications. **[16]**

P.T.O.

Q7) Explain Bragg's law in X-ray diffractometry. Also explain Instrumentation for X-ray diffractometer. **[16]**

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

a) Abbey refractometer.

b) Scintillation counter.

c) Potentiometry.

d) Hollow cathode lamp.

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Total No. of Questions :8] **[Total No. of Pages : 2**

P1987

[3765]-747

M.E. (Instrumentation, Process & Biomedical)

ORGANISATIONAL BEHAVIOUR & MANAGEMENT

(2008)

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

Instructions to candidates:

1) ***Answer 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.***

SECTION - I

Q1) Define management. Explain various functions of management. Critically analyse the roles and required skills of management in a changing business environment brought about by Globalisation. **[16]**

Q2) State and explain the concept of organisational behaviour with its key elements. Briefly explain Elton Mayo's contingency approach and Mc Gregor's system approach of organisational behaviour. **[16]**

Q3) a) "Personality is a complex and multidimentional construct". Explain with reference to determinants of personality. **[8]**

b) Define perception. What are the factors influencing perceptual process? Why perception is a key factor in managerial effectiveness? Justify. **[8]**

Q4) Explain following theories of Motivation : **[18]**

a) Maslow's need heirarchy theory and

b) Victor vroom's expectancy theory.

P.T.O.

SECTION - II

Q5) State and explain the stages of group development, group structure and group processes. As a manager, how would you operate in the group to understand its dynamics and assess its effectiveness. **[18]**

Q6) a) Critically examine Fiedler's contingency theory of leadership. **[10]**

b) What is Managerial Grid? Explain its importance to an organisation. **[6]**

Q7) Define organisational structure with its components. Explain how environment technology and size influence the structure of an organisation? **[16]**

Q8) State and explain the various causes of business conflict and analyse the modes of conflict resolution. How contingency approach to conflict management helpful in this context? **[16]**

# # # #

Total No. of Questions : 8] [Total No. of Pages : 2

P1988

[3765]-509
M.E. (Mechanical) (Mechatronics)
MECHANICAL AND ELECTRONICS MEASUREMENTS
(2008 Course)

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

Instructions to the candidates:

1) ***Answer any three questions from each sections.***
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) Explain important characteristics of measuring instruments. **[8]**

b) Explain the various standards used in measurement. **[8]**

Q2) a) Find the standard deviation of following distribution. **[8]**

Age :	20 - 25	25 - 30	30 - 35	35 - 40	40 - 45	45 - 50
No. of Persons	170	110	80	45	40	35

Take assumed average = 32.5

b) Explain different types of correlations. **[8]**

Q3) a) Obtain the regression equation from following data : **[10]**

x :	6	2	10	4	8
y :	9	11	5	8	7

b) What are features of spearman's correlation co-efficient. **[6]**

Q4) a) Explain with a block diagram the working of logic analyzer. **[9]**

b) Explain with block diagram the working of spectrum analyzer. **[9]**

P.T.O.

SECTION - II

Q5) a) Explain with a neat sketch the working of hot-wire anemometer. **[8]**

b) Explain the working of thermal conductivity gauge for measurement of pressure. **[8]**

Q6) a) Explain a device used for measurement of surface finish. **[8]**

b) Explain the principle and working of Hall sensor. **[8]**

Q7) a) Explain R-2R, DA convertor. **[8]**

b) Explain technique to measure humidity. **[8]**

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

a) Volt standard.

b) CMM.

c) Process control charts.

d) Instrumentation Amplifier.

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Total No. of Questions :6] [Total No. of Pages : 2

P1989

[3765]-525
M.E. (Electrical Engineering) (Control System)
PROCESS CONTROL MANAGEMENT
(2008 Course)

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 wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain the role of management in Process Control System. **[10]**

b) Explain the terms leadership motivation, Group dynamics teams in details. **[15]**

Q2) a) Explain the application of process control system in Electrical Engineering with neat block diagram. **[10]**

b) What is mathematical modelling of the system. Develop a mathematical model for Heat Exchanger. Also find time constant of system? **[15]**

Q3) a) Explain P, PI & PID controllers in details. Also explain reset windup with suitable example. **[20]**

b) Explain Ziegler-Nicholas Tunning method in detail. **[5]**

SECTION - II

Q4) a) Derive expression for discrete PID control algorithm. Explain the effect of digital control on stability of system in details. **[15]**

b) Give merits and demerits of digital control system. **[10]**

P.T.O.

Q5) a) Draw and explain Block diagram of cascade control system in details. Also give advantages and disadvantages of cascade control system. **[15]**

b) Develop a feed forward control system for continuous stirred tank reactor (CSTR) & explain. **[10]**

Q6) a) Define Relative Gain Array (RGA) for process. Give properties of RGA. Also explain how to use RGA for selecting the loops with minimum interactions. **[15]**

b) Explain Decoupling of loops in details with suitable example. **[10]**

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Total No. of Questions : 8] [Total No. of Pages : 2

P1990

[3765] - 122

M.E. (E &TC) (VLSI & Embedded Systems)

REAL TIME OPERATING SYSTEMS

(2002 Course)

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

Instructions to the candidates:

1) ***Attempt any three questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What features of the RTOS support the embedded system operations? Justify the answer using suitable example. **[8]**

b) What are the disadvantages of use of semaphore in the RTOS? What are the techniques used to solve those problems? **[8]**

Q2) a) What are different techniques used to solve sharing data problem? Describe with suitable example. **[12]**

b) How to differentiate RTOS from Desktop OS? **[6]**

Q3) a) Why software generated delays are more accurate than hardware generated delays? **[6]**

b) Why separates means are required in RTOS for inter-process Communication? What are the various techniques used in RTOS? **[10]**

Q4) a) What are the problems of memory allocation using C? How related care is taken in RTOS? **[8]**

b) Can semaphore be used for signaling device? Justify the answer using suitable example. **[8]**

SECTION - II

Q5) a) What are the strengths and weaknesses of the μCOS-II? **[8]**

b) What type of interprocess communication techniques are supported by the μCOS? Which are the various commands/functions used by μCOS for these techniques? **[8]**

P.T.O.

Q6) a) Can VxWorks RTOS be used in small scale embedded system? Justify the answer using features of the VxWorks? **[8]**

b) What features of VxWorks makes it suitable for the network related operations? **[8]**

Q7) a) Whether dynamic scheduling is supported by the μCOS-II? Describe the rate monotonic scheduler. **[10]**

b) What is the advantage of using device drivers? Justify the answer by giving suitable example. **[8]**

Q8) a) What features of the integrated development Environment (IDE) tool are useful in the development of sophisticated embedded system? **[8]**

b) What is the design process/flow used to design and test an embedded system using the emulator/debugger/simulator? **[8]**

Total No. of Questions : 8] [Total No. of Pages :3

P1991

[3765] - 64

M.E. (Mech.) (D. E.)

ANALYSIS AND SYNTHESIS OF MECHANISMS

(2002 Course)

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 and electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) For the function $y = x^2 - x$ in the range $1 \leq x \leq 2$, locate 4 accuracy points with Chebyshev spacing and find the values of y at these accuracy points. Discuss briefly the relation between accuracy point spacing and the structural error of a synthesized mechanism. **[8]**

b) State and prove the Robert-Chebyshev theorem. Also state its uses. **[8]**

Q2) Synthesize a slider-crank mechanism so that the slider displacement is proportional to the crank rotation. The overall displacements of the crank and the follower are 120º and 80 mm respectively. Use 4 accuracy points with Chebyshev spacing. Draw the synthesized mechanism in all 4 accuracy positions. **[18]**

Q3) a) Define the term 'Dyad' and derive the 'Standard Form Equation' of dyad. Explain 4-bar synthesis for 'Rigid body guidance' and 'Path Generation' using the dyad method. Finally, obtain the correlation between the number of prescribed positions and the number of solutions for both the above cases and tabulate this correlation. **[12]**

b) Write a note on 'Branch Defect'. **[4]**

P.T.O.

Q4) a) Explain the principles under lying the 'Method of Normal Acceleration'. **[6]**

b) Figure 1 shows two ternary links EGH and FGI connected to each other and also to four binary links AH, BE, CI and DF. Points A, B, C, and D move with velocities shown in the figure all with zero accelerations. Carry out the velocity and acceleration analysis of the various links and draw the velocity and acceleration polygons. **[10]**

SECTION - II

Q5) a) Synthesize a 4-bar to coordinate the input and output link positions as specified below :

Input link positions	ϕ	0°	30°	60°
Output link positions	ψ	35°	55°	75°

Use the frudenstein's equation. **[8]**

b) Explain D-H parameters, showing a neat sketch of two links of a spatial mechanism connected by a joint with degree of freedom. **[8]**

Q6) a) State and prove the mathematical condition which a 4-bar has to satisfy so that it has a symmetrical coupler curve. **[10]**

b) Explain with a neat sketch the 'Hartmann construction'. **[6]**

Q7) a) Explain with a neat sketch the Bobillier's construction for drawing the inflection circle, if two points A and B on the moving link are given together with their centers of curvature A' and B'. Then explain how this construction can be used for drawing the inflection circle of a slider-crank mechanism. **[10]**

b) Write a note on 'Cubic of stationary curvature'. **[6]**

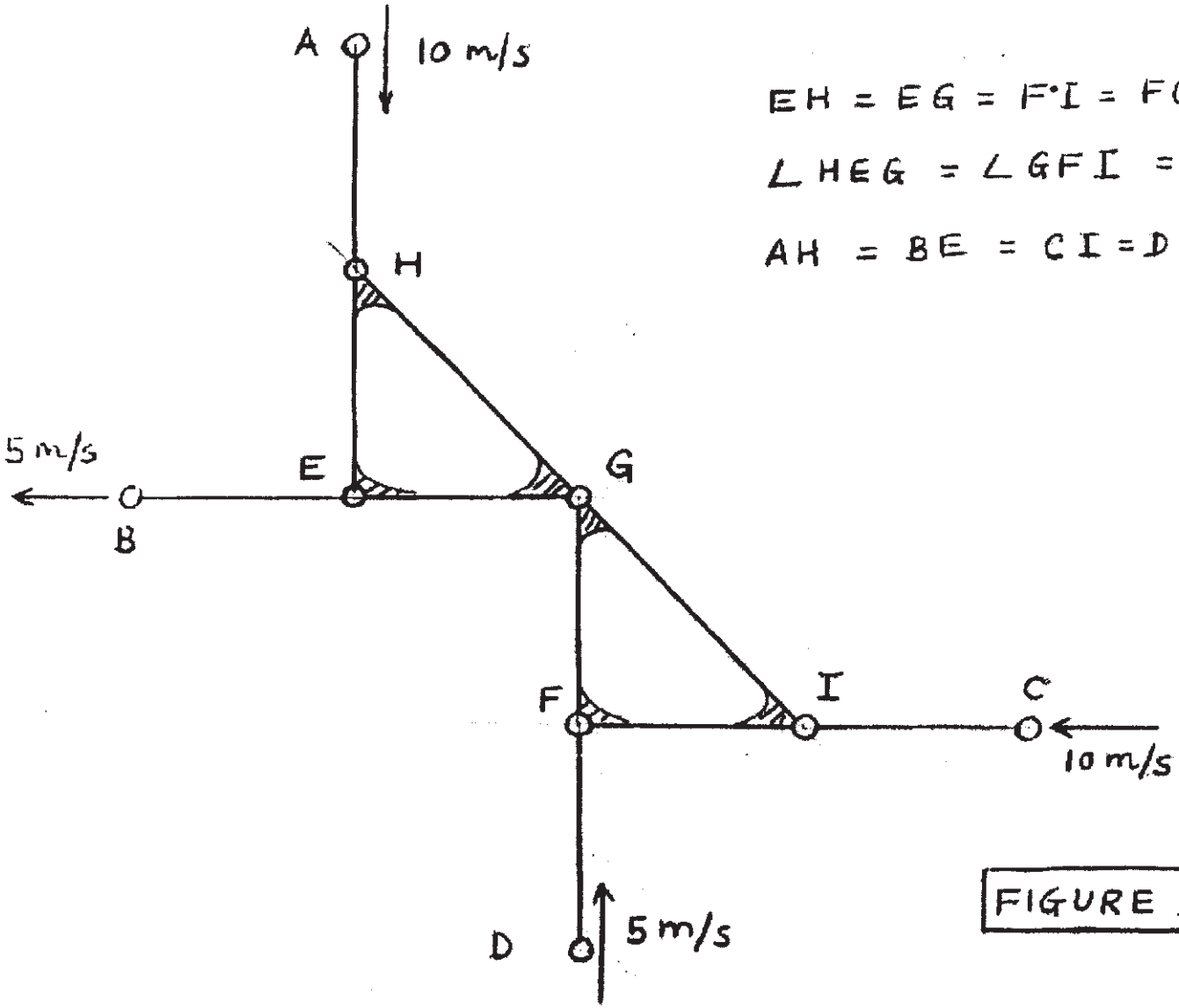
Q8) a) Using the complex vector approach, derive the expressions for the link lengths of a 4-bar mechanism in terms of specified angular velocities and accelerations of its moving links. **[8]**

b) Write notes on any two : **[10]**

i) Mechanical Error of a mechanism.

ii) Pole Triangle.

iii) Mechanical Advantage and Transmission Angle.



$EH = EG = FI = FG = 3\ cm$

$\angle HEG = \angle GFI = 90^{\circ}$

$AH = BE = CI = DF = 3\ cm$

FIGURE 1

Total No. of Questions : 10] [Total No. of Pages : 2

P1992

[3765] - 521

M.E. (Mechanical) (Mechatronics Part - II)

AUTOMOTIVE ELECTRONICS

(5028011 C) (2008 Course)

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

Instructions to the candidates:

1) ***Answer any three questions from each section.***
2) ***Answers to each section should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, wherever necessary but mention it clearly.***

SECTION - I

Q1) Write Short Notes on (Any Two): **[18]**

a) Lambda (Oxygen) Sensor and its role in Emission control.

b) Recent trends in Head lights of cars.

c) Throttle position sensor in engine measurements.

Q2) a) Describe types of batteries employed in Automobiles **[8]**

b) Describe features of Central Locking System and Theft Alarm in cars. **[8]**

Q3) a) Compare Digital speedometer and Analog speedometer in Automobiles in terms of operation, sensors, measurements and lighting. **[8]**

b) Explain in brief CDI with suitable block diagram and its advantage over conventional system. **[8]**

Q4) a) Explain the sensors employed in HVAC unit of automobiles **[8]**

b) Explain EMC and its importance in automobiles. **[8]**

Q5) a) Explain Anti Fog provisions in automobiles. **[8]**

b) Discuss Modes, Controls and Safety features in power windows employed in automobiles. **[8]**

P.T.O.

SECTION - II

Q6) Write Short Notes on (Any Two): **[18]**

a) Three common dashboard sensors and indicators used in Automobiles.

b) Sensors used in wheel alignment and wheel balancing.

c) Function and operating principle of ABS with schematic diagram.

Q7) a) Explain the benefits of 16 bit microprocessors used in ECU of automobiles. **[8]**

b) Write a short note on OBD Systems. **[8]**

Q8) Discuss Engine Control System in general with representative block diagram. Identify six major inputs to engine control unit and four major outputs of engine control system. List out the corresponding sensors and actuators for individual input and output of ECU. **[16]**

Q9) a) Discuss in brief MPFI System in S.I. Engines with a block diagram. **[8]**

b) Discuss in brief traffic indicators in Automobiles. **[8]**

Q10) a) Describe components of Ignition System in S.I.Engines. **[8]**

b) Explain features of battery charging system in automobiles. **[8]**

Total No. of Questions : 10] [Total No. of Pages : 5

P1993

[3765]-611
M.E. (Production Engg.)
RELIABILITY AND FAILURE ANALYSIS
(Revised Course 2008) (511104) (Elective - I)

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) ***Assume suitable data, if necessary.***
5) ***Figures to the right indicate full marks.***
6) ***Use non-programmable electronic calculators is allowed.***

SECTION - I

Q1) a) Calculate the reliability of the system shown in Fig.1. The values in the block show the reliability of individual components in the system. **[10]**

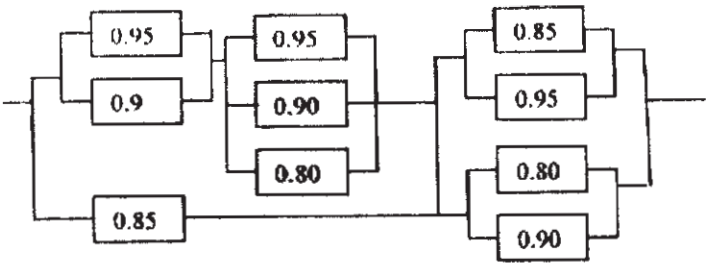


Fig. 1

b) Explain Node Removal Matrix method using Fig.2. The reliabilities of each element is 0.96. Find the system reliability. **[6]**

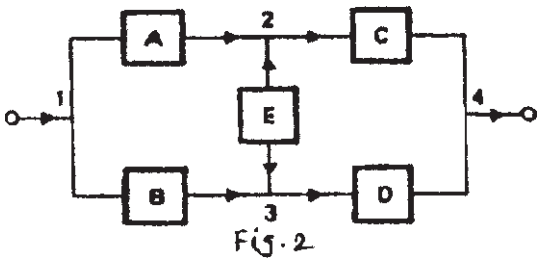


Fig. 2

Q2) a) Explain star-Delta Method of reliability evaluation. **[8]**

b) Write all the possible tie sets and cut sets of system shown in Fig.3. Use minimal tie sets and calculate the reliability of the system if all the components are identical with a reliability of 0.95. **[8]**

P.T.O.

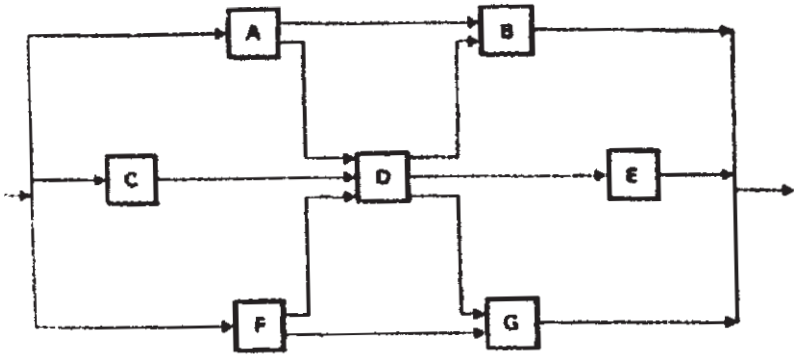


Fig.3

Q3) a) Explain the steps to be followed for FMECA analysis. **[8]**

b) The fault tree diagram is shown in Fig.4. The failure probabilities of the elements are as given below. $E_1 = E_2 = 0.005, E_3 = E_4 = 0.02, E_5 = E_6 = 0.1$. Find out the system reliability. Also draw reliability block diagram for the same. **[8]**

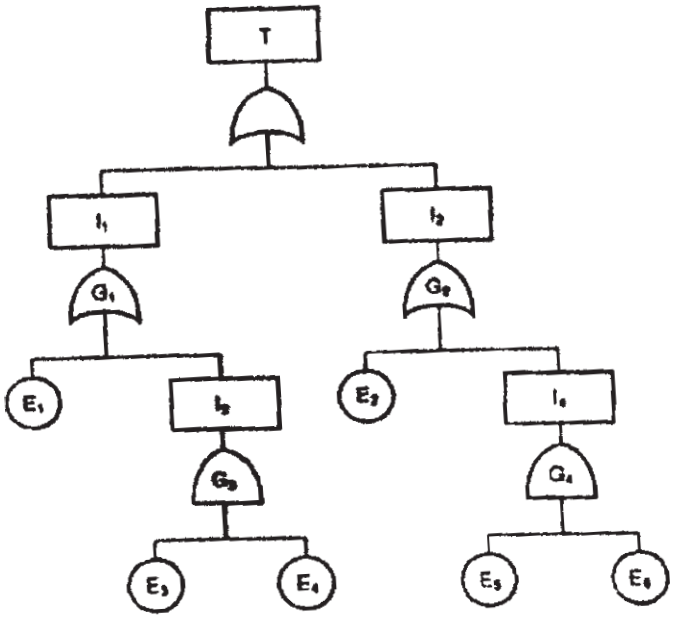


Fig.4

Q4) a) Fig.5 shows a system configuration. The block shows elements of system and each element has reliability 0.90. Find the system reliability. **[8]**

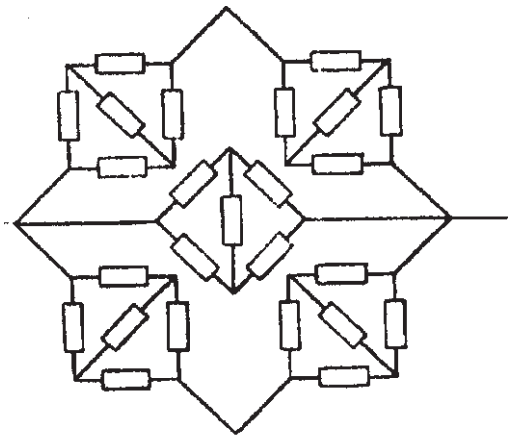


Fig. 5

b) Calculate the system reliability for the system shown in Fig.6. **[8]**

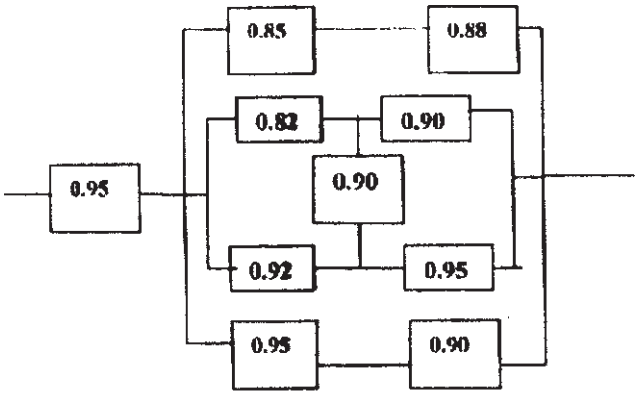


Fig. 6

Q5) Write short note on following (any three) : **[18]**

a) Markov Analysis.

b) Graph Theory approach.

c) Risk Priority Number.

d) Baye's theorem and its applications.

e) ARINC method for Reliability allocation.

SECTION - II

Q6) a) Explain the concept of safety margin and loading roughness. **[8]**

b) Explain the probability distributions used in reliability analysis. **[8]**

Q7) a) Explain the various accelerated life tests carried out for reliability analysis. **[6]**

b) In a short sample life testing of a system the following data is recorded as follows. **[10]**

Failure No.	1	2	3	4	5	6	7	8	9	10
MTTF (Hrs)	28	21	16	26	35	38	30	19	25	20

Plot the variation of reliability against time using i) Mean ranking and ii) Median Ranking Method.

Q8) a) Allocate failure rates and find mean lives for the following data if the reliability goal is 0.90. **[8]**

i	No. of modules	Importance factor	operating time
1	25	1	12
2	85	0.95	10
3	70	0.9	10
4	80	1	12

b) The following data refer to predicted reliability of six components in series. In case the desired reliability of the system is not to fall below 0.80 find the reliability goal for individual components. **[8]**

Components	1	2	3	4	5	6
Predicted reliability	0.99	0.90	0.995	0.996	0.95	0.98

Q9) a) Explain K-statistics method for reliability evaluation. **[8]**

b) The mean strength and the standard deviation of a bolted joint are 3000kg/cm^2 and 250kg/cm^2 respectively. The joint is loaded such that stress induced has a mean value of 2500kg/cm^2 with a standard deviation of 50kg/cm^2. Assuming that shear strength and the induced stresses are independent and normally distributed, find out the probability of survival of the bolted joint. Extract of data from statistical table is given below : **[8]**

Z	1.2	1.3	1.4	1.5	1.6	1.7	1.8
ϕ (z)	0.8849	0.9032	0.9192	0.9331	0.9452	0.9550	0.9640

Q10) Write short notes on (any three) : **[18]**

a) Bath tub curve.

b) Hot Ferrography.

c) SOAP for Wear debris monitoring.

d) Vibration signature analysis.

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Total No. of Questions :12] [Total No. of Pages : 2

P1994

[3765]-626
M.E. (Production Engg.)
RESEARCH METHODOLOGIES
(511112) (2008 Course) (Elective - IV)

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

Instructions to candidates:

1) ***Answer three questions from each section.***
2) ***Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6.***
3) ***Attempt Q. 7 or Q. 8, Q. 9 or Q. 10, Q. 11 or Q. 12.***
4) ***Answers to the two sections should be written in separate books.***
5) ***Neat diagrams must be drawn wherever necessary.***
6) ***Assume suitable data, if necessary.***
7) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Explain the significance of research. **[8]**

b) Distinguish between research methods and research methodology. **[8]**

OR

Q2) a) Briefly describe the research process with flow chart. **[8]**

b) What are the criterions one should expects from scientific research? **[8]**

Q3) a) What is need of research design? Explain the features of a good design. **[10]**

b) What are the techniques involved in defining a problem. **[6]**

OR

Q4) a) Explain basic principles of experimental design. **[8]**

b) Explain Latin square design method of formal experimental designs. **[8]**

P.T.O.

Q5) a) Explain the process of data collection through questionnaires. Also state merits and demerits of the same. **[10]**

b) What are different complex random sampling designs? Explain any two. **[8]**

OR

Q6) a) Explain the methods used for data collection in research methods. **[10]**

b) Explain the difference between survey and experiment. **[8]**

SECTION - II

Q7) a) What are the important statistical measures being used for data analysis? Explain any one. **[8]**

b) What are the measures of relationship? Explain Karl Pearson's coefficient of correlation. **[8]**

OR

Q8) a) How to determine sample size in data analysis? Explain the method of determining sample size based on precision rate and confidence level. **[8]**

b) Explain in brief : **[8]**

i) Index Numbers.

ii) Time series Analysis.

Q9) a) Explain the decision making technique of Analytical Hierarchy Process. **[10]**

b) Explain TOPSIS method of decision making. **[8]**

OR

Q10) a) Explain in short : **[10]**

i) Neural network technique.

ii) Data Envelope Analysis (DEA).

b) Explain Graph theory approach in decision making. **[8]**

Q11) Explain the techniques of interpretation and precautions in interpretation. **[16]**

OR

Q12) Explain the layout of research report and mechanics of report writing. **[16]**

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Total No. of Questions : 8] [Total No. of Pages :2

P1995

[3765] - 575
M.E. (VLSI & Embedded)
ASIC DESIGN AND MODELING
(2008 Course)

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

Instructions to the candidates:

1) ***Answer any 3 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) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Write a VHDL code for a combinational circuit defined by the following 3 function using any F1 = xy' + x'yz
F2 = x' + y'
F3 = xy' + x'y one model. **[10]**

b) Draw neat block diagram to explain the flow in detail for ASIC design. **[8]**

Q2) a) Classify and explain in brief the structure of semi custom ASIC. **[8]**

b) What are the objectives of floor planning. Explain in detail the eigen value algorithm to floorplan. **[8]**

Q3) a) Explain and differentiate between Quadrature min-cut placement and Slice min-cut placement. **[8]**

b) Specify the objectives of Routing. Prove or disprove that the Lee algorithm is guaranteed to find a path if it exists, but not necessary the shortest path. **[8]**

Q4) Write answers in brief : **[18]**

a) What is hardware acceleration and hardware emulation? Describe briefly.

b) What do you mean by syntactical and structural checks in terms of writing code for verification.

c) Describe Race problem. How can you eliminate race problem using non-blocking statement.

P.T.O.

SECTION - II

Q5) a) Explain with flow chart in detail the various block process in DFT for ASIC. **[8]**

b) Explain in detail the Random Testing process and derive the formulae for finding probability of fault coverage. **[8]**

Q6) a) Explain Blocking Vs Non-Blocking Assignments. **[6]**

b) Explain signals Vs variables in VHDL. **[4]**

c) Write short note on EDA Tool. **[8]**

Q7) a) Explain in detail Memory BIST insertion design for Test techniques. **[8]**

b) For the circuit shown in Fig. 1 derive a Test set based on the sensitized path method. **[10]**

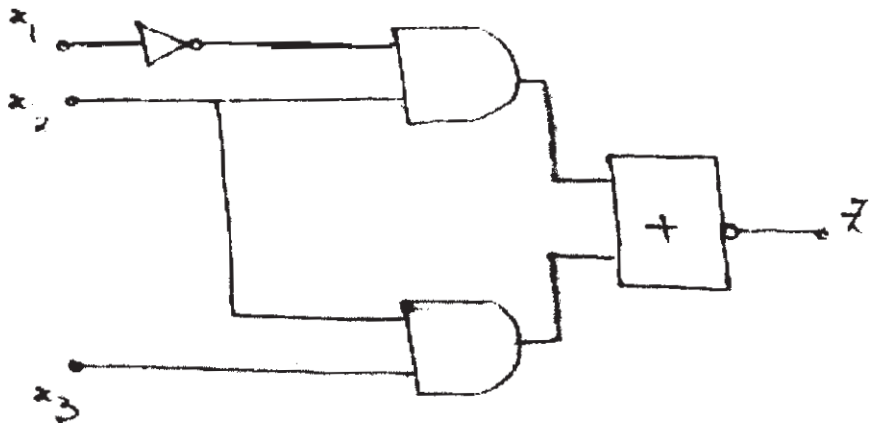

Fig. 1

Q8) a) Explain in detail the Time - Budget compile method for a design. **[8]**

b) Find a Test set to show the coverage of various stuck at '0' and stuck at '1' faults by all possible Test vectors for Fig. 2. **[8]**

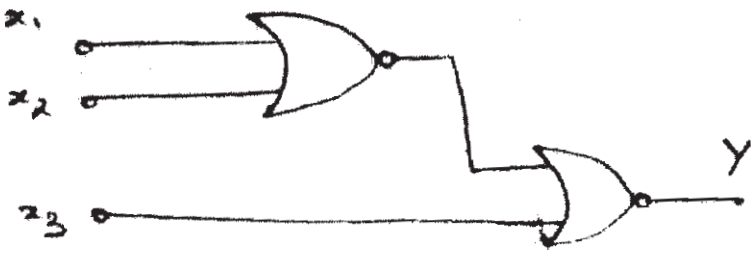

Fig. 2

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Total No. of Questions : 8] [Total No. of Pages : 3

P1996

[3765]-535
M.E. (Electrical Control System)
ROBUST CONTROL SYSTEMS
(2008 Course) (503111(i)) (Semester - II)

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

Instructions to the candidates:

1) ***Answer any three questions from each section.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Define the following terms with respect to LTIV system. **[8]**

i) Controllability.
ii) Observability.
iii) State-controllability.
iv) Stability.

b) Write down the bisection algorithm to compute RL∞ norm. **[8]**

Q2) a) Compute 2-Norm and ∞-Norm for the system **[8]**

$$G(s)=\left[\begin{array}{cc:c} 1 & 0 & 2 \\ 2 & 3 & 2 \\ \hdashline 2 & 1 & 0 \end{array}\right]$$

b) Explain 'Coprime factorization'. **[8]**

Q3) a) Compute 2-Norm of the system. **[10]**

$$G(s)=\begin{bmatrix} \dfrac{1}{(s+1)} & \dfrac{(s+3)}{(s+1)(s-2)} \\ \dfrac{10}{(s-2)} & \dfrac{5}{(s+3)} \end{bmatrix}$$

P.T.O.

b) Explain the terms w.r.t. a LTIV system. **[8]**

i) Well-posed ness.

ii) Internal stability.

Also comment on the necessary conditions for well-posedness and internal stability.

Q4) a) Define **[8]**

i) Nominal stability.

ii) Robust stability.

iii) Nominal performance.

iv) Robust performance.

b) Comment on Internal stability and well-posedness of the system. **[10]**

$$P = \begin{bmatrix} \frac{1}{(s+1)} & 0 \\ 0 & \frac{1}{(s+1)} \end{bmatrix} \text{ and } K = \begin{bmatrix} (1-s) & -1 \\ 0 & -1 \end{bmatrix}$$

SECTION - II

Q5) a) Check the following system for controllability **[8]**

$$A = \begin{bmatrix} 2 & 3 \\ 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, C = \begin{bmatrix} 3 & 1 \end{bmatrix}, D = 0$$

b) Explain Luenberger Observer conditions for the system to be output feedback stabilizable. **[8]**

Q6) a) Write a note on 'Linear fractional Transformation'. **[8]**

b) Let the system be **[8]**

$$A = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, C = \begin{bmatrix} 0 & 0 \end{bmatrix}$$

Wheather the system is observable? Also show that the observability (C,A) is not the necessary condition for the existence of positive definite stabilizable solution w.r.t. the given system.

Q7) a) State the algebraic riccati equation associated with the Hamiltonian matrix H. Also state H. **[8]**

What are the conditions under which $H \in$ dom.(Ric.).

b) Explain Model uncertainty and Robust performance of a system. **[10]**

Q8) a) Prove the tests for Robust stability of additive and multiplicative uncertainties. **[8]**

b) Find M & N matrices such that $\overline{\Delta} = M \Delta N$ where Δ is a block diagonal. **[10]**

i) $\overline{\Delta} = [\Delta_1 \quad \Delta_2]$

ii) $\overline{\Delta} = \begin{bmatrix} \Delta_1 & 0 & 0 \\ 0 & 0 & \Delta_2 \end{bmatrix}$

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Total No. of Questions : 6] [Total No. of Pages :3

P1998

[3765] - 472
M.E. (Civil Structures)
OPTIMIZATION TECHNIQUES
(2008 Course)

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 indicate full marks.*
5) *Use of electronic pocket calculator is allowed.*
6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) What is difference between linear and nonlinear programming problems? **[5]**

b) Formulate an optimization problem for minimum weight and minimum cost to design a rectangular reinforced concrete column section with a constraint on deflection criteria. **[10]**

c) Find the maxima and minima of the function $f(x) = \dfrac{x^4}{(x-1)(x-3)^3}$. **[10]**

Q2) a) State Duality Theorems. **[9]**

Write the dual of the following LP problem

Maximize $f = 50x_1 + 100x_2$

Subject to

$2x_1 + x_2 \leq 1250$

$2x_1 + 5x_2 \leq 1000$

$2x_1 + 3x_2 \leq 900$

$x_2 \leq 150$

Where, $x_1 \geq 0$ and $x_2 \geq 0$

P.T.O.

b) Maximize $F = -x_1 + 2x_2$ **[8]**

Subject to

$$-x_1 + x_2 \leq -2$$
$$x_1 - x_{23} \geq 1$$
$$x_i \geq 0, \ i = 1,2.$$

Using Big-M technique.

c) Maximize $F = 2x_1 + 6x_2$ **[8]**

Subject to

$$-x_1 + x_2 \leq 1$$
$$2x_1 + x_2 \leq 2$$
$$x_i \geq 0, \ i = 1,2.$$

Using simplex method.

Q3) a) Find the dimensions of a cylindrical tin (with top and bottom) made up of sheet metal to maximize its volume such that the total surface area is equal to $A_o = 24\pi$. **[9]**

b) What is the difference between the Fibonacci method and the Golden section method for minimization? **[4]**

c) Minimize $f = 0.65 - \dfrac{0.75}{1+x^2} - 0.65x \tan^{-1}\dfrac{1}{x}$ in the interval of [0, 3] by the Fibonacci method using n = 6. **[6]**

d) Find the minimum of $f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$ **[6]**

SECTION - II

Q4) a) Under what conditions the processes of reflection, expansion, and contraction used in the simplex method? **[5]**

b) Minimize $f = \dfrac{1}{x_1^2 + x_2^2 + 2}$ from the starting point (4, 0) using the Newton's method (two iterations only). **[10]**

c) Formulate an optimization problem for minimum volume to design a two bar truss as shown in Fig. 1 with a constraint on buckling criteria. **[10]**

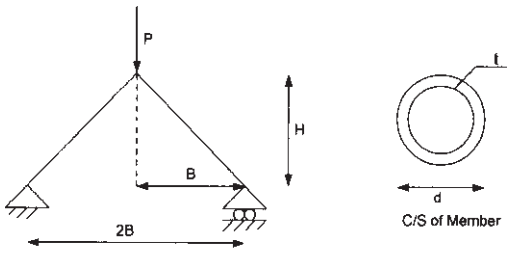

Fig. 1

Q5) a) Complete one iteration of the sequential linear programming for the following NLP problem **[13]**

Minimize $f = 9x_1^2 + 6x_2^2 + x_3^2 - 18x_1 - 12x_2 - 6x_3 - 8$

Subject to $\begin{array}{l} x_1 + 2x_2 + x_3 \le 5 \\ x_i \ge 0, i = 1,2,3 \end{array}$

Use a starting point $X_1 = \{0,0,0\}$

b) Minimize $f = \frac{1}{3}(x_1 + 1)^3 + x_2$ **[12]**

Subject to $\begin{array}{l} g_1 = -x_1 + 1 \le 0 \\ g_2 = -x_2 \le 0 \end{array}$

Use the interior penalty function method.

Q6) a) What are the basic operations in GAs? Explain Fitness function. **[13]**

b) Write a note on Neural Network based optimization. **[12]**

Total No. of Questions : 8] [Total No. of Pages : 3

P1999

[3765]-57
M.E. (Mech.) Heat Power
IC ENGINES - II
(Compression Ignition Engines)
(2002 Course)

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) What are the advantages of multi-cylinder engine over single cylinder engine? **[3]**

b) What is meant by mean piston speed? Explain its importance. **[3]**

c) Explain the importance of Specific power output from Engine Designer's point of view. **[3]**

d) The indicated thermal efficiency of four-stroke engine is 32%. And its mechanical efficiency is 78%. The fuel consumption rate is 20 kg/h running at a fixed speed. The brake mean pressure developed is 6 bar and mean piston speed is 12m/s. Assuming it to be a single cylinder square engine, calculate the crank radius and the speed of the engine. Take CV = 42000kJ/kg. **[9]**

Q2) a) Give general chemical formula of the following fuels : **[6]**

i) Paraffin.
ii) Olefin.
iii) Aromatic.

Also state their molecular arrangements and mention whether they are saturated or unsaturated.

b) What is the effect of high sulphur content on the performance of CI engine? **[4]**

c) Can we use solid fuels for IC engines? **[2]**

d) Explain the any one method by which hydrogen can be used in CI engine. **[4]**

Q3) a) Enlist the salient features and with the help of schematic diagram, explain the working of Common-Rail Fuel Injection System. **[6]**

b) Calculate the diameter of fuel orifice of a four-stroke engine which develops 25 kW per cylinder at 2000 rpm. The specific fuel consumption is 0.3 kg/k Wh fuel with 30º API. The fuel is injected at a pressure of 150 bar over a crank travel of 25º. The pressure in the combustion chamber is 40 bar. Coefficient of velocity is 0.875 and specific gravity is given by S.G = 141.5/(131.5 + ºAPI) **[10]**

Q4) a) At what point of the cycle it is desirable to have the peak pressure? Why? **[4]**

b) State different method to control knocking or detonation in CI engine. **[4]**

c) Make a comparison of DI type combustion chamber with IDI type by sketching two modern DI and IDI combustion chambers. **[8]**

SECTION - II

Q5) a) Define air-fuel ratio and briefly state its effect on power output, fuel consumption and combustion pressure. **[4]**

b) The air flow to a cylinder, four-stroke oil engine is measured by means of a 5 cm diameter orifice having a coefficient of discharge 0.6. During a test on the engine the following data were recorded: bore = 10 cm, stroke = 12 cm, speed = 1200 rpm, brake torque = 120 Nm, fuel consumption 5 kg/h, calorific value of fuel = 42 MJ/kg, pressure drop across orifice is 4.6 cm of water, ambient temperature and pressure are 17ºC and 1 bar respectively. Calculate **[8]**

i) The thermal efficiency on brake power basis.
ii) The brake mean effective pressure and
iii) The volumetric efficiency based on free air condition.

c) Derive the expression for calculating indicated power of an engine? **[4]**

Q6) a) Explain the effect of supercharging on performance of CI engine. **[10]**

i) Power Output.
ii) Mechanical Efficiency.
iii) Fuel consumption; with the help of graph.

b) Make the thermodynamic analysis of a Turbocharged CI engine cycle. **[6]**

Q7) a) Explain the instruments for measuring the following invisible emission. **[6]**

i) Oxides of nitrogen.

ii) Carbon monoxide.

iii) Unburned hydrocarbons.

Write their approximate values.

b) What are the causes of Particulates generation? How are they controlled? **[6]**

c) Explain with sketch working of hartridge smoke meter. **[6]**

Q8) Write short notes on (Any Three) : **[16]**

a) Bio-Diesel Engine.

b) Heat Release Programme.

c) Compressor map for turbocharged CI engine.

d) CI engine fuel rating.

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Total No. of Questions :8] [Total No. of Pages : 2

P2000

[3765]-587
M.E. (E & TC - VLSI)
EMBEDDED AUTOMOTIVE SYSTEMS
(2008 Course)

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

Instructions to candidates:

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

SECTION - I

Q1) a) Explain the current trends in Automotive systems. What is Hybrid vehicle? **[10]**

b) Which are the components for Electronic engine management systems? Explain briefly. **[8]**

Q2) a) Explain the role of dashboard electronic instruments? Discuss on board diagnostic system. **[8]**

b) What are the different types of interferences? How they can be overcome? **[8]**

Q3) a) Write short note on following : **[8]**

i) Electronic management of chassis system.

ii) Vehicle motion control.

b) Which different types of fuel injection systems? Explain. **[8]**

Q4) a) Write short note on any two sensors : **[8]**

i) Crank angle position sensors.

ii) Flow sensors.

iii) Vehicle speed sensors.

b) What are ECUs? Explain their significance in modern vehicles. **[8]**

P.T.O.

SECTION - II

Q5) a) Describe briefly solid state ignition system techniques. **[8]**

b) How fuel metering is done? Which are the different techniques? **[8]**

Q6) a) Briefly explain the technique of Distributor less integrated engine control and exhaust emission control technique. **[8]**

b) Write short note on cruise control of car. **[8]**

Q7) a) Which are the different safety measures taken using embedded systems in modern vehicles? **[8]**

b) Draw a schematic arrangement for a typical CAN network containing a master and number of slaves. How multiprocessor communication is possible? **[8]**

Q8) a) Explain the following systems in modern vehicles. **[10]**

i) Lane departure warning.

ii) Curve over speed countermeasures.

iii) Blind spot monitoring.

iv) Parallel parking assistance.

v) Lane change assistance.

b) How vehicle tracking system is achieved using GPS. **[8]**

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Total No. of Questions : 6] [Total No. of Pages : 2

P2001

[3765]-42
M.E. (Civil-Structures)
HIGH RISE STRUCTURES
(2002 Course)

Time : 4 Hours] *[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 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 them.***
6) ***Use of cell phone is prohibited in the examination hall.***
7) ***Use of electronic pocket calculator, latest IS codes and steel table is allowed.***

SECTION - I

Q1) Design a R.C. chimney for the following data : **[25]**

Height = 30 m.
External diameter = 3.00 m.
Wall thickness = 200 mm (constant).
Safe bearing capacity of soil = 350 kN/m^2.
Wind load (linear varying) = 1.6 kN/m^2 at top and 1.2 kN/m^2 at bottom.
Assume vertical steel = 0.90% and horizontal steel = 0.30%.
Use M 40 grade of concrete and Fe 415 grade of steel.

Q2) a) Design a leg member of transmission tower for the following data : **[15]**

Axial compression = 120 kN, Axial tension, unbraced length = 4.5 m and yield stress = 250 N/mm^2. Assume suitable data and design the connection and draw the design details.

b) Find the maximum sag of the conductor due to temperature variation in the design of transmission line tower. **[10]**

Q3) A 60 m high steel tower is to be erected for transmission line for single circuit three phase 50 cycle per second. Suggest the suitable geometry and determine the various forces acting on tower under normal operating condition. **[25]**

P.T.O.

SECTION - II

Q4) a) Explain with suitable sketches the effect of vertical settlement of foundation in tall building. **[10]**

b) Describe the seismic behavior of various bracing system used in multistory buildings. **[15]**

Q5) a) State the various method of analysis for lateral loads in case of steel multistory building and describe any one method of analysis. **[10]**

b) Describe the different forces acting and stresses induced in case of self supporting steel stack. Also mention the design consideration. **[15]**

Q6) A self supporting steel stack is 60 m high and its diameter at top is 2.8 m. Design the plates for the stack, base plate and anchor bolts. The stack is located in the industrial zone where intensity of wind pressure up to 30 m is 1.5 kN/m^2. Use IS : 6533 and IS : 875. **[25]**

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Total No. of Questions :10] **[Total No. of Pages : 2**

P2002

[3765]-70
M.E. (Mechanical) (Design Engineering)
COMPUTER AIDED DESIGN
(Revised)

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

Instructions to candidates:

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

SECTION - I

Q1) a) Discuss the recent trends in computer Hardware and Software in CAD/ CAM industry. **[8]**

b) Show that : **[8]**

i) Translation is commutative.

ii) Mirror and 2D rotation about Z axis are not commutative.

iii) Scaling and 2D rotation about Z axis are commutative.

Q2) a) Compare CORE and GKS graphics standard. Also discuss salient feature. **[8]**

b) What is mapping of a geometric model. Explain the general mapping matrix. **[8]**

Q3) a) What are different types of computer animation? Explain with suitable example. **[8]**

b) Explain IGES file format with simple example. **[8]**

Q4) a) Explain the mechanism of "Undo" command in CAD software with reference to transformation. **[8]**

b) Describe the method of data communication in serial and parallel modes. **[8]**

Q5) a) Derive a concatenated transformation matrix for rotation about an arbitrary point. **[10]**

b) Explain the following terms related to Networking: Network Server, Transmission Media, Modem, Get way. **[8]**

P.T.O.

SECTION - II

Q6) a) Explain B-rep and C-rep approach to solid modeling. What is Hybrid approach? **[8]**

b) What are the different pitfalls in the simulation? How they can be avoided. **[8]**

Q7) a) What is shape function? Explain it with respect to a typical three-node quadratic element with figure. **[8]**

b) Explain C^0, C^1 and C^2 parametric continuity. **[8]**

Q8) a) Derive an expression for stiffness matrix for a two nodded two-dimensional pin joined truss element. **[8]**

b) Describe in brief types of Simulation approaches. **[8]**

Q9) a) Write the formulae for Bezier-Bernstein blending functions for a five point curve and represent the Bezier curve in the matrix form. **[8]**

b) How effect of temperature is taken care in Finite Element Analysis in a spar or link element? **[8]**

Q10) a) What do you understand by parametric representation of curves? Discuss the advantages of parametric representation. **[8]**

b) What is Local and Global Coordinate system? For 1-D spar element derive the relationship between local and global coordinate system. **[10]**

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Total No. of Questions : 6] [Total No. of Pages :2

P2003

[3765] - 459

M.E. (Civil-Structure)

STRUCTURAL DESIGN OF STEEL BRIDGES

(2008 Course)

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

Instructions to the candidates:

1) *Answer any two questions from section I and II.*
2) *Answers to the two sections should be written in separate answer books.*
3) *Figures to the right indicate full marks.*
4) *Neat diagrams should be drawn wherever necessary.*
5) *If necessary, assume suitable data and indicate clearly.*
6) *Use of nonprogrammable electronic pocket calculator, IS 800 and steel table is allowed.*

SECTION - I

Q1) a) Explain the different factor for the selection of type of bridges. **[10]**

b) Explain in details classification of steel bridges according to load carrying element, layout of main load carrying element, cross section, type of connection. **[15]**

Q2) A through type railway truss girder bridge consists of two Pratt trusses as shown in **Fig. 1**. The bridge supports an equivalent uniformly distributed live load of 180 kN/m. The dead load transmitted to each truss inclusive of self weight is 25 kN/m. Design the members U_2U_3, U_3L_3, U_2L_3 and L_2L_3. Assume the impact factor to be 30%. **[25]**

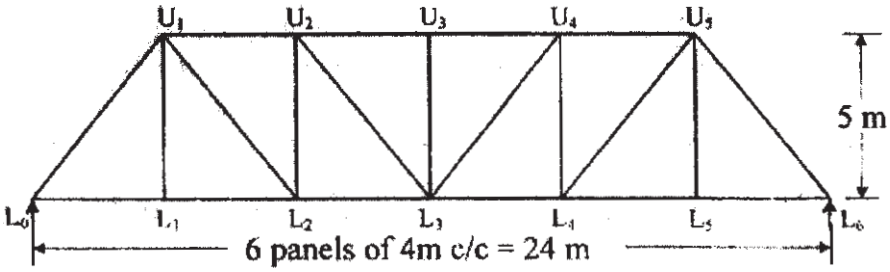

Fig. 1

P.T.O.

Q3) A deck type plate girder railway bridge is provided for a single broad gauge track. The effective span of main girder is 24 m. The self weight of stock rails and check rails are 0.6 and 0.4 kN/m respectively. The self weight of fasteners may be assumed as 0.2 kN/m. The sleepers are provided at a spacing of 450 mm c/c and are 2.8 m x 0.25 m x 0.25 m. The unit weight of sleepers materials may be assumed as 7.5 kN/m^3. Design cross section for plate girder. stiffeners and draw the design sketches for the bridge structures. The EUDL for B M is 2280 kN, for SF is 2503 kN and impact factor is 0.417. **[25]**

SECTION - II

Q4) The effective span of a deck type plate girder two lane highway bridge is 30 m. The reinforced concrete slab is 250 mm thick inclusive 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 as shown in **Fig. 2**. **[25]**

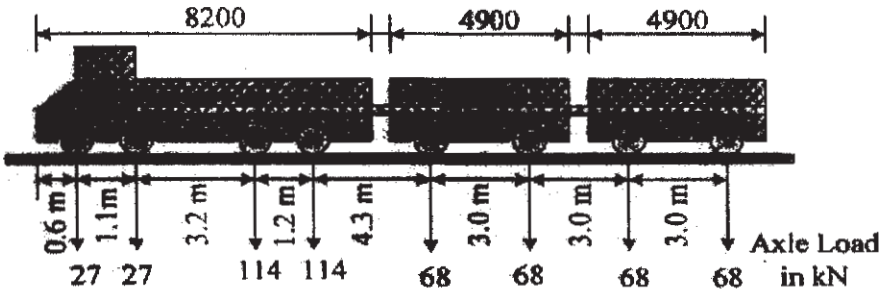

Fig. 2 IRC Class A Loadings

Q5) The effective span of through type truss girder highway two lane bridge is 30 m. The reinforced concrete slab is 250 mm thick inclusive 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 A standard loading. Suggest a suitable truss for the bridge. Determine the forces in central top chord, bottom chord, vertical and diagonal members of the central panel. **[25]**

Q6) a) Design a rocker bearing for a 30 m span truss girder railway bridge with the following data.

The reaction due to dead load, live load and impact load is 1200 kN. The vertical reaction due to overturning effect of wind at each end of the girder is 80 kN. The lateral load due to wind effect at each bearing is 34 kN. The tractive force and braking force are 981 kN and 686 kN respectively. **[18]**

b) Explain different type of bearing and its function for steel bridges. **[7]**

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Total No. of Questions : 12] [Total No. of Pages : 3

P2005

[3765]-530
M.E. (Electrical) (Control Systems)
COMPUTER AIDED CONTROL SYSTEM DESIGN
(2008 Course) (503105) (Elective - II)

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

Instructions to the candidates:

1) ***Answer 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 logarithmic tables and electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain clearly the application of MATLAB-software and simulink for control system design. **[8]**

b) Explain the terms 'Absolute Stability' and 'Relative Stability'. Discuss the measures of relative stability. **[8]**

OR

Q2) a) Distinguish between feedback compensation and cascade compensation. Under what conditions feedback compensation is preferred? **[6]**

b) A unity feedback control system has

$$G(S) = \frac{k}{s(1+0.5s)(1+0.1s)}$$

Design a suitable log-lead compensator to have

i) Velocity error constant $k_{\vartheta} = 1.0\ s^{-1}$

ii) Phase margin $\geq 40^{o}$

Draw Bode diagrams of uncompensated and compensated system. **[10]**

Q3) a) Compare critically the 'describing function method' and 'phase plane method' used for the design of nonlinear control systems. **[7]**

b) Explain the simulation of control system containing saturation nonlinearity by using describing function method. **[10]**

OR

P.T.O.

Q4) a) Discuss clearly the different singular points in phase plane method. **[5]**

b) Explain with illustration the phase plane method for simulation of non-linearity 'dead-zone' in control system. **[12]**

Q5) Describe the computer method for obtaining the transient response of a typical second order control system to a unit step input. Draw the flow chart. Explain clearly how to reshape this response plot to obtain desired response. **[17]**

OR

Q6) Explain with algorithm the computer method for obtaining the root-locus plot of a closed-loop control system. How to reshape this plot to obtain desired performance? **[17]**

SECTION - II

Q7) a) Explain clearly the computer method for obtaining the solution of state and output equations of a closed-loop control system : **[8]**

$$\dot{x}(t) = Ax(t) + Bu(t)$$
$$y(t) = Cx(t)$$

with usual notations.

b) What is the necessity of an observer? Discuss the procedure for designing 'Full-Order State Observer'. **[8]**

OR

Q8) a) What is a linear regulator problem? State the Infinite-time state regulator problem. Outline procedure for obtaining the optimal control for infinite-time state regulator problem. **[8]**

b) Draw the flow chart and explain the iterative method for numerical solution of matrix Riccati Equation. **[8]**

Q9) a) Describe briefly the tunable PID controller. **[7]**

b) Explain with neat diagram the basic computer controller scheme for analysis and design of a multi-loop PID controller. **[10]**

OR

Q10) a) Explain the concepts of controllability and observability of a control system. **[6]**

b) How to determine the controllability and observability using computer method. Give its algorithm and draw the flow chart. **[11]**

Q11) a) Discuss the computer method of solving discrete-time matrix Riccati Equation. **[6]**

b) A discrete-time control system is represented by the difference equation:

$x(k + 1) = Fx(k) + Gu(k)$

where k is the sampling instant; $x(k)$ is $n \times 1$ state vector; $u(k)$ is $m \times 1$ control vector; F and G are constant matrices of compatible dimensions. Give algorithm and explain the procedure for computer solution of closed-loop response. **[11]**

OR

Q12) a) Explain the following design specifications for digital control system: **[10]**

i) Transient Accuracy.

ii) Steady-state accuracy.

iii) Disturbance rejection.

iv) Control effort constraints and

v) Sensitivity to parameter changes.

b) Justify the statement, "when the analog controller is replaced by the equivalent digital controller, the static error constants for the analog and equivalent digital control systems must agree"? **[7]**