QUESTION PAPERS
END TERM EXAMINATION
MAY- 2019

M.TECH (FT/PT) & PH.D COURSE
2ND SEM (FT/PT) 4TH SEM (PT)
&
MBA (DSM) & EMBA
2ND & 4TH SEMESTER

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12	Software Engineering (SWT)	SWT	------	

QUESTION PAPERS FOR MBA (DSM) & EMBA END TERM EXAMINATION, MAY 2019
(Semester – II & IV)

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QUESTION PAPERS FOR M.TECH. II SEMESTER (FT&PT) & IV SEMESTER (PT) & Ph.D WORK END TERM EXAMINATION, MAY 2019

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2nd SEMESTER [M.Tech]

END SEMESTER EXAMINATION (May 2019)

AC-601 Fibre Technology

Time: 3hour *Max Marks: 100*

Note: Answer all questions
Assume suitable missing data, if any

Q.1		Justify the following statement with suitable examples	
	a	Fibre forming polymer should be semi-crystalline in nature.	5
	b	Presence of zinc sulphate in coagulation bath is enhanced the degree of orientation of cellulose chain.	5
	c	Natural fibers shows comfort properties.	5
Q.2	a	How die swell property affect the cross-sectional structure of melt spun fibres	5
	b	Discuss the working principle of false twist texturizing machine with the help of diagram	5
	c	Discuss the theory of dyeing. Write the role of temperature and electrolyte in dyeing of cellulosic fibres	5
Q.3	a	Differentiate between dry spinning and wet spinning processes.	5
	b	Differentiate between DMT route and PTA route of manufacturing polyesters fibres	5
Q.4	a	Draw the time temperature profile and reactions involved in dyeing of (a) vat dye (b) reactive dye with cellulosic fibers	5

	b	How dyeing of wool fibres takes place with acid dye. Why wool fiber shows darkest shade as compared silk and nylon fiber when dyed with same amount of dye?	5
Q.5		Discuss the manufacturing process, properties of viscose rayon fibres.	20
Q.6		Write the manufacturing process and properties of nylon 6.	20
Q.7		Write short note on	
	a	Sources of water pollution in textile industry	5
	b	Recycling of polyester & polyamide fibres	5

Total No. of Pages 02 *Roll No. .....*

SECOND SEMESTER **M.Tech.[Polymer Tech.]**

END SEMESTER EXAMINATION ***May-2019***

AC 6022 SPECIALTY POLYMERS

Time: 3:00 Hours *Max. Marks :100*

Note : Answer all question by Selecting any two parts from each question. All questions carry equal marks. Assume suitable missing data, if any.

Q.1[a]How do you prepare a conducting polymer like polyaniline by chemical polymerization method? Write its growth mechanism also. 10

[b]Discuss polymeric flocculating agents including their use in industrial effluent treatment. 10

[c] What types of methods are being used to enhance the oil recovery? How the polymers are helpful for enhancement of oil recovery? 10

Q.2[a] What is lithography? Describe the role of polymers in lithographic processes and explain its mechanism in detail. 10

[b] Discuss about the polymeric nuclear track detector with suitable examples. 10

[c] Illustrate the specialty of antioxidants and UV stabilizers with suitable examples. Explain the mechanism of antioxidants. 10

Q.3[a] What is the importance of photoconducting polymers in conversion and storage of solar energy. Explain with suitable examples. 10

[b] What is a polymeric surfactant? Discuss ionic and non-ionic polymeric surfactants with suitable examples. 10

[c] What do you mean by the polymeric liquid crystals? Discuss different types of polymeric liquid crystals with suitable examples. 10

P.T.O.

Q.4[a] What are the polymeric cement additives? Discuss these additives in detail by giving suitable examples. 10

[b] What is the role of polymers in stone preservation? How vinyl polymers and epoxies are useful in stone preservation? Discuss in detail. 10

[c] What do you mean by polymer microgel? Illustrate its preparation, properties and uses in detail. 10

Q.5 Write short note on the followings: 2x10

[a] Ionomers

[b] Time dependent polymers

[c] Polymeric dye carriers

[d] IPNs

END

Total No. of Pages 2 *Roll No. .....*

SECOND SEMESTER **M.Tech. (PT)**

END SEMESTER EXAMINATION ***May-2019***

AC-6031 POLYMER CHARACTERIZATION

Time: 3 Hours *Max. Marks: 100*

Note: Answer any ***ten*** questions. All questions carry equal marks. Assume suitable missing data, if any.

[1] Define T_g. Draw and explain a suitable thermogram of DSC. Write two examples of endothermic physical process.

[2] Calculate the energy, frequency and wave number of the electromagnetic radiations corresponding to the wavelength 400 nm (h = 6.63×10^{-34} m^2 kg/s). What are the possible electronic transitions when (i) CH_3OH; (ii) HCHO (iii) CH_4 and (iv) $CH_3CH{=}CH_2$ exposed to UV-visible light?

[3] Draw the block diagram of TEM instrument. Discuss its working and significance.

[4] Suggest the formation of the polymer 'nylon 6' from their monomer, caprolactam using IR spectroscopy without considering their end groups? Suggest the frequency in wave number for the following molecules in IR spectroscopy (i) CH_3CHO (ii) CH_3CH_3 (iii) CH_3OH & (iv) CH_3OOH.

[5] Draw the block diagram of SEM instrument. Discuss its working and significance.

[6] What is the importance of molecular weights in polymer characterization? Classify and name their methods of determination.

[7] List and discuss the components in polymer science that can be characterized by NMR.

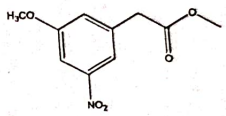
[8] What do you understand by electron microscopy? Discuss its significance.

[9] A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions:

1 g	10,000 molecular weight
2 g	50,000 molecular weight
1 g	100,000 molecular weight

Using this information, calculate the number-average molecular weight, weight-average molecular weight, and PDI of the mixture.

[10] Discuss the ^1H NMR and IR of the following compound:



[11] Write short note on any ***two*** of the following:
[a] Gel Permeation Chromatography
[b] Polymer solution thermodynamics
[c] X-Ray scattering

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Total No. of Pages 01

Roll No.....

END SEMESTER EXAMINATION ***May-2019***

M.Tech (Polymer Technology), 2nd Semester.

PAPER CODE AC-6035

Polymer for Food and Health Applications

Time: 3:00 Hours ***Max. Marks: 100***

Note: Answer **Eight** questions, and Question No.1 is compulsory. Attempt any **Seven** questions from the rest of ten questions.

1. Write on polymers in drug delivery. What are monolithic delivery devices? 16 Marks.
2. What do you understand by the term Biocompatibility in case of Pharmaceutical Polymers? 12 Marks.
3. Why the biodegradability, bio-stability and permeability of implants and polymers is important in devices. 12 Marks.
4. The natural polymers are commonly used in medicine, elaborate on this, and mention the advantage and disadvantage of using natural polymers. 12 Marks.
5. What are polymeric contrast agents? Mention in detail either MRI contrast agents or Optical Imaging agents (only on one of these two, please). 12 Marks.
6. What are Biomimetic polymers, elaborate their usage in biomedical applications. 12 Marks.
7. Write down the importance and utility of Eudragit polymers in pharmaceutical applications. 12 Marks.
8. What are Functional Edible Coatings? Mention four natural polymers used in edible coatings in fruits and vegetables. 12 Marks.
9. What are edible coatings and the advantages & disadvantages of edible coatings? 12marks.
10. What are the regulatory role of FAO & WHO in regulatory aspects of food edible coatings? 12 Marks.
11. Write the regulatory aspects of edible coatings on foods in USA or European Union or India (write only on any one of these countries). 12 Marks.

Total no of pages 2
SECOND SEMESTER
END SEMESTER EXAMINATION

Roll No.....
M.Tech[PT]
May-2019

AC-6511 Polymer Rheology

Time: 3 Hours

Max. Marks - 100

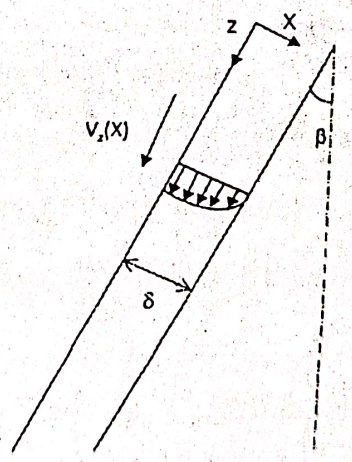
Instructions to the candidates:

1) Attempt All Questions
2) All Questions Carry Equal Marks
3) Write To The Point Answers

1) Write the mathematical expressions for following models of Non-Newtonian Fluids.

(a) Bingham Fluid model
(b) Power Law model
(c) Eyring model
(d) Ellis model

2) An inclined surface of length L and width W is situated at an angle B to the vertical direction as shown in figure below. A Power law fluid is freely falling on the surface as a film of thickness δ. Assuming the flow to be laminar, determine the velocity profile of the fluid.



(Equation of Motion is Given Below:

P.T.O.

$$\left(\frac{\partial v_x}{\partial t}+v_x\frac{\partial v_x}{\partial x}+v_y\frac{\partial v_x}{\partial y}+v_z\frac{\partial v_x}{\partial z}\right)=-\frac{1}{\rho}\frac{\partial p}{\partial x}-\frac{1}{\rho}\left[\frac{\partial}{\partial x}\tau_{xx}+\frac{\partial}{\partial x}\tau_{yx}+\frac{\partial}{\partial x}\tau_{zx}\right]+g_x$$

$$\left(\frac{\partial v_y}{\partial t}+v_x\frac{\partial v_y}{\partial x}+v_y\frac{\partial v_y}{\partial y}+v_z\frac{\partial v_y}{\partial z}\right)=-\frac{1}{\rho}\frac{\partial p}{\partial y}-\frac{1}{\rho}\left[\frac{\partial}{\partial x}\tau_{xy}+\frac{\partial}{\partial y}\tau_{yy}+\frac{\partial}{\partial z}\tau_{zy}\right]+g_y$$

$$\left(\frac{\partial v_z}{\partial t}+v_x\frac{\partial v_z}{\partial x}+v_y\frac{\partial v_z}{\partial y}+v_z\frac{\partial v_z}{\partial z}\right)=-\frac{1}{\rho}\frac{\partial p}{\partial z}-\frac{1}{\rho}\left[\frac{\partial}{\partial x}\tau_{xz}+\frac{\partial}{\partial y}\tau_{yz}+\frac{\partial}{\partial z}\tau_{zz}\right]+g_z$$

3) (a) Derive the different mathematical expressions representing Boltzmann Superposition Principle.

(b) Explain the Dynamic Experiment and define the storage and lost modulus.

4) (a) Explain the Maxwell and Voigt Models in detail.

(b) Derive the mathematical expressions for creep and stress relaxation modulus/compliance incorporating Maxwell Model.

5) Write the short note on the followings (Not more than one paragraph)

(a) Cylindrical coordinate system
(b) Creep Experiment
(c) Rotational Viscometer
(d) Time Temperature Superposition

-END-

$$\left(\frac{\partial v'_x}{\partial t}+v'_x\frac{\partial v'_x}{\partial x'}+v'_y\frac{\partial v'_x}{\partial y'}+v'_z\frac{\partial v'_x}{\partial z}\right)=-\frac{1}{\rho}\frac{\partial p}{\partial x'}-\frac{1}{\rho}\left[\frac{\partial}{\partial x'}\tau_{xx}+\frac{\partial}{\partial x'}\tau_{yx}+\frac{\partial}{\partial x'}\tau_{zx}\right]+g_x$$

$$\left(\frac{\partial v'_y}{\partial t}+v'_x\frac{\partial v'_y}{\partial x'}+v'_y\frac{\partial v'_y}{\partial y'}+v'_z\frac{\partial v'_y}{\partial z}\right)=-\frac{1}{\rho}\frac{\partial p}{\partial y'}-\frac{1}{\rho}\left[\frac{\partial}{\partial x'}\tau_{xy}+\frac{\partial}{\partial y'}\tau_{yy}+\frac{\partial}{\partial z}\tau_{zy}\right]+g_y$$

$$\left(\frac{\partial v'_z}{\partial t}+v'_x\frac{\partial v'_z}{\partial x'}+v'_y\frac{\partial v'_z}{\partial y'}+v'_z\frac{\partial v'_z}{\partial z}\right)=-\frac{1}{\rho}\frac{\partial p}{\partial z}-\frac{1}{\rho}\left[\frac{\partial}{\partial x'}\tau_{xz}+\frac{\partial}{\partial y'}\tau_{yz}+\frac{\partial}{\partial z}\tau_{zz}\right]+g_z$$

3) (a) Derive the different mathematical expressions representing Boltzmann Superposition Principle.

(b) Explain the Dynamic Experiment and define the storage and lost modulus.

4) (a) Explain the Maxwell and Voigt Models in detail.

(b) Derive the mathematical expressions for creep and stress relaxation modulus/compliance incorporating Maxwell Model.

5) Write the short note on the followings (Not more than one paragraph)

(a) Cylindrical coordinate system
(b) Creep Experiment
(c) Rotational Viscometer
(d) Time Temperature Superposition

-END-

Total No. of pages: 2 Roll No. .....

II[nd] SEMESTER **M.Tech. (Polymer Technology)**

END SEMESTER EXAMINATION **(May– 2019)**

Paper Code: **AC-6521** Subject: **Composite Materials**

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

Note: Question No. 1 is compulsory.
Answer any EIGHT Questions from the remaining.
Assume suitable missing data, if any.

1. Answer following questions. 2 x 10 = (20)

i) What is the need of Composite materials in modern day engineering applications?

ii) Explain the role of matrix in fibre reinforced composites

iii) Define Matrix of composite. Name the different matrix materials used in composites.

iv) What is the significance of interface in composites?

v) Which factors influence the fabrication methodology of Composites?

vi) Write the names of any 4 fabrication methods in Composite manufacture.

vii) Which properties of composites are difficult to estimate? Why?

viii) Derive rule of mixture.

ix) Write the Name of the Tests used for estimating Thermal properties of Composites.

x) Which environmental factors affects composites degradation?

2.(a) Discuss the types of Particulate reinforced composites with suitable examples. (5)

(b) What are Liquid crystalline Polymers? Explain the term with respect to Kevlar. (3)

(c) What are the special features of UHMWPE? (2)

3.(a) What are thermoplastic matrix materials? Write their key features. (5)

(b) When unsaturated Polyester resins are used in Composite as matrix material, which advantages and disadvantages will be faced? (3)

(c) Justify the statement "Epoxy resins are used in conjunction with curing agent". (2)

4.(a) Explain Compression moulding technique for composite fabrication with the help of suitable diagram. (5)

(b) "Same fabrication technique cannot be generalized for all composite products" Justify the statement. (3)

(c) Write a comment on types of mandrels used in filament winding process. (2)

5.(a) Explain the effect of fiber alignment on elastic properties of Composites. (5)

(b) The density of a Composite made from boron fibers in an epoxy matrix is 1.8 g/cm^3. The density of Boron is 2.36 g/cm3. Calculate the volume fraction of boron fibers in the composite. (3)

(c) While designing the fibre –reinforced composites what is the contribution of Aspect ratio? (2)

6.(a) Identify the mechanisms of degradation of composite materials. (5)

(b) In which areas Glass fibre reinforced plastics finds applications in Aerospace & Defense applications. (3)

(c). Name any four tests which are performed while testing mechanical properties of composites? (2)

7.(a) Why the temperature of carbonization is determined by the type of application of the resulting carbon fibres. (3)

(b) Why boron fibres are coated with silicon carbide? (2)

(c) Write the chemical reactions involved during preparation of Epoxy resins. (3)

(d) List down the moulding techniques falling under Matched-die mould (2)

8.(a) Explain the preparation of prepregs. (3)

(b) Glass fibres in nylon provide reinforcement. If the nylon contains 30 vol% E-glass, what fraction of the applied stress is carried by the glass fibres? (4)

(c) Explain the Flexural test method for composite material. (3)

9. Answer the following questions. (2x5=10)

(a) What are dispersion strengthened composites.

(b) What is critical fibre length?

(c) Explain Vacuum bag moulding process.

(d) Define Specific strength and specific modulus.

(e) Mention the tests performed for (i) Fire resistance and (ii) Insulation characteristics

Total No. of Pages 2 1 Roll No. .....

Ph.D Applied Mathematics Course Work

END SEMESTER EXAMINATION, *May-2019*

AM-501A Stochastic Process

Time: 3:00 Hours *Max. Marks :100*

Note: Selecting any five questions out of the six set. All questions carry equal marks.

1. Explain birth and death process. Derive the differential-difference equation for a general birth and death process and find the steady-state solution.

2. What is a renewal process ? Give example. Derive renewal equation and find its solution.

3. Consider a sequence of Bernoulli trials with probability p of success. Let X_n the out- comes of n^{th} trial be k, where $k = 0, 1, 2, ..., n$ denotes that there is a uninterrupted run of k successes. Find the transition probability matrix of the process and classify the states giving justification for each class.

4. What is a Markov chain? How is it represented? Explain be considering an example. Discuss the following with reference to Markov chains
   (i) Transient and Persistent States.
   (ii) First passage time distribution.
   (iii) Periodic and aperiodic states

5. Explain Simple Random Walk. State its properties. A gambler has a fortune of Rs.2. He bets 1 rupee at a time and wins 1 rupee with probablity 1/2. He stops playing if he loses all his fortune or doubles it. Write the transition probability matrix. What is the probability that he loses his fortune by the end of 3rd play.

6. What is a Poisson process? Give examples. State its properties. Show that Poisson process is a Markov process.

Total no. of Pages 02 Roll no.....

SECOND SEMESTER Ph.D(AM)

END SEMESTER EXAMINATION MAY 2019

AM-501B GRAPH THEORY AND PETRI NETS

Time: 3 Hours Maximum Marks: 100

Note: Answer any Five. All questions carry equal marks.

Q1(a) Define Petri Net and its reachability tree. Show that the reachability tree of a Petrinet is finite

(b) Prove that a Petrinet is conservative iff there exists a positive vector w such that D . w = 0,where the matrix D has its usual meaning.

Q2(a) Explain the Submarking reachability problem and the Zero-reachability problem of a Petrinet. Show that the Submarking reachability problem is reducible to the Zero-reachability problem.

(b) Show that the following are equivalent:

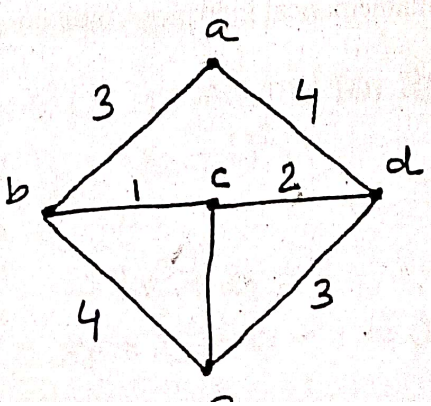
i. The reachability problem
ii. The liveness problem
iii. The single-transition problem

Q3. (a) Define Eulerian graph. Prove that a connected graph is Eulerian iff all its vertices are of even degree.

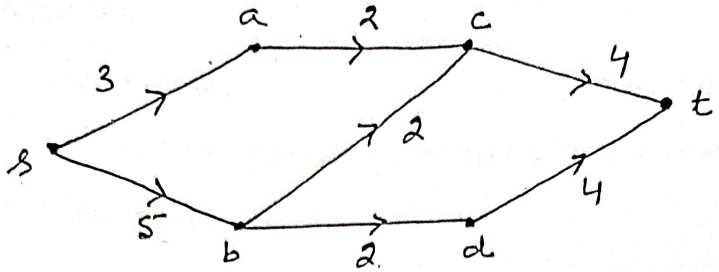
(b) Show that the following are equivalent:

i. There is one and only one path between every pair of vertices in a tree.
ii. A tree with n vertices has n-1 edges.
iii. A connected graph with n vertices and n-1 edges is a tree.

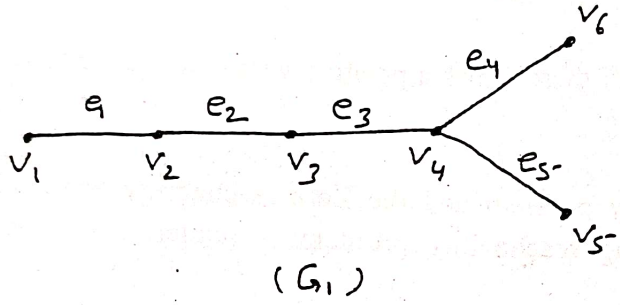
Q4(a) Explain Krukshal algorithm.Find the minimal spanning tree of the graph given below:



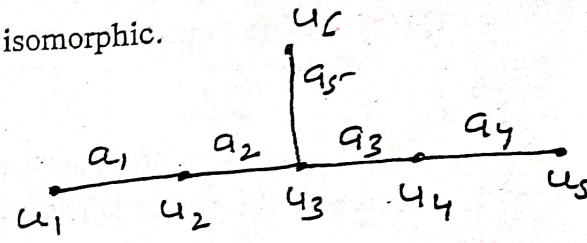
(b) Use Ford-Fulkerson algorithm to find the maximum flow for the following network:



Q5. (a) Using incidence matrix find whether the two graphs are isomorphic.

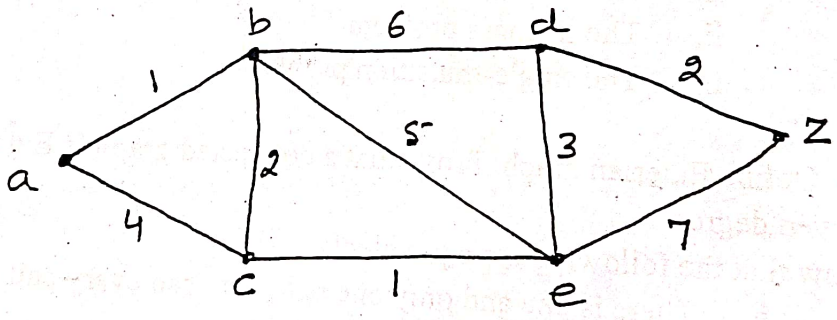


(G_1)



(G_2)

(b) Explain Dijkstra algorithm to find shortest path and hence find shortest path from a to z in the graph given below:



Q6 (a) Show that every cycle in a graph has an even number of edges in common with any cut-set.

(b) Prove that any minimal set of edges containing at least one branch of every spanning tree is a cut-set

(c) Define complete graph. Show by mathematical induction that a complete graph with n vertices has n(n-1)/2 edges.

Total No. of Pages: 02 Roll No:.....

Mathematics **Ph.D.**

END SEMESTER EXAMINATION (May, 2019)

AM-501C(Introduction to Mathematical Software)

Time: 3 Hours Max. Marks: 100

Note: *Attempt* ***all questions*** *and assume the missing values if any.*

Q 1. *Attempt* ***any two parts***

(a) Write a MATLAB program as a function file to determine the root of an equation using Bisection Method by considering a suitable problem of your choice. First write Pseudo code(LOGIC) and then proceed.

(b) Write a MATLAB program as a function file to determine the solution of 2 variable linear programming problem considering a suitable problem of your choice. First write Pseudo code(LOGIC) and then proceed.

(c) Write a MATLAB program as a function file to check closure property of in a set considering a suitable problem of your choice. First write Pseudo code(LOGIC) and then proceed.

Q 2. (a) Write a programme in C++ to generate 20 random numbers between 1 to 100 such that they sum to 250.First write Pseudo code(LOGIC) and then proceed.

(b) Write a programme in Excel to generate 5 random numbers between 1 to 10 such that they sum to 50.First write Pseudo code(LOGIC) and then proceed.

Q 3. (a) Write LATEX command for the following output:

$$\text{MaxZ} = x_1^2 + (x_2 - 1)^2$$

subject to :

$$-2x_1^2 + x_2 = 4$$

$$x_1 + x_2 + x_3 - 1 = 0$$

2

(b) Write programme in LATEX software to generate PPT slides for your presentation with following inclusions:
(i) Title Page
(ii) Introduction Page
(iii) Any subject you want to display in two slides
(iv) Bibliography page

Q 4. (a) Distinguish between MATLAB and Mathematics in detail by providing the merits and demerits of both.

(b) Discuss the following in C programming with suitable examples:
(i) Pointer
(ii) User Defined function
(iii) Decision Making statements
(iv) Loops
(v) Input statement

Q 5. (a) Write a programme in C++ to evaluate equivalence of two or more matrices. First write Pseudo code(LOGIC) and then proceed.

(b) Explain following with suitable examples:
(i) Primary data type
(ii) User defined data type
(iii) Derived data type
(iv) Local variable
(v) Global variable

Total No of pages: 01
Semester Examination

Roll Number----------
May-2019,

END SEMESTER EXAMINATION M.TECH / PHD

AM-502 Mathematical Modelling & simulation

Time 3:00 Hours

Maximum marks: 100

Answer any five questions, and each question has equal marks

1. Discuss the Single variable no constraint optimization problem solving process with a suitable example to your defined procedure
2. Use bisection method with an error tolerance $\epsilon = 0{,}04$ and the initial bounds given interactively to solve the problem $maximize\ f(x) = 6x - x^2$ with $\underline{x} = 0,\ \overline{x} = 4.8$
3. Consider the following convex programming problem $minimize\ z = x^4 + x^2 - 4x$ subject to $0 \leq x \leq 2$. Apply Newton's method with $\epsilon = 0{,}0001$ and $x_1 = 1$ to solve the problem.
4. Summarize Gradient search procedure
5. Consider the two variables unconstrained maximization problem, $maximize\ f(x) = 2x_1x_2 + 2x_2 - x_1^2 - 2x_2^2$. Apply $\epsilon = 0.1$ and $(x_1, x_2) = (0,0)$ as initial trial solution to apply gradient search procedure to obtain an optimal solution.
6. Consider the nonlinear programming problem

$$maximize\ f(x) = x_1 + x_2$$
$$subject\ to \quad x_1^2 + x_2^2 \leq 1$$
$$x_1 \geq 0, \qquad x_2 \geq 0$$

   Use the Karush Kuhn Tucker conditions to check whether $(x_1, x_2) = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$ is optimal.
7. Define the Random variable and write procedure how to generate a set of random numbers by using a discrete or continuous random variables.
8. Write short notes
   a) The discrete event simulation approach
   b) Statistical analysis of simulated data
   c) Variance reduction techniques
   d) Statistical validation techniques

-END-

Total No. of Pages: 02

Roll No:.....

END SEMESTER **Ph.D.(Course Work)**

May, 2019

AM-502 A, APPROXIMATION THEORY

Time: 3 Hours Max. Marks: 100

Note: Attempt any five questions and all the questions are carry equal marks.

(1) Let $f : [0, \infty) \to [0, \infty)$ and the operator define as:

$$L_n(f, x) = \sum_{k=0}^{\infty} p_{n,k}(x) f\left(\frac{k}{n}\right), \quad x \in [0, \infty),$$

where

$$p_{n,k}(x, c) = \binom{\frac{n}{c} + k - 1}{k} \frac{(cx)^k}{(1 + cx)^{\frac{n}{c}+k}},$$

and operators L_n reduce to a particular form of positive linear operator for $c = 1$. Construct its Kantorovich form for $c = 1$ and calculate the values of it for $1, t, t^2$. (20)

(2) (a) State and prove the *Weierstrass* first theorem. (14)

(b) Define *trigonometric series* and *Zygmund* class. (6)

(3) (a) Let $f : [0, 1] \to \mathbb{R}$ and n is non-negative integer. We define the Bernstein polynomial of f of degree n by the formula

$$B_n(f, x) = \sum_{k=0}^{n} f\left(\frac{k}{n}\right) p_{n,k}(x), \quad \text{where } p_{n,k}(x) := \binom{n}{k} x^k (1 - x)^{n-k}.$$

Let

$$T_{n,r}(x) = \sum_{k=0}^{n} (k - nx)^r p_{n,k}(x),$$

then for all $x \in \mathbb{R}$, show that

(*i*) $T_{n,0}(x) = 1$;

(*ii*) $T_{n,1}(x) = 0$;

(*iii*) $T_{n,2}(x) = nx(1 - x)$; (12)

(b) State all four theorems of Jackson (8)

(4) (a) State and prove P. P. Korovkin theorem (12)

(b) Define briefly modulus of continuity (8)

(5) (a) Define Szász operator and construct its Kantorovich form. (10)

(b) Calculate the values of Szász-Durrmeyer for $1, t, t^2$. (10)

(6) (a) Let Y be a finite-dimensional subspace of a normed linear space X, and suppose that each $x \in X$ has a unique nearest point $y_x \in Y$. Then show that the nearest point map $x \mapsto y_x$ is continuous. (10)

(b) Let Y be a subspace of a normed linear space X, and let $x \in X$. Then show that the set Y_x, consisting of all best approximations to x out of Y, is a bounded convex set. (10)

Total No. of Pages 02 *Roll No. .....*

SECOND SEMESTER Ph.D.[AM]

END SEM EXAMINATION MAY-2019

AM-502 B: General Relativity and Cosmology

Time: 3Hrs. *Max. Marks : 100*

Note : Answer any FIVE questions. All questions carry equal marks. Assume suitable missing data, if any.

Q.1[a] Show that $ds^2 = dx^2 + dy^2 + dz^2 - c^2dt^2$ is invariant under Lorenz Transformation.

[b] Discuss Minkowaski's four dimensional space-time continuums. What do you mean by space-like and time-like intervals?

Q.2[a] Discuss the concept of space and time in special relativity theory? Prove that the physical laws retain their velocity under Lorenz transformation.

[b] Explain the principle of equivalence and the principle of general covariance.

Q.3[a] Establish Einstein's field equations for material world in the form $R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R = 8\pi T_{\mu\nu}$, where the symbols have their usual meanings.

[b] Derive Einstein's static model of the universe and describe its properties.

Q.4 [a] Describe the salient features of Einstein's and de Sitter's cosmological models.

[b] Show that geodesic equations of motion are reducible to Newtonian equations of motion in the case of a weak static field.

(P.T.O.)

Q.5 [a] On the basis of general theory of relativity, discuss the bending of light passing close to heavy gravitational mass.

[b] Show that de Sitter's model corresponds to completely empty universe without matter or radiation.

Q.6 [a] Obtain the line element for Robertson's non-static cosmological model. Show how this model reveals that universe is expanding.

[b] Write the Einstein equation with the cosmological constant term. Explain why such a term is interpreted as the vacuum energy-momentum source of gravity.

Q.7 [a] Solve the following Einstein field equations for flat Robertson-Walker line element

$$3H^2 = 8\pi G\rho, \quad 2\dot{H} + 3H^2 = 8\pi Gp$$

for different phases of the universe taking equation of state $p = (\gamma - 1)\rho$. The symbols have their usual meanings.

[b] Write short notes on any two:

(i) Postulates of special theory of relativity.

(ii) Important of constancy of speed of light.

(iii) Hubble's law

Total No. of Pages: 01

MATHEMATICS

END SEMESTER EXAMINATION

Roll No:.....

Ph.D.

(MAY, 2019)

AM-502D, THEORY OF DIFFERENTIAL SUBORDINATION

Time: 3 Hours

Max. Marks: 100

*Note: Attempt **All** questions. All questions carry equal marks. Assume suitable missing data if any.*

1. (a) State and prove Hallenbeck and Ruscheweyh theorem.

   (b) Define Briot- Bouquet differential subordination. Let h be convex in U, with $\Re[\beta h(z) + \gamma] > 0$. If p is analytic with $p(0) = h(0)$, then show that

$$p(z) + \frac{zp'(z)}{\beta p(z) + \gamma} \prec h(z) \quad \Rightarrow \quad p(z) \prec h(z).$$

2. (a) State and prove Marx-Stohhäcker theorem.

   (b) Define Bernoulli function, prove that it is convex function and find its radius of convexity beyond unit disk.

3. (a) Let g be a biholomorphic mapping on P_1^n such that $g(P_1^n)$ is a convex domain in C^n and $Dg(0) = 1$. If $f \in \mu(P_1^n)$ with $f(0) = g(0)$, then

$$Df(z)z \prec Dg(z)z \Rightarrow f(z) \prec g(z),$$

   and g is the best dominant.

   (b) State and prove any second order linear differential subordination implication involving convex dominant.

4. (a) State and prove Jack's lemma for 3rd order differential subordination.

   (b) Use admissible functions to solve the domain of the functions satisfying the given equation in the following examples:

   i Let $\psi(r, s, t; z) = r + s + t, a = 0$, and $\Omega = h(\mathbf{U})$ where $h(z) = (n^2 + 1)Mz$.

   ii Let $\psi(r, s, t; z) = r + s + t$, and $\Omega = \Delta = (w : Rew > 0), Rea > 0$.

   iii Let $\alpha : \mathbf{U} \to \mathbf{R}, \psi(r, s, t; z) = r + \alpha(z).s/r, \Omega = \Delta = (w : Rew > 0), Rea > 0$.

5. (a) Let n be a positive integr and let $\alpha > 0$. If $F \in A_n$ and

$$J(\alpha, F; z) \prec 1 + z + \frac{n\alpha z}{1+z} = h(z), \qquad (1$$

then $zF'(z)/F(z) \prec 1+z$, and $|zF'(z)/F(z) - 1| < 1$. Also prove if $F \in A_n, \alpha >$ and

$$|J(\alpha, F; z)| < M(\alpha, n). \qquad ($$

then,

$$\left|\frac{zF'(z)}{F(z)} - 1\right| < 1. \qquad ($$

(b) State and prove Robertson theorem.

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Total No. of Pages: 01 *Roll No:*.....

MATHEMATICS Ph.D.

END SEMESTER EXAMINATION (MAY, 2019)

AM-503A, GEOMETRIC FUNCTION THEORY

Time: 3 Hours Max. Marks: 100

Note: Attempt All questions. All questions carry equal marks. Assume suitable missing data if any.

(1) (a) Define the following with suitable examples:
(i) Univalent functions (ii) Caratheodary function (iii) Subordination
(iv) close-to-convex function (v) α-Spiral Function
(b) State and prove the growth theorem.

(2) (a) State and prove the Area Theorem.
(b) State and prove Lindeloff Principle.

(3) (a) Define a Starlike function with an example.
Show that $f \in S^*$ iff $\Re(\frac{zf'}{f}) \geq 0$.
(b) Define typically Real functions with some examples and also give the geometrical interpretation. Describe convexity in one direction with the help of an example.

(4) (a) State and prove Bernstein's theorem?
(b) State and prove Little wood's theorem?

(5) (a) Show that $f \in S$ maps the disk $|z| < \rho$ onto a convex domain for every positive number $\rho \leq 2 - \sqrt{3}$ but not for $\rho > 2 - \sqrt{3}$.

(b) State the necessary and sufficient condition for a function to be in the class of close to convex functions and prove only the necessary part.

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Total No. of Pages 1 *Roll No. .....*

Ph.D Applied Mathematics Course Work

END SEMESTER EXAMINATION, *May-2019*

AM-503B Information Theory and Coding

Time: 3:00 Hours *Max. Marks :100*

Note : Answer any five questions. All questions carry equal marks.

1. Derive Shannon's entropy measure for a discrete probability distribution using axiomatic approach. What are its important properties ?

2. Describe joint, marginal and conditional entropies. What's mutual information? Show that it is non- negative and symmetric.

3. What is differential entropy? What are its limitations. Derive its expression in case of a Gaussian random variable.

4. What are linear block codes? Illustrate the basic mathematical structure for the designing of an LBC. How does d_{min} determine the error detecting and error correcting capacity of a code?

5. Explain channel capacity. Two BSCs defined by the channel matrices

$[p[y_j|x_i]]=\begin{bmatrix}0.8 & 0.2\\ 0.2 & 0.8\end{bmatrix}$ and $[p[z_k|y_j]]=\begin{bmatrix}0.7 & 0.3\\ 0.3 & 0.7\end{bmatrix}$ are connected as

$X \longrightarrow Y \longrightarrow Z$

Find the channel capacity of the resultant BSC.

6. Define cyclic code. What is syndrome decoding? Explain by considering a suitable example of your choice.

7. Write note on any two of the following:

(i) Channel encoding, (ii) REED SOLOMON Codes,

(iii) BCH Codes, (iv) Quantum Information Theory

No. of pages:2
End Semester Examination
Paper Code: AM-503E
Max Marks: 100

Roll No.: .....
Ph.D. Course, May-2019
Fuzzy Logic and Applications
Time: 3.00 Hours

Note:

- **All Questions are compulsory carry equal marks.**
- **Assume suitable missing data if any.**

Q 1. (a) We want to compare the strength of two types of groups. Four units from each type of group are stressed until they fail. The lowest stress at failure of a unit is denoted 1, and the highest stress at failure is denoted 5, so unitss are rank ordered by failure stress, that is, $X = 1, 2, 3, 4, 5$. Since "failure" of units is fuzzy, the membership value for a specific unit represents the judgment that the unit really failed. The following fuzzy sets represents the failure estimates for the two different concrete type:

$$\underline{A} = \{\frac{0.1}{2} + \frac{0.5}{3} + \frac{0.3}{4} + \frac{0.2}{5}\}$$

$$\underline{B} = \{\frac{0.5}{2} + \frac{0.7}{3} + \frac{0.2}{4} + \frac{0.4}{1}\}$$

Perform Complement, Union, intersection, Difference, De Morgan's Principles for the two concrete types.

(b) i. Consider a fuzzy number characterized by by a triangular fuzzy number $\tilde{A}$ under $y = x$ that is $f(\tilde{A}) = \tilde{B}$. Calculate the image for each interval for which $\mu_A(x)$ is defined as :

$$\tilde{A}(x) = \begin{cases} 0 & x < 1, x > 5 \\ \frac{x-1}{2} & 1 \leq x \leq 3 \\ \frac{5-x}{2} & 3 \leq x \leq 5 \end{cases}$$

ii. Explain Fuzzy Controller with suitable example.

Q 2. (a) i. Explain intuitionistic fuzzy variable . What do you mean by intuitionistic Fuzzy Relation. If R and S be two intuitionistic fuzzy relations on two sets XxY and YxZ respectively, then prove that

A. $R^{-1-1} = R$

B. $(SoR)^{-1} = R^{-1}oS^{-1}$

ii. R_1 and R_2 are two fuzzy equivalence relations on a set A of order m then ckeck if $R_1 \bigcup R_2$, $R_1 \bigcap R_2$, R_1^{-1} are also fuzzy equivalence relations.

(b) define homomorphism and strong homomorphism. explain by taking suitable example.

Q 3. (a) Apply clustering method for the given relation to get resolution form and also give the tree diagram.

$$\begin{pmatrix} 1 & (.3,.7) & (.1,.3) & (.2,.4) \\ (.5,.7) & 1 & (.4,.7) & (.3,.5) \\ (.1,.3) & (.4,.6) & 1 & (.8,.9) \\ (.2,.4) & (.3,.5) & (.7,.9) & 1 \end{pmatrix}$$

(b) Let $\tilde{A}_1 = [2,5,7,9]$, $\tilde{A}_2 = [-1,3,6,10]$ and $\tilde{A}_3 = [3,6,7,8]$ are three trapezoidal fuzzy numbers. Perform the following:

i. Aggregate Fuzzy set $\tilde{A}_1$, $\tilde{A}_2$ and $\tilde{A}_3$ and do the defuzzification using centroid method.

ii. Perform ($\tilde{A}_1 + \tilde{A}_2 - \tilde{A}_3$) and ($\tilde{A}_1 * \tilde{A}_2 / \tilde{A}_3$).

Q 4. (a) Let $\tilde{A} = [2,5,7,9]$, $\tilde{B} = [-1,3,6,10]$ and $\tilde{C} = [3,6,7,8]$ are three trapezoidal fuzzy numbers. Solve the following equation:

$$\tilde{A}\tilde{X} + \tilde{B} = \tilde{C}$$

(b) Write a short note on

i. Extension Principle For Fuzzy Relation.

ii. Max-Min operation in Intuinistic fuzzy environment.

Q 5. (a) Give membership function for given data:

i. Old people

ii. Very Old people

iii. Young People

iv. Very Young people

v. High speeds for racing cars

(b) i. Define implication operator and explain it in by taking suitable example.

ii. Define bi implication operator and explain it in by taking suitable example.

Total No. of Pages : 02

IInd Semester END SEMESTER EXAMINATION Ph.D. (AM)
PAPER CODE - AM-504B May/June 2019
TITLE OF PAPER - Advanced Mathematical Method
TIME: 03 HRS MAX. MARKS: 100

Note: Attempt any **FIVE** questions. Each question carry equal marks.
Assume suitable missing data, if any.

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1. Discuss the leading behaviour of Stieltjes integral $I(x) = \int_0^\infty \frac{e^{-t}}{1+xt}$ for small positive values of x. Why integration by parts fails to depict the behaviour of $I(x)$ as $x \to +\infty$? (20)

2. (a) Discuss various techniques to determine controlling factors. (10)
   (b) Find asymptotic behaviour of the solution near boundaries for the non-linear boundary value problem $yy'' = -1$, $y(0) = y(1) = 0$. (10)

3. Consider the non-linear IVP, $(x - \epsilon y)y' + xy = e^{-x}$, $y(1) = \frac{1}{e}$ and determine a leading-order perturbative approximation to $y(0)$ as $\epsilon \to 0^+$. (20)

4. (a) State and prove Watson's lemma. (10)
   (b) Discuss WKB approximation for singularly perturbed reaction-diffusion equations. (10)

5. (a) Show that the general solution of the Airy's equation $y'' = xy$ is (10)

$$y(x) = c_1 \sum_{n=0}^{\infty} \frac{x^{3n}}{9^n n! \Gamma(n+\frac{2}{3})} + c_2 \sum_{n=0}^{\infty} \frac{x^{3n+1}}{9^n n! \Gamma(n+\frac{4}{3})}.$$

(b) Solve the linear difference equations $a_{n+2} - 5a_{n+1} + 6a_n = 0$ and hence find the Wronskian. (10)

6. (a) Define Euler Summation, Borel Summation and Padé Summation. (15)

(b) Differentiate between regular and singular perturbation problems with the help of an example. (5)

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Total No. of Pages ___ Roll No.....

11 SEMESTER B.Tech./M.Tech./MBA/Ph.D/ B.Tech.(Evel)

END SEMESTER EXAMINATION *May/June-2019*

PAPER CODE: AM 505D &

TITLE OF PAPER: Quantum Information Theory

Time: 3:00 Hours *Max. Marks : 100*

Note : Answer all question by Selecting any two parts from each questions.
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1[a] Write the postulates of quantum mechanics.
Show explicitly that the Hadamard transform on 2 qubits may be expressed as $H^{\otimes 2} = \frac{1}{2}\sum_{x,y}(-1)^{x.y}|x\rangle\langle y|$. Write out an explicit matrix representation for $H^{\otimes 2}$.

[b] State and Prove Schmidt decomposition.
Find the Schmidt decompositions of the state $\frac{|00\rangle+|01\rangle+|10\rangle}{3}$.

Q.2[a] Define Positive operator valued measurement (POVM).
Suppose Alice gives Bob a qubit prepared in one of two states: $|\psi_1\rangle = |0\rangle$ or $|\psi_2\rangle = \frac{|0\rangle+|1\rangle}{\sqrt{2}}$. Construct POVM containing three elements so that Bob can determine whether he has been given $|\psi_1\rangle$ or $|\psi_2\rangle$ with perfect reliability.

[b] Prove that non-orthogonal states cannot be reliably distinguished.

Q.3[a] State and Prove Bell Inequality.

Show that the singlet state violate the Bell inequality maximally

[b] Suppose we have two qubits in the state $\frac{|00\rangle - |11\rangle}{\sqrt{2}}$, and we measure the observable $\sigma_z \otimes \sigma_z$. What is the average value of $\sigma_z \otimes \sigma_z$. What is the standard deviation of $\sigma_z \otimes \sigma_z$.

Q.4[a] Show that $\vec{v}.\vec{\sigma}$ has eigenvalues ± 1, and that the projectors onto the corresponding eigenspaces are given by $P_{\pm} = \frac{(I \pm \vec{v}.\vec{\sigma})}{2}$.

[b] State and Prove Shannon's source coding theorem.

Q.5 Describe in detail the conventional teleportation protocol.

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

II[nd] SEMESTER **Pre Ph. D.**

END SEMESTER EXAMINATION **(MAY-2019)**

AM 505C: Group Rings

Time: 3:00 Hours **Max. Marks: 100**

Note: All questions are compulsory and carry equal marks. **Attempt any two parts from each question.** Assume suitable missing data, if any.

Q1. a) Let R be a ring and H be a subgroup of a group G. Then show that the set $B_H = \{q(h-1) : q \in T, h \in H, h \neq 1\}$ is a basis of $\Delta_R(G,H)$ over R.

b) Let R be a ring and let H be a normal subgroup of a group G. If $|H|$ is invertible in R and $e_H = \frac{1}{|H|}\hat{H}$, then prove that $RG = RGe_H \oplus RG(1-e_H)$, where $RGe_H \simeq R(G/H)$ and $RG(1-e_H) = \Delta(G,H)$.

c) Let I be a two sided ideal of a ring R and let G be a group. Show that $IG = \left\{\sum_{g\in G} a(g)g \in RG : a(g) \in I\right\}$ is a two sided ideal of RG and that $RG/IG \simeq (R/I)G$.

Q2. a) Prove that if the augmentation ideal $\Delta(G)$ is a direct summand of RG as an RG-module, the G is finite and $|G|$ is invertible in R.

b) Let K be a field and G be a group. Then show that the group ring KG is Artinian iff G is finite.

c) Prove that the following statements are equivalent:

i) R is Von Neumann regular ring.

ii) Every principal left ideal Ra is generated by an idempotent.

iii) Every principal left ideal Ra is a direct summand of R.

PTO

Q3. a) Let KG be the group algebra of a finite group over a field K of characteristic $p \geq 0$. Then prove that KG has a (nonzero) nilpotent ideal iff $p > 0$ and $p \mid |G|$.

b) Let G be a group and let $H_1, \ldots, H_n$ be a finite number of subgroups. Suppose there exists a finite number of elements $x_{ij} \in G$ with $G = \cup_{i,j} H_i x_{ij}$. Then show that $(G : H_i)$ is finite for some i.

c) Let H be a subgroup of a group G and K be a field. Then show that the following assertions are equivalent:

i) H is finite.

ii) The right annihilator of $KG(\Delta H)$ contains a nonzero element.

Q4. a) Let G be a finite group and K be a field of characteristic 0. If $e \in KG$, then prove that:

i) $e(1) \in Q$,

ii) $0 \leq e(1) \leq 1$.

b) Let RG has only trivial units. If R is reduced and G has no element of order 2, then show that RG is reduced.

c) Let G be an abelian group and H be its torsion subgroup. For an commutative ring R, show that any idempotent e of RG belongs RH.

Q5. a) Let G be a torsion group such that $u_1(ZG) = G$. Then show that every subgroup of G is normal.

b) Let G be a torsion free abelian group and R be a domain. Then prove that RG has no nonzero zero divisors.

c) Let G be a finite abelian group and let H be another group such that $ZG \simeq ZH$. Then prove that $G \simeq H$.

***** END *****

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

SECOND SEMESTER **M.Tech. [NST]**

END SEMESTER EXAMINATION ***(May- 2019)***

AP-601: PHYSICS OF LOW DIMENSIONAL SYSTEMS

Time: 3:00 Hours ***Max. Marks :100***

Note: Answer ***ALL*** the questions

Assume suitable missing data, if any.

1(a). Describe the nature and origin of various forces exciting between atoms of a solid. Explain the formation of a stable bond using potential energy versus interatomic distance curve. **[05]**

(b). Explain van der Waals bonding in the inert gas crystals along with properties. Why do inert gases get solidified at very low temperatures? **[05]**

2 (a). Classify the different types of molecules based on the relative values of principal moments of inertia with suitable examples. **[06]**

(b). In an MX molecule, suppose M atom has an ionization potential energy 5 eV and X atom has an electron affinity of 4 eV. What is the energy required to transfer an electron from M to X when they are at a distance of 5 Å? **[04]**

3. Discuss how a diatomic molecule is behaving as anharmonic oscillator and its features with a suitable diagram.How it is different from the harmonic oscillator. **[10]**

4(a).State and explain Franck-Condon principle with suitable diagrams. **[06]**

(b). Assume that H_2 molecule has a force constant k = 573 N/m. Find the vibrational quantum number corresponding to 4.5 eV dissociation energy. Given mass of H atom= 1.68×10^{-27} kg, h =6.63×10^{-34} Joules/sec. **[04]**

5(a). The spacing of a series of lines in microwave spectrum of AlH is constant at 12.604 cm^{-1}. Calculate the moment of inertia, rotational energy and frequency of rotation for the AlH molecule when J=15? **[06]**

(b). What is the maximum and minimum value of probability of occurrence of a macro-state for the case of n distinguishable particles distributed in two compartments? Prove? Explain the concept of most probable state? **[09]**

6. Write short notes on any **FOUR** of the following: **[20]**

i) Applications of low dimensional systems

ii) Role of indistinguishability in quantum statistics

iii) Condition for most probable distribution of Fermions

iv) Eigen functions and Eigen values

v) Comparison between electron and optical microscopy

7. (a) What is the significance of partition function (Z) in low dimensional systems? Show that in a general interaction between two systems, mechanical equilibrium is reached when the temperatures of the two systems become equal and the pressures of the two becomes equal. **[10]**

(b) What types of changes in the properties of the materials occur at low dimensions? What are the prominent effects which play an important role at nano scale? **[10]**

(c)The Hydrogen atom consists its first excited state at approximately 10 eV above its ground state. Calculate the temperature required to excite hydrogen atoms to be first excited level? **[5]**

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Total No. of Pages:02 *Roll No. ... .*

SECOND SEMESTER M.Tech. [NST]

END SEMESTER EXAMINATION *(MAY - 2019)*

AP-6021 MATERIALS SCIENCE AT NANOSCALE

Time: 3:00 Hours *Max. Marks: 100*

Note: Answer *ANY FIVE* questions

Assume suitable missing data, if any.

1(a). Explain Schottky defect in solids. Obtain an expression for the equilibrium concentration of vacancies at a given temperature in metallic crystal. **[10]**

(b). What are surface imperfections? Discuss about grain, twin and tilt boundaries with suitable diagrams. **[10]**

2(a). Discuss the electronic conduction properties of nano-materials in 3-D to 0-D (dimension). Draw the I-V characteristics for 3-D and 0-D nano-materials and hence explain the I-V characteristics of both. **[10]**

(b). Explain the magnetization and demagnetization nano-materials. Showing the variation of coercivity filed vs particle or grain size, discuss the critical diameter and super-paramagnetic diameter for single and multi- domains. **[10]**

3(a). Explain dielectric properties of nano-materials. Briefly discuss the piezoelectric and pyroelectric properties of bulk and nano-materials. **[10]**

(b). Discuss synthesis technique of zeolite nano-particles. Write down applications of zeolite nano-particles. **[10]**

4(a). Describe fabrication of carbon nano-tubes using chemical vapour deposition (CVD) method. Highlight the merit and demerits of this method. **[10]**

(b). How porous silicon (p-Si) is different from Silicon (Si)? Discuss the synthesis and characterization of porous silicon. Write any two application of p-Si. **[10]**

5(a). What is spin transport? Discuss giant magneto-resistance (GMR) using spin transport diagram and explain the working mechanism of GMR. Write applications of GMR. What are the merits of GMR over AMR. **[10]**

(b). What is the effect of nano-structuring? Discuss the properties of nano-carbon ferromagnets. **[5]**

(c). Calculate the number atoms per unit cell of a metal having lattice parameter 0.29 nm and density of 7870 Kg/m^3. Given the atomic weight of metal is 55.80. **[5]**

[5 x4]

6. Explain Briefly any **FOUR**:

(a). Thermal transport in1-D and 2-D nano-materials

(b). Ceramic-matrix composites

(c). Dielectric loss

(d). Grain boundary effect on mechanical properties of nano-materials

(e). Staking faults

(f). Edge Dislocation

Total No of Pages:1 Roll No..... .....

Semester – II M. Tech (NST)

END SEMESTER EXAMINATION May-2019

AP-6031 Processing and Fabrication of Nanostructures

Time: 3:00 Hours Max Marks: 100

Note: Answer any 5 questions. Assume suitable missing data, if any.

Q.1 What is Chemical Vapor Deposition (CVD)? Discuss with suitable diagram different types of CVD system. **(20)**

Q.2 Write short notes on any four of the following: **(5×4=20)**

(a) Top-down and bottom-up approaches

(b) Photolithography

(c) Vapor phase growth

(d) Ball Milling

(e) Physical Vapor Deposition

Q.3 (a) What are quantum dots and nanowires? Describe one method with an example each for the synthesis of quantum dots and nanowires.

(b) Describe Electrospinning technique? Discuss the various parameters that affect the electrospinning of nanomaterials. **(10×2=20)**

Q.4 (a) With suitable diagram explain the synthesis of carbon nanotubes by laser ablation technique. Discuss the difference between Raman spectra of SWNT with MWNT.

(b) Explain the growth mechanism of SWNT in arc and laser vaporization technique. **(10×2=20)**

Q.5 Explain the working of E-beam Lithography (EBL) using a suitable schematic of the EBL system with the necessary components. What are the advantages of EBL compared with photolithography? Describe the major differences between EBL and Focused-Ion-Beam Lithography. **(20)**

Q.6 Differentiate between 1D, 2D and 3D nanostructures Discuss the mechanism for template assisted fabrication of nanowires. Why the surface to volume ratio of a nanoparticle is much higher than that of the bulk particle of the identical material? **(20)**

-End-

Total Number of Pages 2
SECOND SEMESTER
END SEMESTER EXAMINATION

Roll No.....
M .TECH (NST)
May/June-2019

AP-6511 NanoElectronics and NanoPhotonics

Time: 3:00 Hours *Max Marks: 100*

Note: Answer All questions.
Assume suitable missing data, if any

Part A

Q1. Attempt any **Two** of the following:
(a) Describe propagation of photon and electron through classically forbidden zone. 10
(b) Describe nanoscale localization of electromagnetic field achieved both axially and laterally. 10
(c) How to fabricate the photonic crystal using different methods? 10

Q2. Describe any **Five** of the following with examples. 10×4=40
(a) Localization of photon and electron under periodic potential
(b) Surface Plasmon Resonance (SPR) and Ballistic Transport
(c) Photonic crystals and photonic crystal fibres
(d) Optical communication, sensors and IR detectors
(e) Nonlinear photonic crystals
(f) Density of state (DOS) and Local density of state (LOS)
(g) Quantum dots and quantum dots lasers

Part B

Q3. (a) Using the Bohr model of the hydrogen atom, show that the magnetic moment associated with an electron moving in the lowest circular orbit is the Bohr Magneton given by

$$\mu_B = \frac{e\hbar}{2m_0}$$

Also, show that the magnetic flux density B_n associated with the n^{th} orbital is given by

$$\mu_n B_n = \frac{1}{4}\left(\frac{\alpha^4 Z^4}{n^5}\right) m_0 c^2,$$

where m_0 is the rest mass of the electron, c is the speed of light in vacuum, Z is the atomic number of the atom, n is the principle quantum number and α is the fine structure constant. 10

(b) Discuss the quantum mechanical operators for the spin components along three orthogonal axes-S_x, S_y and S_z and hence workout for Pauli's dimensionless matrices. 10

Q4. Show that the operators for S_x, S_y and S_z satisfy following equation:

$$|S|^2 = S_x^2 + S_y^2 + S_z^2 = \frac{3}{4}\hbar^2[I] = \bar{s}(\bar{s}+1)\hbar^2[I] \quad 5$$

Q5. Write short note on any **Three** of the following: 5×3=15
(i) Passive Spintronics Devices
(ii) Hybrid Spintronics Devices
(iii) Monolithic Spintronics
(iv) Kondo Effect
(V) Spin-Polarized Transport

Total No. of Page 03 *Roll No. .....*

SECOND SEMESTER **M.Tech. (NST)**

End-Semester Examination ***May-2019***

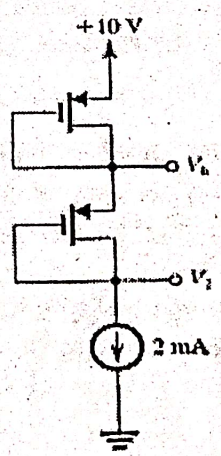
AP-6521: Semiconductors: Nanostructures and Devices

Time: 3:00 Hours *Max. Marks : 100*

Note : Attempt any 10 questions. All questions carry equal marks. Assume suitable missing data, if any.

Q.1. (a) Obtain a pull-up to pull down ratio when an n-MOS inverter is driven through one or more pass transistors. Assume the default logic voltage levels. [5]

(b) In the circuit shown below, transistors are characterized by $|V_t| = 2V$, $kW/L = 1 mA/V^2$. Find V_6 and V_7.



[5]

Q.2. (a) Design a stick-diagram layout for a CMOS based XOR gate. [5]

(b) For the tunnel junction with C = 1.2 aF and Rt = 100 kΩ, what is the temperature at which coulomb blockade is expected to occur in Single Electron Transistor? Characterize the Current versus Voltage variation of Single Electron Transistor thereby explaining the Coulomb Blockade Gap and threshold voltage. [5]

Q.3.(a) Derive the expressions for drain current in saturation regime along with the expression for the transconductance and cut-off frequency in an n-channel enhancement mode MOSFET. [5]

(b) Put some light on the stoichiometry of Pervoskite Solar Cell Structure and give the significance of band gap tuning in these solar cells. [5]

Q.4.(a) Characterize the LED in terms of its Cathode Current and Forward Voltage. Explain the bi-colour nature of LEDs and the colours being produced by GaInN and AlGaP. [5]

(b) Give the fabrication steps involved in Surface Micromachining with relevant figures. Compare surface micromachining with bulk micromachining. [5]

Q.5. (a) Evaluate the input voltage in terms of β ratio and other circuit voltages and currents for a CMOS inverter. Also give the transfer characteristics and current between the rails for a CMOS inverter. [5]

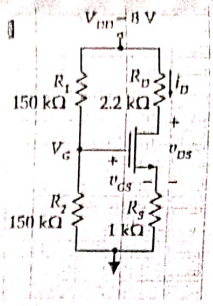
(b) Put some light on HARM and LIGA micromachining processes of MEMS fabrication. Which materials are used as wet etchants and dry etchants in its fabrication? [5]

Q.6. (a) How resonant states in the quantum well of double barrier structure contributes in the conduction process of RTDs? Explain the origin of negative differential resistance by suitable energy band diagram. [5]

(b) Give the criterions that have to be met to achieve Coulomb Blockade in Single Electron Transistor. Assume that initially there are n = 100 electrons on the quantum dot. If $C_L = C_R = 1.2$ aF, what is the Vs for electron to tunnel? [5]

Q.7. (a) Give the significance of Multi Junction Solar Cells and its structure along with the six types of layers. [5]

(b) For the circuit shown, use the NMOS equations to find I_D and V_{DS}. For the NMOS, $V_T = 1$ V and $KW/L = 0.25$ mA/V^2. [5]



Q.8. (a) Determine the minimum tunnel resistance offered by SET for electron tunneling. Evaluate the switching time of the single electron transistor if the gate capacitance is 1.0aF, the tunnel capacitances are 1.5aF each and the tunnel resistance is 30KΩ. [5]

(b) Compare and analyze the characteristics of tunneling diode and resonant tunneling diode in both forward and reverse bias. Give the advantages of RTD over the tunnel diodes. [5]

Q.9. Determine the constant voltage and constant field scaling factor for each of the following:
(i) Switching Energy,
(ii) Power-Speed Product,
(iii) Channel Resistance,
(iv) Saturation Current and
(v) Gate Delay [10]

Q.10. How MEMS function as Capacitive Accelerometer and Pressure Sensor with a suitable diagram in each case. [10]

Q.11. Write short notes on: [10]
(a) NEMS
(b) Direct and Indirect Semiconductor Materials w.r.t. LEDs.
(c) Lambda Based Design Rules

-END-

Total No. of Pages 02 Roll No. .....

II SEMESTER **M.Tech. [BIOINFORMATICS]**

END SEMESTER EXAMINATION ***May-2019***

BT 601 BIOINFORMATICS-II

Time: 3:00 Hours *Max. Marks: 100*

Note : Answer all questions.
All questions carry equal marks.
Assume suitable missing data, if any.

1. Answer any two of the following questions: (2x10)
   (i) Comment on "Loss of function" and "Gain of function" consequences of mutations with examples.
   (ii) What is 1000 genome project? What are its key outcomes?
   (iii) Explain different types of genetic variations. Write some applications of SNP study. Also mention two widely used SNP databases.
   (iv) Why are SNPs used as biomarkers? Mention some applications of SNPs in biomedical research.

2. Answer any two of the following questions: (2x10)
   (i) What are the effects of single amino-acid variation in protein structure?
   (ii) Explain the role of different forces in tertiary structure of protein. Also state the role of proline and cysteine residues in protein structure.
   (iii) Explain the basis of algorithms behind SIFT and PolyPhen tools.
   (iv) What is the application of molecular dynamics study in mutational analysis?

3. Answer any two of the following questions: (2x10)

(i) How is genetic algorithm derived from evolution?

(ii) How environmental factors can influence the phenotype of an organism? Give suitable examples.

(iii) Differentiate between monogenic and complex disorders. Describe the methods for prioritizing genes associated with complex disorders.

(iv) What is classical Mendel's theory of genotype and phenotype association? How it is different from Morden principle on genetics.

4. Answer any two of the following questions: (2x10)

(i) What are the methods for evaluating a machine learning model which has been trained for classification?

(ii) How is soft-margin different form hard-margin in Support vector machines? Explain the kernel trick used in SVMs.

(iii) Write the general steps for training a machine learning model.

(iv) Explain the backpropagation algorithm for training of ANNs. Discuss some applications of CNNs.

5. Answer any two of the following questions: (2x10)

(i) What is predictive prescribing? How it can be applied on a patient?

(ii) Explain the role of cytochrome P450 family in drug metabolism.

(iii) What are the methods for identifying pharmacogenomic variants?

(iv) Write a short note on various web resources for pharmacogenomic studies and their applications.

-END-

Total No. of Pages 2

END SEMESTER

Roll No. .....

M.Tech [Bioinfo]

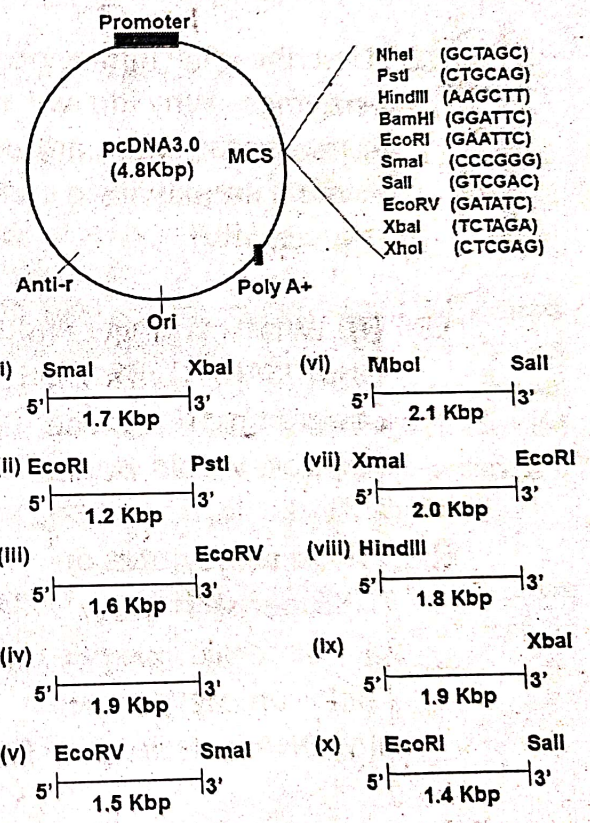
END SEMESTER EXAMINATION May-2019

BT-6022 ADVANCED GENETIC ENGINEERING

Time: 3:00 Hours *Max. Marks: 100*

Note: Answer five questions (1-3 questions are compulsory).
All questions carry 20 marks.
Assume suitable missing data, if any.

Q.1. How are you making cloning strategy for generating a construct? Why do we need YAC and BAC and why these vectors are called as "Chromosome". Based on pictorial representation, clone all the inserts with vector. Also, describe the construct size. *Avoid blunting in the every clone and if blunting is necessary an alternate cloning strategy is required with each inserts.* How would you define isoschizomers, neoschizomers with appropriate examples?



Q.2. What do you mean by high and low copy number of a gene? *In vitro* gene transfer is a strong tool to study eukaryotic gene expression. Describe the different gene transfection and infection technique. How would you make Adenoviral, Lentiviral and Retroviral genes constructs to get maximum expression in the host system?

Q.3. With the help of given arbitrary sequence (i) prepare atleast two sets of primers and load EcoRI (5'-GAATTC-3'), BamHI (5'-GGATTC-3'), XhoI (5'-CTCGAG-3'), SalI (5'-GTCGAC-3'), SmaI (5'-CCCGGG-3') in the primers together with Tm of each primer:

P.T.O.

5'CTCAGACTAGCATGGACCGAGCAGCAACAATTCACGATTAACTTAGCCGATTGC TAATACTAGCTTACGTTACGACATGAACTAATACGCCGGATCGATCGACTAACATT C3'.

How would you analyze PCR curve and describe the limiting factors of PCR and primer designing *per se*. (ii) Describe the usage of master mix and why do we need different Taq polymerases? (iii) Define "HOT start, multiples and non- specific PCR" (iv) Why do we need semi-quantitative PCR?

Q.4. An arbitrary internal DNA sequence is present in the qARM of human chromosome number 15 which is; 5'-CTCAGTCACTAGCATGGACCGAGCTAGATACAACAATTCACGATTAACTTAGCCGA TTGCTAATACTAGCTTACGTTACGACATGAACTAATACGCCGGATCGATCGACTAA CATTC-3'. In order to identify and validate the sequence in human genomic DNA what methodology would you opt? Write detail steps with pictorial representation. Also describe the function of TBP in trans acting expression.

Q.5 Describe the difference between restriction enzyme and modification enzymes. Why do we need modification enzymes? Describe the role of various restriction and modification enzymes with required protocol? How buffers are playing a crucial role in the cleavage of a DNA fragment? What is star activity?

Q.6. (i) What strategy would you opt to access the activity of cis-acting, MAR/SAR, TFBEs activity. Write detail protocol/steps with suitable diagrammatic representation and internal controls.
(ii) How would you radiolabel a DNA fragment to generate suitable probe?

Q.7. Write short notes on
(i) Super shift assay
(ii) Genomic library construction
(iii) Promoter element
(iv) DNA isolation and RNA separation

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Total no of pages: 2 Roll No:... .....

2nd_ SEMESTER M.Tech. (Bioinformatics)

END SEMESTER EXAMINATION May 2019

BT-6032 Drug Design and Discovery

Time: 3:00 Hours *Max. Marks : 100*

Note: Part A (Compulsory and carries 60 marks)
Part B: Answer any 4 questions out of 5 in Part B (4x10=40)

Part A (Compulsory)

1. Write short notes on any 3: (15 Marks)
   a. Peptide libraries
   b. Pure and pharmaceutical drug preparations
   c. 2D vs 3D QSAR
   d. Quantum mechanics in drug design

2. A company is developing a clinical trial for tuberculosis vaccine; the company needs to decide whether a longitudinal study or cross-sectional study will be useful in this case. Give reasons for your answer.
   A study starts with 1000 subjects out of which 100 subjects show symptoms of the disease and 100 subjects are serologically positive but do not show symptoms of the disease. Over the next 1 year, 10 patients die. What is the incidence and prevelance of the disease for this 1 year. Can you comment if this disease is a chronic or sporadic disease? (15 marks)

3. What are drug-receptor occupation theories and discuss using examples how classical Clark's theory is insufficient in explaining many receptor-ligand interactions. (15 marks)

4. What are the different phases of clinical trials, justify each phase. What is a cohort? How blinded and double blinded trials are significant for clinical trials. (15 marks)

Part B (Answer any 4 questions, each question carries 10 marks)

5. Explain pharmacophore modeling. What are force fields? How can molecular mechanics help in better prediction of a drug molecule and its bioactivity?

6. Explain in detail how human genome project has affected drug design and also discuss some of the ethical issues associated with complete genome sequencing of human beings. What are alternative medicines?

7. Explain how thermodynamic properties of a compound affect its binding to a receptor? Compare and contrast between competitive and non-competitive enzyme inhibitors.

8. Using a case study explain how computational drug design helps modern drug discovery process.

9. Enumerate the process of patenting in India in an explicit flowchart. Does Indian patent allow both product and process patent? If an individual has developed a new surgical instrument and has used it in a novel surgical process to extract a tumor, that was earlier not possible, can he patent both the surgical instrument and the surgical process? Give reasons for your answer.

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Total No. of Pages: 03

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II SEMESTER

M.Tech. [BME]

END SEMESTER EXAMINATION

May/June-2019

PAPER CODE-BT-611

TITLE OF PAPER Principle of image processing in medicine

Time: 3 Hours

Max. Marks: 100

Note: Answer all questions by selecting any **two parts** from each question.
All questions carry equal marks.
Assume suitable missing data, if any.

Q1.a) Explain the structure of the eye along with a diagram. What are the differences between rod and cone vision?

b) What is power law transformation (explain with a graph)? How is it different from log transformations? Explain the significance of gamma correction in brief.

c) A person standing in broad daylight perceives a well-lit room as dark before finally adapting to the brightness. Name and explain this phenomenon with graph/diagrams. How does Weber's ratio correlate with brightness discrimination? Which one out of rod and cone vision has better brightness discrimination?

Q2. a) What is computed tomography (CT)? Explain its principle, device design and advantages over conventional radiography. Enumerate the basic features of the third generation CT configurations.

b) i) Define the terms 'voxel' and 'CT number'. How does windowing help in visualization of region of interest in a CT image? Calculate the CT number of a body structure whose $u_{voxel} = 2u_{water}$ and K is 1000.

ii) Discuss in brief the distinctive features and advantages of spiral CT. What is the significance of slip rings towards the reduction of CT scan time?

c) Why is it that first-generation computed tomography (CT) configurations were considered virtually 'scatter-free'? Discuss any two limitations of third generation CT configurations and methods employed to prevent them.

Q3. a) What is digital subtraction angiography (DSA)? Explain its significance in medical imaging. Discuss in brief the image processing technique utilized in DSA.

b) Explain the working of an image intensifier with the help of a diagram. What would happen if the photocathode is removed from the intensifier without changing anything else in the design? Explain in detail.

c) Define resolution and contrast. Differentiate between grey level resolution and spatial resolution? What is a digital image? Consider the following image matrix:

0	5
0	255

Calculate the contrast of the image described by the matrix.Given the grey level values, how many bits may have been assigned to the image in memory storage?

Q4. a) What is a Fourier transform? What is the significance of Fourier transform in digital image processing? What do you mean by high pass and low pass filters? Enumerate the characteristic features of any two types of employed filters in image processing.

b) Consider the following image matrix (considering an 8-bit/pixel storage):

255	255
255	255

What colour(s) would be visually observed in the image described by this matrix? Describe any two techniques that can be employed to completely invert the colour (brightness/contrast) of this image?

c) A person urgently requires replacement of a stent placed in the coronary arteries. Which radiographic technique can be employed to both visualize the stent placement and guide the surgery for replacement? Explain the technique in detail with advantages and limitations.

Q5.a) What is multi-detector CT (MDCT)? Explain the significance and applications of MDCT in medical imaging.

b) How does radiation interact with living cells and tissue? Why is radiotherapy, employed for the treatment of cancer? What are the side effects/dangers associated with radiation exposure to patient/radiologist? How does the C-arm configuration in fluoroscopy help in reducing radiation exposure to the operator/radiologist?

c) Consider the following image matrix (8-bit/pixel storage):

250	199	224	224	200	255
255	200	199	200	255	250
200	198	224	199	255	224
199	200	255	200	199	224
250	255	200	199	200	199
255	200	198	200	198	255

What is the contrast of the image described by the above matrix? How can frequency (or, probability) of grey level intensities given in the above ma be utilized in enhancing the contrast of the image? Describe the technique can be employed to distribute the grey level intensities *uniformly* acros image described by the above matrix.

Total No. of Pages 02 — 47 — Roll No.....

II SEMESTER M.Tech.-BME

END SEMESTER EXAMINATION May/June–2019

PAPER CODE BT- 6121

TITLE OF PAPER-Biophysical System and Signal Simulations

Time: 3:00 Hours *Max. Marks:100*

Note: Answer all question by selecting any two parts from each question.
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1[a] Give the mathematical and graphical representation of continuous time and discrete time Unit impulse function.

[b] What is a feedback? Explain therole of negative feedbackwith proper block diagram.

[c]Briefly discuss the Hodgkin-Huxley Model. Explain myoelectroactivity.

Q.2[a]Define causal, non-causal and anti-causal systems with appropriate examples.

[b]Explain the different types of noises that effect the signals. How can we eliminate the noise from the signal?

[c] Define the Gabor transform. Write down the steps for performing the short time Fourier transform on a signal x(t).

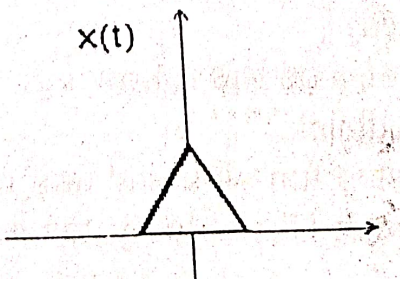
Q.3[a]Let f(x) be a function of period 2π such that $f(x) = x^2$ over the interval $-\pi < x < \pi$.

i) Sketch a graph of f(x) in the interval $-3\pi < x < 3\pi$.

ii) Show that the Fourier series for f(x) in the interval $-\pi < x < \pi$ is

$$\frac{\pi^2}{3} - 4\left[\cos x - \frac{1}{2^2}\cos 2x + \frac{1}{3^2}\cos 3x - \dots\right]$$

[b] Define time scaling. If $x(t \pm t_0)$ is time shifted version of the signal x(t), then draw the negative and positive shift of the signal x(t).



[c] Let f(x) be a function of period 2π such that

$$f(x) = \begin{cases} \pi - x, & 0 < x < \pi \\ 0, & \pi < x < 2\pi \end{cases}$$

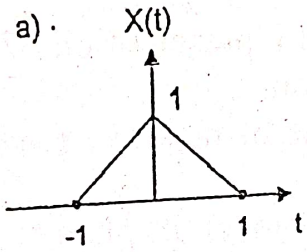
i) Sketch a graph of f(x) in the interval $-2\pi < x < 2\pi$.

ii) Show that the Fourier series for f(x) in the interval $0 < x < 2\pi$ is

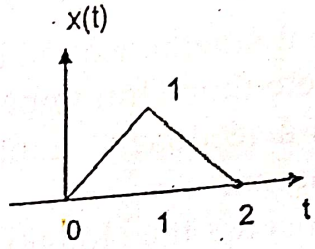
$$\frac{\pi}{4} + \frac{2}{\pi}\left[\cos x + \frac{1}{3^2}\cos 3x + \frac{1}{5^2}\cos 5x + \cdots\right] + \sin x + \frac{1}{2}\sin 2x + \frac{1}{3}\sin 3x + \frac{1}{4}\sin 4x + \cdots$$

Q.4[a]For the given signal determine whether it is even, odd, or neither.

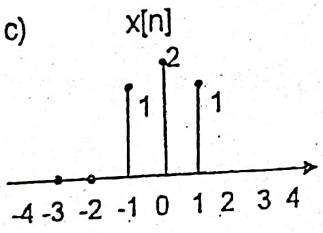
a)



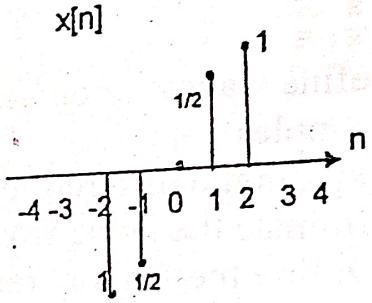
b)



c)



d)



[b] Determine if the signal x[n] given below is periodic. If yes, give its fundamental period. If not, state why it is aperiodic.

$$X[n] = \sin\left(\frac{6\pi}{7}n + 1\right)$$

[c]State the different types of noise distortions occurring in the continuous time signals.

Q.5 [a]What is a wavelet? Briefly explain the properties of Daubechies wavelets.

[b]If a voltage amplifier has an open loop gain (AO) of 300 and a feedback factor (β) of 1/60, what will be the approximate gain with negative feedback applied?

[c] Write short notes on the following:

(i) Biofeedback

(ii) Unit step function and unit ramp function

(iii)Stable & Unstable Systems

Total No. of Pages 2

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END SEMESTER

M.Tech.

IBMEI

END SEMESTER EXAMINATION May-2019

BT-6131 APPLICATION OF GENOMICS IN MEDICINE

Time: 3:00 Hours *Max. Marks: 100*

Note: Answer five questions (1-3 questions are compulsory).
(All questions carry 20 marks).
Assume suitable missing data, if any.

Q.1. Describe the critical steps in DNA-DNA/RNA-RNA interaction assay. Write a detailed protocol for two such assays. How baking and cross-linking (at low wavelength) is the important tool in studying DNA and RNA identification? How would you label DNA and RNA? Why do we need native and denaturing gels to study DNA and RNA?

Q.2. Write notes on
(i) DNase 1 Footprinting assay
(ii) RNA preparation and *in situ* gel estimation
(iii) Yeast two hybridization
(iv) Gene Microarray

Q.3. Write notes on
(i) Comparative genomics
(ii) Magnetofection and electroporation
(iii) Ras/Raf pathway
(iv) RNA preparation
(v) HOT start PCR

Q.4. How glycine and chloride ions are important for protein separation and why it is affected with hydrogen ion concentration? How would we get the protein fragment and its isoforms in one gel? Write the recipe of 10 X-triton lysis buffers. Write a detailed methodology to accomplish protein detection?

Q.5. A patient is suffering from a *cardiac ailment* and required a genetic manipulation. How would you use gene therapy approach to cure this problem? Also, describe the difference between germline and somatic cell gene therapy? Why human gene cloning is unethical?

Q.6. Based on quantum physics theory, how would you establish close proximity between two or many proteins? Describe the role of Fluorescence recovery after photo-bleaching (FRAP).

Q.7. Describe the various transfection techniques and how it is useful to understand gene expression? Why cells do not like lipid mediated gene transfer?

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Total No. of Pages: 01

Roll No. ... .

M. Tech. (*INDUSTRIAL BIOTECHNOLOGY*) *Second Semester*

End Semester Examination *(May-2019)*

Paper: Biopharmaceuticals (BT-621)

Time: 03hours

Max. Marks: 100

NOTE: Attempt any 5 questions
Each Question carries 20 marks.

1. How are secondary metabolites derived from primary metabolites? Explain the biosynthesis and advantages of terpenoids. (20)

2. Explain with the help of flow chart drug design and discovery. Discuss the role of genomics and related technologies in Drug Design and discovery (20)

3. a. List different routes of drug delivery and dosage forms. (10)
   b. What is the significance of quality control of packaging material. (10)

4. a. Define drug metabolism. Describe different phases of drug metabolism (10)
   b. Discuss the factors responsible for Drug Quality assurance (10)

5. a. Discuss the positive impact of recombinant DNA technology on the production of therapeutic proteins. Give two examples. (10)
   b. What is gene therapy. Discuss gene therapy strategy for Cancer treatment. (10)

6. a. What is pharmacokinetics and pharmacodynamics? Name and define the three pharmacokinetic parameters that describe a typical plasma level time curve. (10)
   b) What are patents? Explain patenting process in drug manufacture. (10)

Total No. of Pages 02 Roll No. .....

SECOND SEMESTER M.Tech [IBT]

END SEMESTER EXAMINATION MAY-2019

BT-6221: Bioprocess Engineering

Time: 3:00 Hours Max. Marks: 100

Note: Answer ALL questions.
Assume suitable missing data if any.

Q.1. (a) Define the term del factor. How it is used to calculate thermal death kinetics of a microorganism. (7)

(b) Write the differences between absolute and fibrous air filters. (5)

Q.2 (a) Explain Kreb cycle along with ATP generation involved in respiration. (7)

(b) Production of single-cell protein from hexadecane is described by the following reaction equation:

$$C_{16}H_{34} + a\ O_2 + b\ NH_3 \rightarrow c\ CH_{1.66}O_{0.27}N_{0.20} + d\ CO_2 + e\ H_2O$$

where $CH_{1.66}O_{0.27}N_{0.20}$ represents the biomass. If RQ = 0.43, Determine the stoichiometric coefficients. (5)

Q. 3 (a) Derive the rate equation assuming first order kinetics for immobilized reactor system along with their assumptions. (10)

(b) Define Malthus law. How it is used to calculate the doubling time. (6)

Q. 4 (a) What is turbidostat? Derive an expression for steady state concentration of limiting substrate in continuous flow bioreactor. (12)

(b) A 5 m^3 fermenter is operated continuously with feed substrate concentration 20 kg/m^3. The microorganism cultivated in the reactor has the following characteristics: μ_{max} = 0.45 h^{-1}, K_S = 0.8 kg/m^3. What flow rate is required to achieve 90% substrate conversion. (8)

P.T.O

Q.5 (a) Explain how the temperature, pH, and dissolved oxygen are measured and control in a fermenter. (12)

(b) Discuss the use of computer in control and optimization of fermentation processes. (8)

Q.6 (a) What do you mean by partition coefficient. Discuss the working of counter current liquid liquid extraction. (10)

(b) Why cell disruption is an important step during product recovery. Discuss the various membrane based separation processes involved in downstream processing. (10)

OR

(a) Why airlift reactor is better than bubble column reactor. Discuss the principle and working of microbial biosensors. (10)

(b) In a fermentation process producing baker's yeast, the biomass is separated using a continuous centrifuge, operating at 4000 rpm, with a feed rate of 80 l/min. The solid particles may be assumed to have an average diameter of 0.05 mm. The density of the biomass is 1010 kg/m^3. The fluid may be assumed to have properties of water. Find the sigma factor for the centrifuge. (10)

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Total No. of Pages ___ — 54 —

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SEMESTER: M.Tech

END SEMESTER EXAMINATION *May 2019*

PAPER CODE: BT6231 TITLE OF PAPER: Biosensor

Time: 3:00 Hours *Max. Marks: 100*

Note :
Answer Eight Questions
Question Number Nine is Compulsory
Assume suitable missing data, if any.

1. What is a transducer? What are optical, amperometric, piezoelectric transducers? Describe in details the advantages and disadvantages of optical transducers? **10**
2. What is immobilization? Discuss in details the various methods of immobilization used for binding of enzymes? **10**
3. What is point-of-care diagnostics? Explain the advantages and disadvantages of point-of-care biosensor? Explain with the working of glucowatch? **10**
4. What is a conducting polymer? Give a few examples of some conducting polymers used in biosensors. What are the advantages of conducting polymers towards application in biosensors? **10**
5. What are the properties of a nanomaterial? How can nanomaterial based biosensors be used for food toxins detection?Discuss with examples? **10**
6. Explain the various components of a biosensor. Discuss the working of a glucose biosensor. What are the normal levels of glucose and cholesterol present in a human body? **10**
7. What is a bioprocess? How can biosensors be utilized in bioprocessing? Illustrate with examples. **10**
8. What is a pesticide? How can biosensors be used for pesticides detection? Discuss with examples? **10**
9. Write short notes on any five: **30(5x6)**

   (i)Artificial intelligence in biosensors(ii)Organ-on-a-chip(iii)IoT based biosensors(iv)Biosensors in pharmaceuticals (v) Biosensors for stress management(vi)Calculate 50 mg/dL of cholesterol($C_3H_6O_3$) in mM/L and 5.6 mM of glucose($C_6H_{12}O_6$) in mg/dL

Total No. of Page: 01

Roll No.....

II SEMESTER

M.TECH. [BT]

END SEM EXAMINATION

(MAY'2019)

BT-6512 Computer Graphics

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

Note: **First question is compulsory.** Attempt **any 4 out** of rest.
Assume suitable missing data, if any.

Q1 a) Explain the seed fill algorithms. 4
b) What are the difficulties encountered while implementing painter's algorithm? 4
c) What is supersampling and its purpose? 4
d) What is anti-aliasing? What are the techniques use in anti-aliasing method? 4
e) Explain Reflection and transparency. 4

Q2 a) Explain what are raster scan systems? How does interlacing improve flickering? 7
b) Given input ellipse parameters $r_x = 7$ and $r_y = 5$. Using midpoint ellipse algorithm, plot the raster positions in the first quadrant. 7
c) Explain the various types of parallel and perspective projection. 6

Q3 a) Formulate the matrix for reflection about a line L with slope m and y intercept (0,b). 7
b) Derive the normalization transformation matrix for window to viewport transformation. 7
c) Discuss the properties of Bezier curves and how are they different from B-Spline curves? 6

Q4 a) Compare and contrast between RGB and CMY color in details. 7
b) Find the clipping points for the line whose end points are P_0 (50,60) and P_1 (200,250) with window parameters as: xmin = 70, xmax = 180, ymin = 80, ymax = 240 using cohen sutherland clipping algorithm. 7
c) How do you create shaded objects and draw shadows? Explain. 6

Q5 a) What are the types of curves? Give the mathematical formulation for a Bezier curve with four control points given as A(2,3), B(4,5), C(6,9), D(10,4).
b) Briefly explain different types of fractals with neat diagram? 7
c) What is texture mapping? Give at least two techniques in details of texture mapping. 7

Q6 a) What is scaling factor? Can it be negative and fractional? Discuss the impact of each using mathematical derivation and example. 6
b) Consider a triangle having vertices at A(0,0),B(5,1) and c(3,4) . We need to scale this triangle by scale factors Sx=2 and Sy=1, about the origin followed by a translation of displacements (2,3). Formulate the matrix and show the steps in calculation of the transformed triangle. 7
c) What is the difference between vanishing point and principal vanishing point? 7

Q7 Write short notes on the following: 6
- CRT
- Convex and conclave polygons
- Polygon tables
- Bresenham's line drawing
- Connected components

(4x5)

--END--

Total No. of Pages: 01 *Roll No.....*

IV[th] SEMESTER B.Tech. (Bio Technology)

END SEMESTER EXAMINATION (Old Scheme) May-*2019*

BT-6522 Data Warehousing and Data Mining

Time:3:00 Hours ***Max. Marks: 70***

Note: Answer any five questions, all questions carry equal marks. Assume suitable missing data, if any.

Q.1 [A] What is Data Warehouse? How it is different from database? [5 Marks]

[B] Compare and contrast OLAP and OLTP. [5 Marks]

[C] What is difference between classification and clustering? [4 Marks]

Q.2 [A] Define the term *Data Mining*.Explain the architecture of Data Mining system with diagram. [7 Marks]

[B] Explain the need of Data Transformation. What are the different ways by which data can be transformed? [7 Marks]

Q.3 [A] What is Warehouse Schema? Differentiate between Star Scheme and Snowflake Schema. [7 Marks]

[B] What is clustering? Discuss different types of clustering techniques with example. [7 Marks]

Q.4 [A] List and explain four distance measures to compute the distance between a pair of points and find out the distance between two objects represented by attribute values (1,6,2,5,3) & (3,5,2,6,6) by using any 2 of the distance measures. [7 Marks]

[B] What is metadata and why is it important? Discuss the Multidimensional Data model. [7 Marks]

Q.5 [A] Explain the operations of data-cube with suitable examples [7 Marks]

[B] What is Bayes Theorem? Show how it can be used for classification with suitable example. [7 Marks]

Q. 6 Write short notes on:

i) Text Mining

ii) Outlier Analysis

iii) KDD process

[4+4+6 = 14 Marks]

Total no. of pages. 2 Roll No.....

II SEMESTER M.TECH (BIOMEDICAL ENGINEERING)

END SEMESTER EXAMINATION (May-2019)

BT-6611 TISSUE ENGINEERING AND ARTIFICIAL ORGANS

Time: 3.00 Hours Max. Marks: 100

Note: Part A is compulsory.
Answer any 4 questions out of 6 from Part B where each question carries 20 marks with a) 7.5, b) 7.5, c) 5.
Assume suitable missing data, if any.

PART A

1) **All questions are Compulsory, answer briefly** **(4×5=20)**

a) What is Cardioplegia, what is role of Cardioplegia solution in heart surgery?
b) What is difference between hemodialysis and hemofiltration?
c) Discuss the risk factors associated with natural organ transplant and artificial organ transplant?
d) Discuss in detail how Decellularization and Recellularization is used in artificial organ transplantation.
e) Write down two biomaterials each for the designing of scaffolds of muscles, neurons, adipose and cardiovascular system.

PART B

Attempt any 4 out of the following 6 questions **(20×4=80)**

2) a) What are the ideal properties of scaffolds, support your statement with reference to bone scaffolds.
b) Briefly discuss about bone formation and repair, with suitable examples explain bone tissue engineering.
c) Briefly describe the basic functioning of Bioreactors in tissue engineering. Support your statement in relevance with synthesis of artificial blood vessel.

3) a) What are the methods applied for evaluation of artificial organs

P.T.O

b) Briefly discuss about blood substitutes, what are the current scenario on artificial blood developments.

c) Describe the treatment methods for neuronal damage using tissue engineering and mention what are alternative strategies and biomaterials applied in treating nerve injuries.

4) a) What are the potential sources of heart valve failure, explain?

b) What are the advantages and disadvantages of tissue and mechanical valves.

c) Briefly discuss about the engineering concern and hemodynamic assessment of prosthetic heart valve.

5) a) Discuss about therapeutics options in diabetes, what are the current methods are being applied in development of artificial pancreas.

b) Briefly explain Transcatheter Aortic Valve Implantation (TAVI) process.

c) The patient is a 60 year-old female with a recent history of non-ST-elevation anterior myocardial infarction and congestive heart failure. She has a past medical history of hypertension, diabetes, hyperlipidemia, peripheral vascular disease, stroke and remote myocardial infarction.

i. Diagnose the diseases and what are the medical complications regarding this?

ii. Discuss the remedy.

6) a) Discuss about the engineering design and function of implantable bioartificial kidney.

b) Describe the steps involved in wound healing and repair, briefly discuss on artificial skin implants.

c) Discuss some of the limitations with artificial skin and scope of future research you suggest in development of skin grafts.

7) a) Describe the structure and function of Total Artificial Heart.

b) Briefly discuss the engineering design of total artificial heart and circulatory assist devices.

c) Discuss the difference between functioning of artificial lung and natural lung?

-END-

Total No. of Pages:02 *Roll No. ... .*

Second Semester **M.Tech[BME]**

END SEMESTER EXAMINATION ***(May-2019)***

BT-6622 REHABILITATION ENGINEERING

Time: 03Hours ***Max. Marks: 100***

Note: Answer all questions.
Assume suitable missing data, if any.

1. Briefly discuss ***all*** the following **[4x5]**

   I. Discuss the manufacturing of artificial limbs and which problems may occur during use of these prosthesis?
   II. Explain about the functioning of electronic speech synthesizer.
   III. Component of lower limb prosthesis.
   IV. How do you restore gait problems; explain?
   V. Design a visual prosthesis for a person having retinitis pigmentosa.

2. Write short note on any ***eight*** of following **[5x8]**

   a. Role of Rehabilitation engineering in designing communication aids
   b. Enlist ergonomic consideration in designing wheel chair
   c. Functional Electrical Simulation (FES) system and its applications
   d. Different types of hear losses and their remedy
   e. Ultrasonic canes and their working principle and benefits
   f. Automated speech recognition therapy for hearing impaired
   g. Working and types of intelligent body powered hand prosthesis
   h. What is purpose and characteristic of successful limb prosthesis? Also, define the considerations those are made while choosing prosthesis.

P.T.O.

i. Describe several types of lower extremity orthoses.
j. Mention some examples of devises used in rehabilitation showing involvement of sensors.

3. Describe any *five* of following [8x5]

(A) Describe various steps of Rehabilitation project designing.
(B) Explain auditory substitution devices in detail.
(C) Explain tactual visual system substitution with various techniques
(D) Describe conceptual framework of technology and disability in rehabilitation engineering.
(E) Write down different types of electronic cognitive devices available in market.
(F) Describe brain-Machine interface and its applications.
(G) Explain various engineering concepts involved in sensory rehabilitation

-END-

Total no. of pages. 3 Roll No.....

II SEMESTER M.TECH (INDUSTRIAL BIOTECHNOLOGY)

END SEMESTER EXAMINATION (May-2019)

BT-6711 NANOBIOTECHNOLOGY

Time: 3.00 Hours Max.Marks: 100

Note: Answer all questions in part A, answer any 5 question in part B and answer any 3 questions out of 5 from Part c. Assume suitable missing data, if any.

PART A

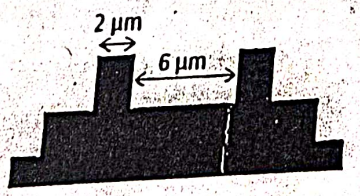
Q1. All questions are Compulsory, answer briefly (3×10=30)

a) Explain nanomaterial based theranostics with suitable example?

b) How does doping with P, B, As and Al affect electrical properties and etch rate of Silicon?

c) List two advantages and two disadvantages of positive and negative photoresist. What are the common applications of each?

d) Outline the technique used and the steps involved in fabricating structure below.



e) What are Radiolabeled Somatostatin analogs, briefly describe its role in cancer treatment.

f) To design nano-drug for fast drug response, improved resident time with low toxicity, what kind of nanomaterials and formulations are used, explain why?

g) Explain the working principle behind electrochemical etch stop method. Why it is better than "time dependent and boron doping" etch stop methods.

P.T.O

h) Briefly describe the each of the following Etch parameters on the Etch profile of the microstructure in RIE chamber.
   i. Plasma
   ii. Pressure
   iii. Gases

i) State the difference between wet and dry etching process. Write down three anisotropic etchants and mention the reaction mechanism of any one?

j) You are using KOH etching to define a 200 mm thru-hole in a <100> wafer. What should the dimensions on your mask be if you are using a: (a) 400 mm thick wafer (b) 600 mm wafer. (tan 54.7^{o}=1.412).

PART B

Q2. Attempt <u>any five</u> of the following questions **(5×5)**

a) Describe the structure and function of ATP synthase.

b) Describe the principles behind the Czochralski method for silicon manufacturing.

c) Explain the principle of biobarcode assay. What are its advantages and significance in current scenario?

d) Describe the term "point-of-care" medical diagnostics; with three suitable examples explain their applications.

e) Suppose you have to prepare a **four inlet microfluidic device for neuronal cell culture**, explain every step you would apply for the preparation of microfluidic device with diagrammatic representations.

f) Elaborate on therapeutic application of carbon nanotubes; why only carbon nanotubes out of tremendous nanocarriers.

g) Briefly describe the principle and instrumentation of any one of following
   i. NMR spectroscopy
   ii. PET (Positron emission tomography)
   iii. Fluorescent microscopy

P.T.O

PART C

Q3. Attempt <u>any three</u> out of the following questions **(15×3= 45)**

a) Briefly describe the various techniques involved in liquid based synthesis of nanomaterial. How can we get 0-D, 1-D, 2-D and 3-D nanostructures using nanosynthesis methods, explain with suitable example.

b) Briefly discuss the role of nanomaterial in cancer diagnostics and treatment, what are its advantages and significance in current scenario?

c) Give two important reasons why lithography is one of the most critical technologies in MEMS? What are the ingredients (tools and materials) of a lithography process? Briefly explain the basic principles behind every step in a lithography sequence.

d) What are drug delivery systems? How are nano drug delivery systems used in current medical practice, briefly discuss about the new technologies being developed by researchers for nano drug delivery?

e) Discuss about the extracellular biosynthesis of metallic nanomaterials using bacterial extracts, In addition explain the pharmacological properties of metallic nanomaterials.

-END-

End Semester Examination – May 2019

II[nd] Semester

M.Tech (IBT)

Paper Code: BT-6721
Paper: Environmental Biotechnology

Max. Marks: 100
Time: 3 Hours

Attempt any five questions. All questions carry equal marks.

Q1. Discuss the following. Attempt any four. **5 X 4 = (20)**

a. UV-B radiation
b. Standards of water quality
c. Gaseous pollutants
d. Vermicomposting
e. E-Waste

Q2. How does the Nitrogen cycle maintain ecological balance in the environment? Explain with the help of suitable diagrams. **(20)**

Q3. What is air pollution? Discuss in detail its sources, effect on ecosystem and control measures. **(20)**

Q4. What are the different sources of water pollution? Explain in detail about primary, secondary and tertiary water treatment. **(20)**

Q5. What is Hydroponic System? Discuss its utility in bioremediation of waste water. **(20)**

Q6. How solid waste is a serious threat to the environment? Write about different steps of solid waste management. **(20)**

Q7. Write short note on any four **5X 4= (20)**

a. CPCB
b. Noise Pollution
c. Recirculating System
d. Eutrophication
e. Food Chain

Total No. of Pages 02 —64— Roll No._____

SECOND SEMESTER M.Tech (Structural Engg.)

END SEMESTER EXAMINATION (May - 2019)

CE601 Structural Dynamics

Time: 3:00 Hours **Maximum Marks: 100**

Note: Answer **ALL** questions. All questions carry equal marks.
Assume suitable missing data, if any.

Q.1 Answer **ALL** parts of the following: **(5 × 4 = 20)**

(a) Explain the different types of Dynamic Excitation with help of suitable examples.

(b) Describe the Equation of Motion. Write the different methods of solution for it.

(c) Prove that for the steady state motion of a SDOF system due to harmonic motion, the energy dissipated by viscous damping is equal to the input energy per cycle of vibration.

(d) What are two types of problem dealt through Vibration Isolation? Derive an expression for Force Transmissibility.

(e) Show that the resonant frequency for displacement amplitude of an SDOF system is given by:

$$\omega_r = \omega_n\sqrt{(1-2\xi^2)}$$

Q.2 Answer any **TWO** parts of the following: **(2 x 10 = 20)**

(a) Derive the expression for response of a undamped free vibration of a SDOF system using exponential form.

(b) An empty elevated water tank is pulled by a steel cable by applying a 30 kN force. The tank is pulled horizontally by 5 cm. The cable is suddenly cut and the resulting free vibration is recorded. At the end of five complete cycles, the time is 0.2 sec. and amplitude is 2 cm. determine the damping ratio, natural period of undamped vibration, effective stiffness, effective weight, and damping coefficient for the given data.

(c) A vertical single cylinder diesel engine of 500 kg mass is mounted on springs with k = 200 kN/m and dampers with ξ = 0.2. The rotating parts are well balanced. The mass of the equivalent reciprocating parts is 10 kg and the stroke is 200 mm. Determine the dynamic amplitude of the vertical motion, the transmissibility and the force transmitted to the foundation, if engine is operated at 200 rpm.

Q.3 Answer any **TWO** parts of the following: **(2 x 10 = 20)**

(a) Derive an expression for dynamic magnification factor for an undamped SDOF system subjected to harmonic loading , $F(t) = F_o\sin(\omega t)$.

Contd.....2

(b) Determine the magnification factor of forced vibration produced by an oscillator fixed at the middle of the beam at a speed of 600 rpm. The weight placed at the middle of the beam is 5000 N and produces a static deflection of the beam equal to 0.025 cm. Neglect the weight of beam and assume that the damping is equivalent to a force acting at the middle of the beam proportional to the velocity and equal to 500 N at a velocity of 2.5 cm/s.

(c) What is Equivalent Viscous Damping? Show that the energy dissipated per cycle for viscous damping can be expressed by:

$$E_D = \frac{\pi F_o^2}{k} \cdot \frac{2\xi(\omega/\omega_n)}{[1-(\omega/\omega_n)^2]^2 + [2\xi(\omega/\omega_n)]^2}$$

Q.4 Answer any **TWO** parts of the following: **(2 x 10 = 20)**

(a) Describe the response of a Rectangular impulse loading with help of neat diagrams.

(b) A portable eccentric mass shaker is used to evaluate the in situ dynamic properties of a structure, using two different frequencies and measuring the displacement amplitudes as well as the phase angles. A test was carried out on a single story building and the following responses were recorded:

(1) $\omega_1 = 18.3$ rad/s, $Fo_1 = 837$ kN, $X_1 = 0.139 \times 10^{-3}$ m, $\Theta_1 = 8^0$

(2) $\omega_2 = 60.99$ rad/s, $Fo_2 = 9300$ kN, $X_2 = 0.332 \times 10^{-3}$ m, $\Theta_2 = 174.29^0$

Determine the natural frequency and damping ratio for the structure.

(c) Determine the response of a system shown in Fig.1 to a periodic loading shown in Fig.2 .

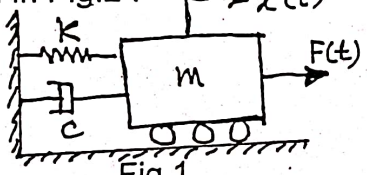


Fig.1

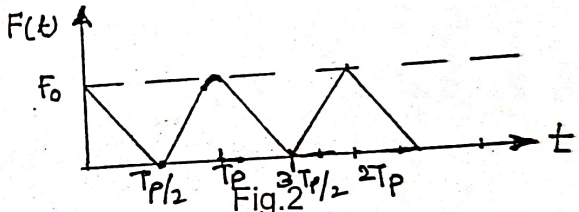


Fig.2

Q.5 Answer any **TWO** parts of the following: **(2 x 10 = 20)**

(a) Determine the natural frequencies and mode shapes for the shear frame shown in Fig. 3 . Take EI = 5×10^6 Nm^2, M = 500 kNs^2/m, span = 5 m.

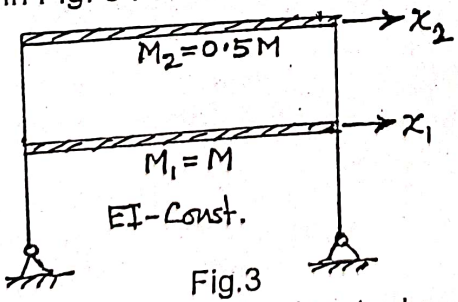


Fig.3

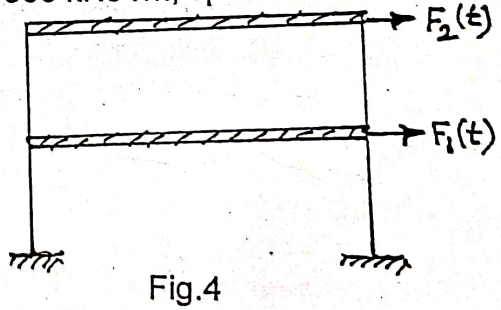


Fig.4

(b) Determine the response due to harmonic excitation for the shear frame shown in Fig. 4 . Take EI = 24×10^6 Nm^2, M = 500 kNs^2/m, $F_1(t) = 0$, $F_2(t) =$ (10000 sin30t) kN, storey height = 3 m.

(c) Write the equation of motion for the MDOF system shown in Fig.5. Also determine the natural frequencies and mode shapes for the system.

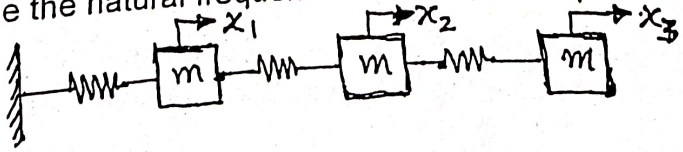


Fig.5

Total No. of Pages:02 Roll No.....

SECOND SEMESTER **M.Tech. [STE] CIVIL ENGG**

END SEMESTER EXAMINATION ***May/June-2019***

CE-6021 : Material Science &Technology

Time: 3:00 Hours ***Max. Marks : 100***

Note : Answer all question by Selecting any two parts from each questions.
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1 [a] What are the raw materials for the manufacture of cement? Mention the function in the properties of cement.

[b]How do accelerators affects the concrete in which they are added? What are their side effects?

[c]Why do superplasticizers perform better than surface-active agents? (10x2=20)

Q.2[a] Distinguish between segregation and bleeding of concrete.

[b] Explain the chemistry as to why gypsum is added during the manufacture of cement. Why must the content of gypsum in the cement be strictly regulated? Does ettringite play any role?

[c] What is non-destructive testing of concrete? Discuss any two methods. (10x2=20)

Q.3[a] How is concrete placed under water?

[b] Write short notes on (i) S-N curve (ii) Miner's rule

[c] Discuss the effects of adding fly ash, silica fume and GGBFS in concrete. (10x2=20)

Q.4[a] Explain the method of finding the flexural and split tensile strength for concrete.

[b] What are the causes of thermal cracking in concrete walls?

[c] How does creep manifest itself if concrete specimen is subjected to a constant load. (10x2=20)

Q.5[a] Explain in detail about the Indian standard recommended method of concrete mix design (IS 10262:2009).

[b] What are the advantages and disadvantages of steam curing?

[c] What are micro-cracks? Explain why they are caused and how do they lead to the ultimate failure? (10x2=20)

Total No. of Pages 1

Roll No. .....

SECOND SEMESTER

M.Tech. (Str. Engineering)

END SEMESTER EXAMINATION

MAY - 2019

CE-6032 DESIGN OF TALL BUILDINGS

Time: 3:00 Hrs.

Max. Marks: 100

Note :

- Answer **any five** questions.
- Assume suitable missing data, if any.

1. Write notes on the following:
   (i) Creep and shrinkage effects,
   (ii) Effect of foundation rotation,
   (iii) Live load reduction and
   (iv) Importance of structural form. (4 X 5 = 20)

2. Explain in detail various design philosophies, which are available for the design of tall buildings. (20)

3. Analyse a continuous given beam using Two Cycle Moment Distribution method, which consists of three spans of 8.0 m, 7.8m and 7.0m respectively from left to right. It is fixed at extreme ends and its dead load is 25 kN/m on all spans along with concentrated load of 250 kN on midspan of left span and 200 kN concentrated loads at middle third location of second span from left. The beam is also subjected to live load of 30kN/m, 25kN/m and 35 kN/m on the spans from left to right. Additionally, the beam is subjected to concentrated live loads of 400 kN at mid span of left span and 300 kN each at middle third location of second span from left. (20)

4. Explain the importance of Symmetry and Anti-symmetry in the analysis of tall buildings. Also explain the end conditions of cut members (i.e. beam) for their six degrees of freedoms when you are taking benefits of symmetry and anti-symmetry. (20)

5. A 15-storey double-diagonally braced frame consists of three 5-storey regions. It is required to determine drift at floors 5, 10 and 15 (i.e., where floor n is at the top of storey n) for a uniform wind load of 6.5 kN per storey. Assume elastic modulus of 200 kN/m^2. Storey height is 3m and distance between columns is 6m.Cross-section areas of members in various regions are given below:

	Top region	Middle region	Bottom region
Area of columns (cm^2)	64.5	129	225.8
Area of diagonals (cm^2)	32	32	64.5
Area of girders (.cm^2)	193.5	193.5	193.5

6. Explain the procedure in detail, which you will adopt in the direct P-Δ analysis. (20)

Total No. of Pages 01
IInd SEMESTER

Roll No. .....
M.Tech.

END SEMESTER EXAMINATION

MAY –JUNE -2019

CE-611 WASTE WATER TREATMENT DESIGN

Time: 3:00 Hours

Max. Marks: 100

Note : Attempt any five questions
All questions carry equal marks.
Assume suitable data required, if any.

Q1. What are various characteristics of waste water which are required for design of waste water treatment. Also discuss quality of sewage generated and per capita contributions to the pollution in different Indian cities. Also discuss the self purification, deoxygenation and reaeration of polluted streams.

Q2 (a) What are primary treatment of sewage .Discuss various types and design criteria for screens in detail.

(b) Design a grit chamber having a proportional weir as the velocity control devices for STP having maximum flow of 15 MLD.

Q.3 Discuss settling velocity analysis and design criteria for primary settling tanks. Design a primary settling tank for city STP having population of 15 lacs. Assume desired BOD removal in primary settling tank as 32%

Q.4 Discuss low cost treatment of waste water. Also discuss working and design criteria of oxidation ponds. Design an oxidation pond to treat sewage of a town having population 5 lacs in Uttar Pradesh.

Q.5 What are the principal of biological treatment. Explain process design consideration of activated sludge process. Design an Activated Sludge plant for a town having population 5 lacs.

Q.6 Write short notes on any five

(a) MBBR
(b) MBR
(c) UASBR
(d) SBR
(e) Oxidation ditches
(f) Sludge digestion

Total no. of pages: 02 — 70 —

SECOND SEMESTER

END SEMESTER EXAMINATION

CE-6122 INSTRUMENTATION

Roll No.....

M. Tech. [ENV]

MAY- 2019

Time: 3:00 Hours

Max. Marks: 100

Note: Question 1. Is compulsory.
Answer any four question from the rest.
Assume suitable missing data if any.

Q1. (i) Write down the characteristics of kathatometers. 7

(ii) How U tube manometer can be modified to increase the sensitivity and accuracy. 6

(iii) Write in brief the method used to measure the level of the molten metal. 7

Q2. a) Differentiate between classical method and Instrumental method. 6

b) With suitable example and neat block diagram discuss the basic component of an Instrument. 14

Q3. Draw neat Diagram Explain the principle working, application, advantages and disadvantages of the following. **(Any two)** 2x10=20

i. NDIR
ii. Chemiluminesenee Method.
iii. Radio Analytical Method.

Q4. a) Classify flow measurement methods. What do you mean by flow visualization and how it is done? 8

b) A 30 cm x 15 cm ventrimeter is used to measure the flow of water in a pipeline. A U tube mercury manometer is connected at the entrance and throat, shows a deflection of 25cm. Find the rate of flow of Water. Take the co-officient of discharge of venthri C_d =0.97. 6

c) A radiation pyrometer measured the temperature of a hot piece of metal on 727^0 C assuming a surface emissivity of 0.82, Later it was found that the accurate value of emissivity for 0.76. Find the error in the temperature determination. 6

Q 5. a) Define the term chromatography. Enumerate different types of Chromatographic analysis. 6

b) Write down the principle, application and limitation of the following chromatographic detector. 7x2=14

i. FID
ii. ECD

Q 6. Write Explanatory notes on: **(Any Two)** 10x2=20

i. Ring oven Technique.
ii. Flue gas analyser.
iii. Spectrophotometer.

Q7. Write short notes on **(Any Four)** 5x4=20

i. Electroanalytical Analysis.
ii. Volumetric Analysis.
iii. Atomic absorption spectrophotometer.
iv. Flame Photo Meter.
v. N.M.R.
vi. Flourimeter.

-End-

Total no. of Pages 02 Roll no.....

SECOND SEMESTER M.Tech.(Env. Engg.)

END SEMESTER EXAMINATION May 2019

CE-6132 INDUSTRIAL WASTEWATER TREATMENT

Time : 3 Hours Max. Marks : 100

Note: Attempt any five questions. All questions carry equal marks. Draw neat labelled diagrams wherever necessary. Assume suitable missing data if any.

Q.1(a) Explain the necessity of equalization and proportioning for industrial wastewater Treatment.

Q.1(b) What is the necessity of Neutralization in Industrial waste treatment? Explain citing suitable examples?

Q.2(a) Why are solvents, grease, cyanide, phenol and sulphates considered undesirable for discharge into public sewers?

Q.2(b) What are the various polluting effluents generated by integrated steel plants?

Q.3(a) Discuss the characteristics of petrochemical Industrial wastewater.

Q.3(b) Draw the neat process flow sheet, highlight the origin and characteristics of wastewater generated in typical tannery industry.

Q.4(a) Write the different ways involved in Strength Reduction of Industrial wastewater

Q.4(b) On what factors the selection of particular process for treating the effluent of Industrial Waste Water depends? Write three alternatives for the disposal of the industrial wastes.

Q.5(a) How Oils and grease are removed in Industrial in Industrial effluent?

Q.5(b) Draw the neat process flow sheet, highlight the origin and characterization of wastewater generated in pulp and paper mill.

Q.6(a) Write a short note on Recovery of potash from distillery waste

Q.6(b) Discuss the processes, sources of wastewater generation in a Pharmaceutical Industry

Q.7(a) Discuss the processes, sources of wastewater generation in a Distillery Industry

Q.7(b) Explain the treatment options for Distillery wastewater in India.

Total No. of Pages 2 Roll No.....

Second Semester **M. Tech. [Civil Geo tech]**

End Semester Examination **May 2019**

Paper Code-CE 6222

Plasticity & Fracture Mechanics in Rock Structures

Time: 3.00 Hours Max. Marks: 100

Note: Question one is compulsory. Answer any two out of the rest. Use SI Units. All Parts of a question must be answered at a one place in a sequence
Assume suitable design data if missing.

1. a) What are failure theories from the considerations of three-dimensional stress analysis, stress invariants with respect to estimating in situ deformation of rock masses using a hardening parameter?

   b) Differentiate yield criteria namely Von Mises, Drucker-Prager, MC, Original and Generalized HB criteria.

   c) Obtain a relation for isotropic, kinematic and hardening in relation to softening normality principle, plastic flow rule, and plastic potential.

   d) What plastic stress-strain relations are path dependent behavior?

   e) If σ_1=300 kPa, σ_2=100 kPa, σ_3=100 kPa, find out the invariants of stress and strain, ε_1=3%, ε_2=1%, ε_3=1%, state if material is elastic in this range of stresses? (8x5=40)

2. a) Derive constitutive equations for linear elastic-plastic stress fields in rocks for Mode-I Mode-II and Mode-III cracks and tabulate the results.

   b) Consider a central crack of length 2a in an infinite plate subjected to uniaxial stress σ at infinity perpendicular to the crack plane. According to the Irwin model, the effective crack is larger than the actual crack by the length of plastic zone. Show that the stress intensity factor corresponding to the effective crack, called effective stress intensity factor K_{eff}, for conditions of plane stress and plane strain is given by a standard equation.

   c) A large plate of steel contains a crack of length 50 mm and is subjected to a stress σ = 800 MPa normal to the crack plane. Plot the σ_y, stress distribution directly ahead of the crack according to the Griffith model c) Irwin model. The yield stress of the material is 4600 MPa. (10x3=30)

3 a) What is application of plastic and damage theories from the considerations of three-dimensional stress analysis, stress invariants with respect to computing in-situ strength of rock masses
b) based upon RQD using pressure and damage sensitive constitutive relationship?

c) How the relationship of volumetric crack size with material strength has evolved? How the joint factor is related to the applied loads? (10x3=30)

4 a) What is the concept of damage theories in rock mechanics and with reference to hardening and softening parameters?

b) A large plate of steel contains a crack of length 30 mm and is subjected to a stress σ = 600 MPa normal to the crack plane. Plot the σ_y, stress distribution directly ahead of the crack according to the elastic as well elastic-plastic model. The yield stress of the material is 8000 MPa.

c) c) The stress components in a part of a structure have been calculated to σ_x= 100 MPa, σ_y= 80 MPa, and τ_{xy}= 40 MPa (all other stress components are zero). For this structure a safety factors = 1.5 with respect to yielding is required. What yield strength σ_y should the material have to fulfil this condition? Investigate both the Tresca and the von Mises yield criteria.

(10x3=30)

5 Write shot notes on

a) Intrinsic joint characteristics: joint number, joint factor and RQD

b) Joint strains, volume changes and yield function

c) Softening parameters and joint stiffness

(10x3=30)

7)

a) Delineate the factors to be included in development of a typical index for the ground water and suggest an index for ground water to be used as a source of irrigation water or potable water. Calculate the same for the data mentioned in question number 6 (a), above.

b) Explain Toxicity test for ground water. (15+5)

8)

a) What are linear stochastic models and explain their utility in ground water level modelling. Why these models are considered as data driven models ? Explain the various steps involved in development and validation of typical seasonal ARIMA model

b) Write the equation of ARMA(2,1) model , given $\phi_1 = .76$, $\phi_2 = .13$, $\Theta_1 = .27$ (12+8)

END

Total No. of Pages 04 *Roll No.....*

SECOND SEMESTER M.Tech.

END SEMESTER EXAM May-2019

CE-6233 GROUND WATER and SEEPAGE

Maximum Marks : 100 Time: 3:00 hours

Note: Attempt 5 questions. Attempt at least 2 questions from each section.
All questions carry equal marks
Make necessary assumptions wherever required and clearly state them.

Section A

1)

a) Write an explanatory note on 'Boundary condition of Groundwater Flow through sloping seepage face'.

b) In a homogeneous isotropic confined aquifer of constant thickness of 20 m, effective porosity of 20% and permeability of 15 m/day; two observation wells 1200 m apart indicate peizometric heads of 5.4 m and 3.0 m, respectively, above m.s.l. Assuming uniform flow, average grain diameter of sand 1 mm and kinematic viscosity of water = 0.01 cm^2 /sec, find out

i) Whether Darcy's law is applicable?

ii) What is the average flow velocity in pores? (6+14)

2)

a) Rainfall at the rate of 12 mm/hr falls on a strip of land 1200 m wide lying between two parallel canals. It is underlain by a horizontal impervious stratum. The depth of water above this stratum in the two canals are 10 m and 8 m. Assuming a permeability of 10 m/day with vertical boundaries, and all the rainfall infilters into the soil, compute the discharge per meter length into both the canals.

Determine the equation to the pheratic surface. If there is no rainfall, what would be the seepage to the lower canal ?

b) Three tube wells 20 cm diameter are located at the vertices of an equilateral triangle of side 120m and penetrate fully in a confined aquifer of 12 m thickness. Calculate the discharge when only one well is discharging under a

depression head of 3 m. What will be the percentage decrease in the discharge of this well, if both the other wells are discharging under the depression head of 3 m. Assume the radius of the circle of influence for each well as 200 m and permeability of the aquifer 40 m/day. (10+10)

3)

a) A Pump test was conducted on a leaky artesian aquifer 30 m thick situated on an impervious base and overlain by a semi confining layer 10 m thick. The well was pumped at a constant rate of 1800 lpm. The steady state drawdowns in the observation wells are given below. Determine the aquifer constants.

Distance of observation Well from the pumped well (m)	10	20	60	100	300
Drawdown (m)	0.66	0.55	0.35	0.26	0.07

b) A production well fully penetrating a water table aquifer is pumped at a constant rate of 100 m^3/hr for a period of 200 days. The observed drawdown in fully penetrating observation wells at the end of pumping period are given below. Compute the coefficients of storage and transmissibility of the aquifer.

Distance of observation			
Well from production well, m	2	20	20
Drawdown, m	2.75	1.80	0.90

(10+10)

4)

a) A Pump has to be installed to lift water from a shallow well to irrigate 2.4 hectares of paddy. The level of the field to be irrigated varies from RL + 34.00 m to + 37.00 m and the field is 360 m away from the well. The lowest water level in the well during pumping may be taken as RL+ 20.00 m. Assuming an overall efficiency of 60% determine the horsepower of the pump set required,

b) Size of suction and delivery pipe, and the monthly electricity bills for running the pump for 12 hours a day, on an average. The rate per unit of electric power (kWhr) may be taken as Rs. 3.0.

c) Write a note on Characteristics curves for centrifuged pump.

d) Write an explanatory note on analysis of seepage under Hydraulic Structures using slide program. (10+5+5)

Section B

5)

a) **Write short notes an any three of the following**

i) Renny walls

ii) Selection of pump set

iii) Explain and relate porosity and specific retention.

iv)'Slope instability from ground-water seepage.

b) Write an explanatory note on 'Assessment of artificial groundwater recharge potential through estimation of permeability values from infiltration and aquifer tests in unconsolidated alluvial formations in coastal areas'. (12+8)

6)

a) The chemical analysis of a water sample, obtained from medium depth borewell at a distance of 1 km from the sea shore, is given below. Report the results qualitatively, i.e. Total Hardness, Non-carbonate hardness, TDS, SAR, Residual carbonate (RC), and permeability index.

Constituents	Ca	Mg	Na	HCO_3	CO_3	SO_4	Cl
mg/l	56	16	85	256	24	43	82

b) Write an explanatory note on 'Hydraulic conductivity behavior of soil blended with geofiber inclusions'. (14+6)

Total No. of Pages 3 Roll No. .....

M Tech (Hydraulics & Water Resources Engineering) II SEMESTER

END SEMESTER EXAMINATION May-2019

CE- 631 PLANNING & MANAGEMENT OF WATER RESOURCES

Time: 3 Hours Max. Marks : 100

Note : Answer any FIVE questions.
Assume suitable missing data, if any.

1 [a] Explain the terms: curse of dimensionality, planning horizon and analysis of different un-certainties in water resources. 5

[b] Enlist different discounting techniques used for economical analysis of projects. How do you select a suitable discounting rate technique for a given water resources problem? 5

[c] Two options of laying tunnels for a hydroelectric project are to be compared.

(1) Tunnel of full capacity with cost of Rs 30 millions, life 20 years, lining and repair cost Rs 1 millions, at an interval of 10 years.

(2) Tunnel of half capacity initially and other half capacity after 10 years costing Rs 20 millions each, life 20 years, lining and repair cost Rs 0.8 millions, at an interval of 10 years.

Take rate of interest 12% compounding annually. 10

2 [a] Write a brief note on probable physical, economical and environmental effects to be kept in mind while planning for water resources project. 5

[b] Write a brief note on real time reservoir operation for irrigation 5

[c] A water resources project has benefits that equal Rs 20 million at the end of first year and increase on a uniform gradient series to Rs 100 million at the of fifth year. The benefits remain constant at Rs 100 million each year until the end of the year 30, after which they decrease to zero on a uniform gradient series at the end of year 40. Calculate the present worth of these benefits using 10 percent interest rate. 10

3 [a] How do you calculate annual losses caused due to flood of given magnitude in the flood plain of a river valley? 5

[b] Justify the use of Dynamic Programming to optimise cost of flood control in a flood plain of a river on which it is planned to construct one reservoir on the river and another on its tributary for the purpose along with channel improvement as the third option. 5

[c] Suggest most economical storage capacity for a dual purpose storage reservoir. Relevant details required for the analysis are as below: 10

Active storage In 10000 ha-m	Annual cost Rs in millions	Yield for Irrig. In 10000 ha-m/year	Flood control benefits Rs in millions/year
1	11	1.0	10.5
2	15	1.45	21
3	19	1.65	27
4	25	1.75	30
5	35	1.79	31.5

Irrig. Demand In 10000 ha-m/year	0.1	0.3	0.5	0.7	0.9	1.1	1.3
Irrig. Benefits Rs in hundred/ ha-m	29	22	18	15	13	10	5

4 [a] Write a brief note on Fuzzification of inputs and defuzzification 5

[b] write a brief note on applications of remote sensing and GIS in water resources economics. 5

[c] A river has total available resources of 900 units. The river basin has one reservoir and two more are contemplated. A minimum of 200 units are allocated to existing reservoir. Determine optimal allocation to the three reservoirs with following net benefits (in Million Rs) for 700 units of supply from different reservoirs. 10

Supply (units)	100	200	300	400	500	600	700	800	900
Net benefits for									
Reservoir 1	150	350	500	620	800	850	870	890	900
Reservoir 2	200	400	550	750	890	1000	1050	1090	
Reservoir 3	230	480	600	720	830	940	1000		

5 [a] Explain the role of Simulation techniques applicable to solve the problems relating to different objectives like flood management, drought management and reservoir operation rules a river valley. How do these techniques differ for the different objectives? 5

[b] Write brief notes on Saddle point, Pay off matrix, Game theory with mixed strategies, Artificial neural network and Break even (point) analysis. 5

Table: 1

t=1			t=2		
K	i	l*	k	i	l*
1	1	1	1	1	1
1	2	2	1	2	1
2	1	2	2	1	1
2	2	2	2	2	2

Table: 2

t=1	t=2 j		
	i	1	2
	1	0.5	0.5
	2	0.4	0.6

t=2	j		
	1	2	
1	0.4		0.6
2	0.8		0.2

Write the steady state probabilities of release from the reservoir under consideration, i.e. the values of PR corresponding to t=1. 10

6[a] Find the deterministic equivalent of the statement $P[A_{11}x_1+x_2 \leq 5] \geq 0.8$ of a Chance constrained Linear Programming problem, where P stands for probability. The coefficient A_{11} is uncertain and follows a normal distribution with mean of 3 units and standard deviation of 0.5 units. Take the area under normal curve at normal variate of 0.84 as 0.8. 5

[b] write a brief note on one advanced topic you studied in this course and has not been asked in question paper. 5

[c] Following table gives availability of water at points 1,2& 3 and requirement of water at destinations A,B,C&D along with the cost (as elements in table) of shipping one unit of water from given supply to given point .Solve the problem for optimal solution. 10

	Destination				Availability
Source	A	B	C	D	
1	8	6	9	8	35
2	9	11	13	7	50
3	14	10	15	6	40
Requirements	45	20	30	30	

END

Total No. of Pages = 1 Roll No.....

SECOND SEMESTER M. Tech. (Hydraulics and Water Resources Engineering)

END SEMESTER EXAMINATION [May 2019]

Paper code-CE-6321 Ground Water Hydrology

Time: 3.00 Hours Max. Marks: 100

Note: Answer any TEN questions.
Assume suitable missing data, if any .

1. Explain the various ground water modelling techniques with neat sketches. 10
2. Describe the surface investigation of ground water techniques. 10
3. Describe the sub-surface investigation of ground water techniques. 10
4. Explain the various artificial recharge method of ground water 10
5. A well of diameter 30 cm fully penetrates a confined aquifer of thickness 15 m. When pumped at a steady rate of 30 l.p.s., the drawdowns observed in the wells at radial distances of 10 m and 40 m, are 1.5 and 1.0 m respectively. Compute the radius of influence, the permeability, the transmissibility and the drawdown at the well. 10
6. Derive Dupuit-Thiem's equation for yield of a well penetrating an unconfined aquifer. What are the assumptions of the theory? 10
7. Derive the expression for the yield of a well penetrating a confined aquifer. 10
8. A 0.4 m diameter well fully penetrates an unconfined aquifer whose bottom is 80 m below the ground water table. When pumped at a steady rate of 1.5 m^3/minute, the drawdown observed in two observations wells at radial distances of 5 m and 15 m are respectively, 4 m and 2 m. Determine the drawdown in the well. 10
9. What is Darcy's law? What are its limitations? How will you measure the coefficient of permeability of a soil? 10
10. Describe the various method of computation of T and S with neat diagrams. 10
11. Determine the discharge from a strainer well of 20 cm diameter working under a depression head of 6 m. the well taps only one confined aquifer whose thickness is 20 m. take the coefficient of permeability as 3×10^{-4} m/s and radius of influence as 300 m. 10
12. A field test for the permeability consists in observing the time required for a tracer to travel between two observation wells. A tracer was found to take 10 h to travel between two wells 50 m apart when the difference in the water-surface elevation in them was 0.5 m. the mean particle size of aquifer was 2 mm and the porosity of the medium 0.3. if v= 0.01 cm2/s estimate a) the coefficient of permeability and intrinsic permeability of the aquifer , and b) the Reynolds number of the flow. 10

Total No. of Pages 2 — 81 — Roll No.....

II SEMESTER M.Tech.[HYD]

END SEMESTER EXAMINATION May/June-2019

CE-6332 ADVANCED IRRIGATION AND DRAINAGE ENGG

Time: 3:00 Hours Max. Marks: 100

Note : Answer all question by Selecting any two parts from each Questions.
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1[a] Write short note on the development of irrigation in India after independence?

[b] What is the scope of irrigation in India? Discuss clearly

[c] Explain the role of National Water Development Agency (NWDA). Briefly write a note on any ongoing project?

Q.2[a] Explain in detail soil water constants ?

[b] A moist soil sample collected from agricultural field weighs 120 g. When it is dried the soil weighs 100 g. density of soil is 2.4 g/cm^3. Calculate the gravimetric moisture content and volumetric moisture content of the soil sample. Depth of water present in soil as the depth of soil is 75 cm.

[c] Write a detailed note on Soil Moisture Measurement Methods with neat sketches.

Q.3[a] What is meant by 'Duty' ? Enumerate the different terms by which duty can be improved. What are the factors affecting duty? The base period of paddy is 120 days. If the duty for this crop is 900 hectares per cumec. Find the value of delta

[b] Define the following

(i) Field irrigation requirement
(ii) Water application efficiency
(iii) water storage efficiency
(iv) water distribution efficiency
(v) Consumptive use

[c] For the data given in table and taking kor depth and kor period for wheat as 13.5 cm and 4 weeks respectively and for rice as 19.0 cm and 2.5 weeks respectively, compute the average discharge requirement and peak demand?

Crop	Area under crop (hectare)	Total depths (cm)	Base period (day)	Average duty (ha/cumec)
Wheat	5000	37.50	140.0	3225.60
Rice	2500	120.00	120.0	864.00

Q.4[a] Design a channel to carry discharge of 8 m^3/sec through 0.5 mm sand using Lacey's Theory ?

[b] For a border strip method of irrigation, determine the time required to irrigate a strip of land of 0.04 hectares in area from a tube well with a discharge of 0.02 cumec. The infiltration capacity of the soil may be taken as 5 cm/hr and the average depth of flow on the field as 10 cm. Also determine the maximum area that can be irrigated from this tube well?

[c] What do you understand by surface irrigation? explain in details their different types?

Q.5[a] What is meant by water logging? What are the ill effects? Describe some anti water logging measures with suitable sketches?

[b] Give the various steps involved in the design of land drainage?

[c] What do you understood by salinity and alkinity of soil? Discuss briefly how the problems of salinity and alkinity arise from the various sources

Total No. of pages 04
IInd SEMESTER

Roll No. _____
M.Tech. [Civil Engg.][Structural Engg.]
Code Branch/ Group

END SEMESTER EXAMINATION (May 2019)

CE6512
Paper Code

Prestressed Concrete Design

Title of the Subject

Time: 3 Hours

Max. Marks: 100

Note: Answer all questions. Assume suitable missing data if any. Use of IS 1343:2012 and IS 456:2000 and CEB-FIP/ACI code, PCI design manual data as given in page 4 is permitted. Assume suitable missing data if any. Draw Reinforcement detailing if required.

Q.1 Attempt any three of the following: [3 × 04 = 12]

(a) Explain transmission of pre-stress in pre-tensioned beam
(b) Explain different stage strain variation in composite construction
(c) Explain draping or harping of pre-tensioned member
(d) Explain bursting failure in anchorage zone in post tensioning
(e) Draw the curvature diagram due to prestressing for the determinate frame shown in figure Q.1 (e) below for the given straight tendon profile. (Roller support at D).

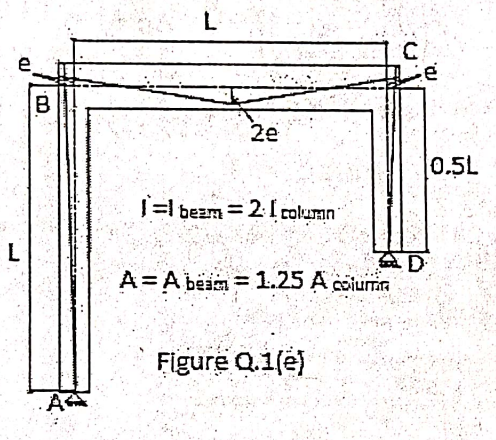


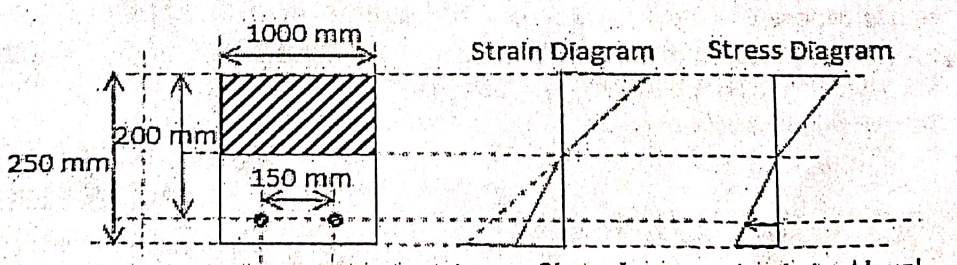
Figure Q.1(e)

Q.2 Attempt any four of the following: [4 × 05 = 20]

(a) Comment on moment redistribution at service state and at limit state as per IS 1343: 2012
(b) Explain the limit state of flexural collapse based on IS 1343:2012
(c) Explain the prestressing equipment based on IS1343:2012
(d) Explain the requirements for durability of concrete as per IS 1343:2012
(e) Explain the design model for combined shear and torsion as per IS 1343: 2012

Q.3 Attempt any two of the following: [2 × 10 = 20]

(a) Determine the crack width as long-term response, at the soffit level for the slab section shown in figure Q.3(a) below at the nearest a_{cr} point. Follow the provisions of IS 456: 2000. Detailed data are given in the figure.



Fe 415-20 #-150c/c
f_{ck} = 40 M Pa
E_s = 200,000 M Pa
CC_{min} = 40 mm

Stress in concrete at steel level
0.55 M Pa for long term response

Figure Q.3(a)

(b) The precast pretensioned single Tee beam section is as shown in figure Q.3(b) below. It has concrete strength at transfer as 24.1 MPa and 28 days strength of 34.5 MPa. It has span of 24.4 m. After installation of the beam a 50 mm thick topping is added after 50 days. The topping concrete has 28 days strength of 20.7 MPa. Mid span moment is 644 kNm due to self-weight of precast tee = 644 kNm, M_o and N_o are 784 kNm and 2880 kN respectively. Signature strain is 0.0069. Take $\emptyset(57,7) = 0.96$; $\epsilon_{sh} = -0.23 \times 10^{-3}$; $E_{peff} = 197000MPa$; $E_p = 200000\ MPa$. Take $A_{gross} = 37.2 \times 10^4 mm^2$; $I_{gross} = 28.72 \times 10^9 mm^4$; $A_p = 1379\ mm^2$; $y_{BG} = 662.12\ mm$

(i) Determine the stresses and strains just prior to placing of topping.

(ii) Determine the additional stresses and strains caused by the self-weight of the topping just after the fresh concrete topping is done.

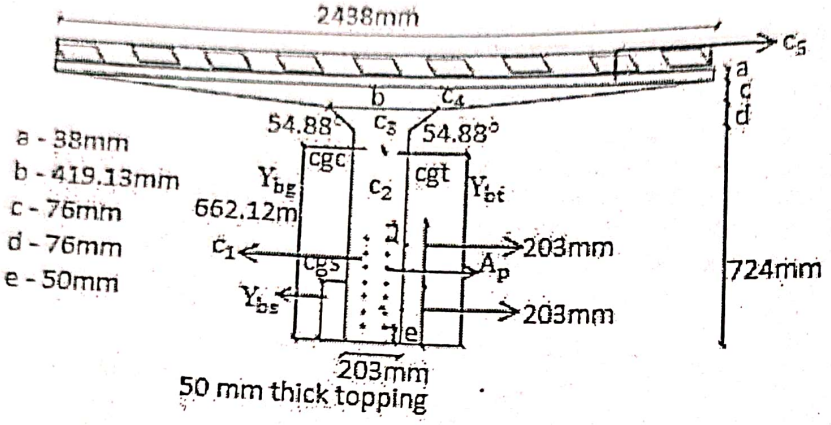


Figure Q.3(b)

(c) Analyze the fixed beam shown in figure Q.3(c) below and determine the fixed end moments.

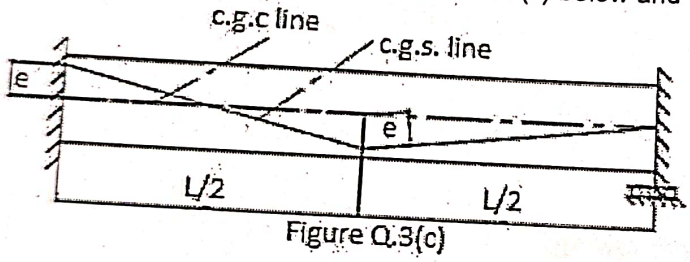


Figure Q.3(c)

Q.4 **Attempt any two of the following:**

[2 × 12 = 24]

(a) Check the design of a s/s double Tee Beam shown in figure Q.4 (a) for flexural strength of the section as per 1343: 2012 with bonded pre tensioned tendons with single harping point at center of the span.

Data for flexural design:

Total udl at service load = 13.71 kN/m, location of CGC line from top = 410 mm, $b_{av\ web\ width}$ =244.3 mm(of both the webs), eccentricity of tendons at left support = 236 mm from CGC line, eccentricity of CGS from CGC line at midpoint of span = 371.5 mm, A = 258709 mm^2; y_b= 436 mm; y_t= 174 mm; I = 8735 x 10^6 mm^4; S_b = 20058 x 10^3 mm^3 ; S_t = 50194 x 10^3 mm^3 M_{ult} = 504 kNm, d_p = 545.5 mm, A_p = 594 mm^2, f_{pu} = 1860 MPa, f_{ck} = 34.5 MPa and signature strain = 0.00698.

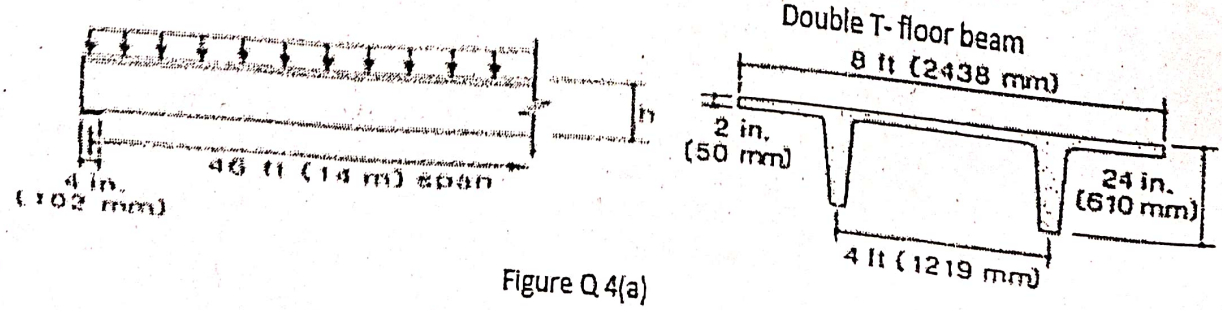
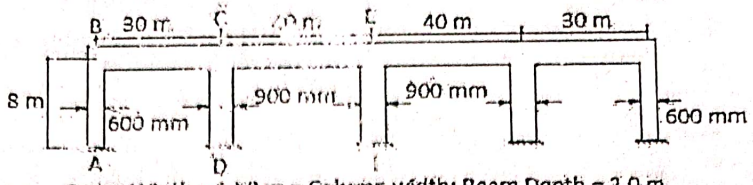


Figure Q.4(a)

(b) A four span post tensioned guideway girder has a solid rectangular section 1.5 m wide x 2.0 m deep. The girder is supported by the columns cast integrally with the girder as shown in figure Q.4(b)(i). The tendon profile in the guideway girder is as shown in figure Q.4 (b)(ii). The tendons are post tensioned in such a manner that the average force in each span after tensioning is 20000 kN. Calculate the restraint action and draw restraint BMD caused by prestressing. Assume that E_c = 27600 MPa at the time of prestressing.



Beam Width = 1.50 m = Column width; Beam Depth = 2.0 m
Figure Q.4(b)(i)

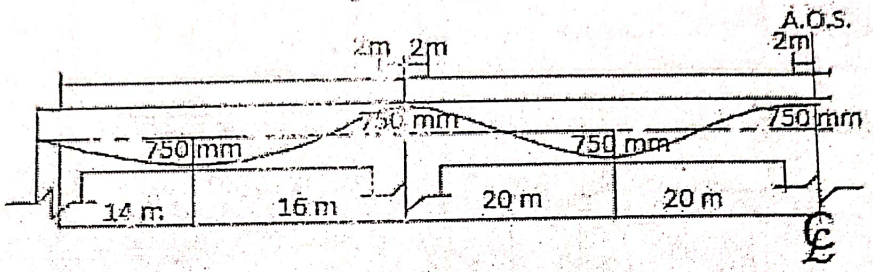


Figure Q.4(b)(ii)

(c) Design the anchorage zone reinforcement to prevent bursting in a bonded post tensioned beam shown in figure Q.4 (c) below. Take the bearing plate dimensions as 200 mm x 300 mm. The concrete is of grade M40. The prestress is transferred after 7 days. The prestressing force of 1000 kN is applied at transfer by a single tendon. Check the section for bearing stresses.

Section beyond end zone

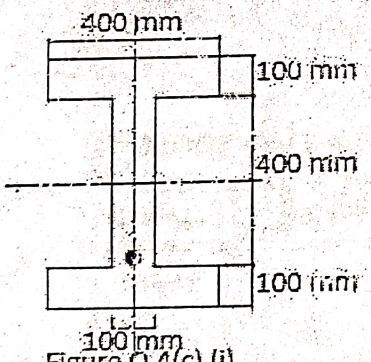


Figure Q.4(c) (i)

Section at end zone

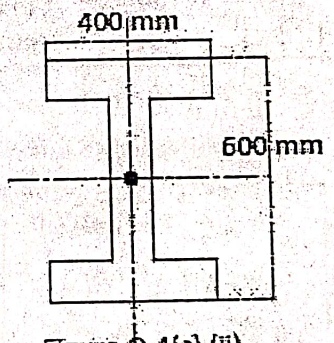


Figure Q.4(c) (ii)

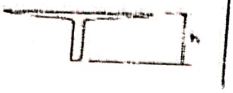
Q.5 One way two span floor slab for an assembly hall is post tensioned with bonded tendons. Each span of the slab is 20 m. The tendons are 4 nos. 13 mm dia. 7 wire low relaxation strands having f_{pu} = 1860 MPa and facilitated with oval duct 20 mm high. The floor slab supports a specified live load of 4 kN/m² and a floor finish load of 0.5 kN/m². The grade of concrete is M50 and the slab shall be post tensioned after 7 days when concrete strength is 0.665 f_{ck}. Design the slab as follows:

(a) Design slab thickness and tendon profile.

(b) Find prestressing force in the tendon and design the tendon spacing.

(c) Plot the BMD for the load cases
   i. DL+LL in both the spans
   ii. DL+LL in left span and DL in right span
   iii. and Restraint BMD

Do the moment redistribution and find the design ultimate maximum +ve and -ve BMs.

Type of element	Live load, psf (kN/m²)	Span/depth ratio
	Dead load	40
	50 (2.4) 100 (4.8)	45-50 32-42
	50 (2.4) 100 (4.8)	20-30 18-28
	50 (2.4) 100 (4.8)	28-32 19-24

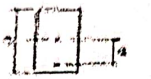
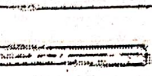
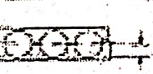
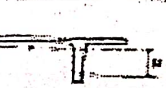
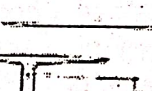
Typical span-to-depth ratios for simply supported prestressed concrete members.

Values of f_{ps} and f_{pj}

Strand Type f_{pu} = 270 ksi (1860 MPa)	f_{pj}/f_{pu}	f_{ps} ksi (MPa)	Long-Term Losses ksi (MPa)	f_{pf} ksi (MPa)
Stress-relieved	$0.7f_{pu}$	170 (1172)	35 (249)	135 (932)
Low-relaxation	$0.75f_{pu}$	187 (1290)	30 (218)	157 (1084)

Typical values of f_{pe}/f_{pu}

Tendon Type	f_{pe}/f_{pu}
Low-relaxation strand	0.80
Stress-relieved strand	0.65
Bars prestressing bars	0.85
Deformed prestressing bars	0.80

Cross section shape	$a = k_1$	$k_2 = k_3$
	0.50 h	0.33 h
	0.47 h	0.33 h
	0.50 h	0.45 h
	0.70 h	0.43 h
	0.75 h	0.48 h

Approximate values of flexural lever arms for preliminary service load design.

Cleveon types from *CPCI Metric Design Manual*

Tendon Type	Grade f_{pu} MPa	Size Designation	Nominal Dimension: Diameter mm	Nominal Dimension: Area mm²	Mass kg/m
Seven-wire strand	1860	9	9.53	55	0.432
	1860	11	11.13	74	0.582
	1860	13	12.70	99	0.775
	1860	15	15.24	140	1.109
	1760	16	15.47	143	1.173

Total No. of Pages:03

II SEMESTER **M.Tech, (Structural Engineering)**

END SEMESTER EXAMINATION ***MAY-2019***

CE-6521 Design of Hydraulic Structures

Time: 3:00 Hours ***Max. Marks:100***

Note: Answer any FIVE questions. Question 1 is compulsory.
Assume suitable missing data, if any.

Q1 (i) How does Bligh's theory differ from Lane's Weighted Creep theory? (5)

(ii) Explain the Stream lines and Equipotential lines. (3)

(iii) Determine the percentage pressures analytically using formulas at various key points in the Weir as shown in Fig 1. Also, determine the exit gradient and plot the hydraulic gradient line for pond level on u/s and no flow on d/s. (12)

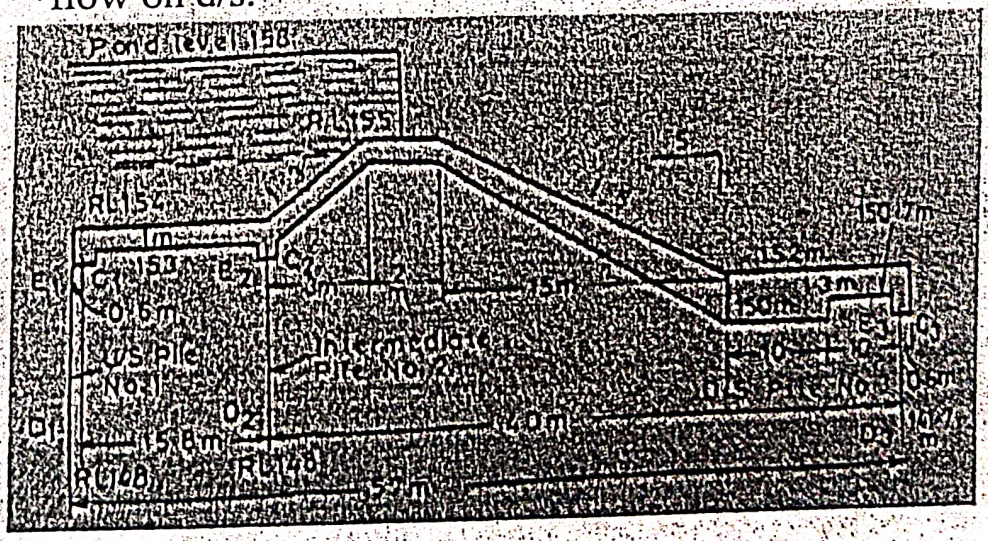


Fig 1

Q2 (i) What precautions and remedial measures should be taken to control seepage through earthen dam body? (5)

(ii) A flow net is plotted for a homogeneous earthen dam of height 22m and free board 2.0 m. The numbers of potential drops are 10 and number of flow channels are 4. The dam has a horizontal filter of 30m length at the downstream end and coefficient of permeability of the dam material is 5×10^{-4} cm/sec. Calculate the (5)

discharge per m run of the dam.

(iii) An embankment dam made of homogenous material has the following data: (10)

Level of the top of the dam = 200.00m

Level of the deepest river bed = 178.00m

H.F.L. of reservoir = 197.5m

Width of the top of dam = 4.5m

Upstream slope= 3:1

Downstream slope = 2:1

Length of the horizontal filter from d/s toe, inwards = 25m

Cohesion of soil = 24kN/m^2

Cohesion of soil of foundation = 54kN/m^2

Angle of internal friction of soil in foundation = 12°

Angle of internal friction of soil in dam = 25°

Dry weight of the soil in dam = 18kN/m^3

Submerged weight of the soil in dam = 12kN/m^3

Dry unit weigh of the foundation soil = 18.3kN/m^3

Coefficient of permeability of soil in dam = 5X10^{-6} m/sec

The foundation soil consists of 8m thick layer of clay, having negligible coefficient of permeability. **Check the stability of the dam.**

Q3 Answer any FOUR parts(5 marks each)

(i) What is the purpose of spillways and subsidiary spillways? (5)

(ii) With suitable diagram explain the functioning of Straight drop Spillway. (5)

(iii) Discuss the profile of gravity dam from practical considerations. (5)

(iv) What are the criteria for selection of a suitable dam site? (5)

(v) What are the various factors affecting the coefficient of discharge in Ogee spillway? (5)

Q4 (i) Explain the failure of two dams with suitable reasons and illustration. (10)

(ii) What is Seiche effect with suitable example? (5)

(iii) Explain in details the conditions of various types of gravity dam w.r.t to valley and geology of rocks. (5)

Q5 (i) How the location a spillway is decided on a dam site? (5)

(ii) Design a suitable section for the overflow portion of a concrete gravity dam having the downstream face sloping of 0.7H:1V. The design discharge for the spillway is 8000 cumecs. The height of spillway crest is kept at RL 204.0m.The average river bed level at the site is 100m. The spillway length consists of 6spans having a clear width of 10m each. Thickness of each pier may be taken to be 2.5m (15)

Q6 (i) Explain the causes of failure of earthen dams? (10)

(ii) Explain in detail the procedure of design of a high gravity dam. (10)

Total No. of Page 2 Roll No. .....

Second Semester M.Tech.

END SEMESTER EXAMINATION
May 2019

CE - 6611 Global Warming and Climate change

Time: 3:00 Hours *Maximum Marks: 100*

Note: Answer any 6 questions.
Question No. 7 is compulsory.
All questions carry equal marks.
Assume suitable missing data, if any.

1. What are the properties of F-gases? Write down their sources and different methods to reduce fluorinated gas emissions. **(15)**
2. What is GWP? Explain the components of Smart Way program and what kind of steps an individual can adopt to cut their vehicular emissions and reduce nation's dependence on oil and save money? **(15)**
3. Explain the role of CH_4 in climate change. Also explain about their GWP and different reduction opportunities in agriculture and industry sector. **(15)**
4. Define greenhouse effect and what is the percentage contribution of global greenhouse gases by economic sector. Explain the different sources of greenhouse gas emission along with their percentage contribution. **(15)**

5. Smart growth is the backbone of modern development? Justify this statement by explaining the different principles of Smart growth. (15)

6. What is difference between Annex-I, Annex-II and Non Annex I countries? Define their role and responsibility towards carbon credit. Also describe the role of CDM, JI and ET towards the energy conservation and emission reduction. (15)

7. Write short notes on any **five** of the followings: (25)

   (i) UV Index and SPF

   (ii) CO_2 Flooding

   (iii) VAIP

   (iv) Ag STAR

   (v) Alternative fuel

   (vi) Kyoto Protocol

No. of pages: 02

Roll No.: .....

SECOND SEMESTER
M.TECH. (ENE)
END SEMESTER EXAMINATION
MAY– 2019

CE-6622 SOLID WASTE MANAGEMENT

Time: 03 Hours *Max. Marks: 100*

Note: Attempt any five questions
Assume suitable missing data if any
All the questions carry equal marks

1. DTU has installed a waste to energy (WTE) plant of 1.0 TPD capacity in its campus. Discuss the environmental significance of WTE plant along with the technology used, processes, and key design parameters. What are the possible challenges and their solutions in operation of this WTE plant? 20

2. a) A community of 20000 people generates MSW at a rate of 0.5 kg per person per day. The density of MSW in the collection truck is 500 kg/m^3. If the capacity of collection truck is 15m^3, how many truckloads of MSW, on average, will be unloaded at the landfill each year? 10
   b) Adoption of RDF plant is a challenge in Delhi. Prepare a matrix of major challenges and their possible solutions. 10

3. a) Briefly discuss the challenges associated with solid waste management in India. 10
   b) With the help of a neat sketch explain the functions of the different components of sanitary landfill and its operation. 10

4. Write short notes on
   a) Recycling of plastic
   b) Incineration
   10

5. a) Describe the significance of composting in waste management. Briefly explain the factors regulating composting. 10
   b) What is the significance of reuse and recycling in waste management? Explain. 10

6. a) Define leachate. What are the environmental effects of leachate? How is the leachate managed at the sanitary landfills? Explain. 10
   b) Briefly discuss the role of civic agencies in solid waste management. 10

7. MSW 'as delivered' has 65.1% of paper, food waste, yard trimmings, wood and other decomposable matter. The moisture content of this waste is 35%. The elemental analysis of decomposable has mass percentages as given:

Element	C	H	O	N	Other	Total
Dry Mass (%)	45.2	6.0	43.7	0.43	4.67	100

Find the chemical formula for the C, H, O, N portion of decomposable. Also find out the percentage of methane generated, per kilogram of waste.

20

-END-

Total No. of Pages 2

Roll No. .....

II SEMESTER M.Tech.(GEOTECHNICAL ENGG)
END SEMESTER EXAMINATION May-2019
CE-6713-THEORY OF ELASTICITY & PLASTICITY

Time: 3 Hr

Max Marks: 100

Note: Answer all questions of equal marks. Assume suitable missing data, if any.

1. Attempt all of the following questions:

a. Explain the concept of critical state soil mechanics and define state boundary surface. (4)
b. What is residual shear strength. Discuss its importance in long term stability of slopes. (4)
c. Write down compatibility equations in terms of stresses. (4)
d. Explain how lateral earth pressure is determined due to surcharge line load. (4)
e. Discuss the stability of dam in sudden drawdown condition. (4)

2. Attempt any Two questions out of the following:

(a) The displacement field in a micro unit of a soil mass is given by

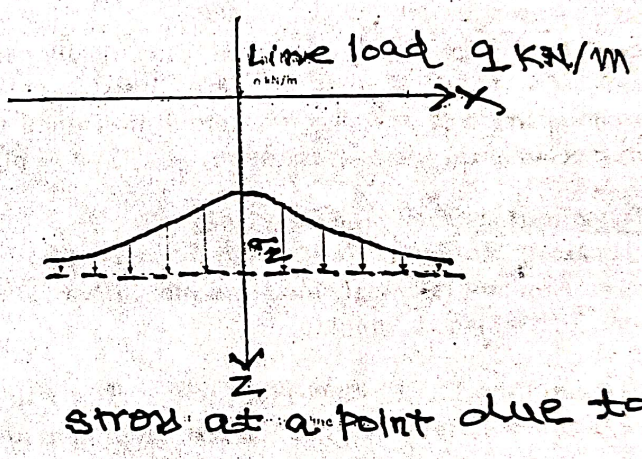
$$u = (x^2+y)i + (3+z)j + (x^2 + 2y)k$$

Determine the principal strains at (3, 1, -2) and the direction of minimum principal strain. (10)

(b) The stress at any point inside a semi infinite medium due to a line load q kN/m(as shown in figure below) is given by a stress function $\Phi = A \times \tan^{-1}(z/x)$, where A is a constant. The equation satisfies the compatibility equation. Determine-

(i) σ_{xx} and τ_{xz}

(ii) What will be the value of A after applying proper boundary condition. (10)



stress at a point due to line load

(c) Differentiate Boussinesq's equation and Mindlin's equations for stress distribution. Explain Mindlin's equation for vertical, radial and tangential stresses. (10)

3. Attempt any Two questions out of the following:

(a) Find the vertical stress at a depth z m below ground level due to circularly loaded area. The equation for cubic parabolic load is $q = q_{max}(1-(r/R)^3)$, where R is radius of circular area. (10)

(b) Explain Westergaard's analysis for non homogeneous soil and derive the relevant relations. Also discuss Fenske's curve. (10)

(c) The hollow cylinder test as proposed by Krikpatrick was conducted on sand sample of internal and external diameter as 31.8mm and 50.8 mm respectively. The results of the test are given below. Determine-

(i) The inside and outside circumferential stresses.
(ii) The effective axial stress.
(iii) The angle of shearing resistance as per Mohr-Coulomb failure criterion. (10)

P.T.O.

Test no.	σ_1'(kN/m^2)	σ_3'(kN/m^2)
1	148.5	101.0
2	190.3	131.0
3	308.6	214.2
4	390.0	269.5
5	460.3	320.6
6	480.4	335.5
7	510.2	352.1
8	540.1	378.1
9	549.0	384.0

4. Attempt any Two questions out of the following:

(a) A consolidated drained test at a constant cell pressure, $\sigma_3=\sigma_3'=120$ kPa, was conducted on a sample of normally consolidated clay. At failure, $q=\sigma_1'-\sigma_3'=140$ kPa. What is the value of M in compression? If an extension test were to be carried out, determine the mean effective and deviatoric stresses at failure. (10)

(b) A saturated soil sample was isotropically consolidated in a triaxial apparatus and a selected set of data is shown in the table. Determine λ, κ and e_Γ. (10)

Condition	Cell pressure (kPa)	Final void ratio
Loading	200	1.82
	1000	1.30
Unloading	500	1.35

(c) Two specimens, A and B, of a clay were each isotropically consolidated under a cell pressure of 300 kPa and then unloaded isotropically to a mean effective stress of 200 kPa. A consolidated drained test is to be conducted on specimen A and a consolidated undrained test is to be conducted on specimen B. Estimate for each specimen the yield stresses, p'_y, q_y, $(q')_y$, and $(\sigma'_3)_y$. (10)

5. Attempt any Two questions out of the following:

(a) A smooth vertical wall 7m high is constructed for a granular backfill (bulk density=17.5 kN/m^3 & angle of shearing resistance= 27.5^0). Calculate and plot the variation of pressure for translation mode of the wall movement. Use Dubrova's theory. (10)

(b) A 7.0 m high retaining wall with back face inclined 20° with vertical retains cohesionless backfill (ϕ= 33°, γ_t = 18.5 kN/m^3 and δ=20°). The backfill surface is sloping at an angle 10°to the horizontal.

(i) Determine the total active earth pressure using Coulomb's theory or Culmann's graphical construction.

(ii) If the retaining wall is located in a seismic region (k_h= 0.1), determine total active earth pressure using Mononobe's equation or modified Culmann's graphical construction. Assume the value of α as $\alpha_h/2$. (10)

(c) Derive expression for the factor of safety based on Bishop's method of slope stability analysis for the case of a submersed slope of an earth dam. Explain how this method is different from Spencer's method. (10)

Total No. of Pages: 02 Roll No.....

SECOND SEMESTER M. Tech. (Geotechnical Engineering)

END SEMESTER EXAMINATION May – 2019

CE 6721 Ground Improvement Techniques

Time: 03:00 Hours Max Marks: 100

NOTE: Answer any Five questions. Marks carried by a question are indicated against it. Assume suitable missing data, if any. Useful data is given at the end of the paper.

Q.1 [a] A geotextile is used as a separator between soil subgrade and stone base course in a pavement, derive expression for factor of safety against burst resistance by assuming standard field situation as per ASTM D3786. (8)

[b] If the ultimate flow rate of a geotextile from a lab test is 21 l/min-m, what would be the allowable flow rate for design purposes for: (i) Gravity drainage problems; (ii) Erosion control filters. (6)

[c] What is the factor of safety for a geotextile with allowable puncture strength of 260 N considering a tire inflation pressure of 700 kPa and relatively large stones of 35 mm size? The stones come from different queries as (i) angular; (ii) subangular; (iii) rounded. (6)

Q.2 What are the purposes of dewatering? Show neat and clear sketches with all components and parts of the following:

(i) Ditches and sumps
(ii) Well point
(iii) Single Stage well point system
(iv) Multi stage well point system
(v) Well point with vacuum system
(vi) Deep well system

(2+3×6)

Q.3 A geotextile reinforced retaining wall is 6 m high. The wall is backfilled with a granular soil having $\gamma = 18$ kN/m^3, and $\varphi = 36°$. A woven geotextile having an ultimate wide-width strength of 50 kN/m is intended to be used in its construction. The wall carries a uniform surcharge of 20 kN/m^2 on the top surface. A factor of safety of 1.4 is to be used alongwith site specific reduction factors. Design the following:

(i) Spacing of the individual layers of the geotextile
(ii) The length of the fabric layers
(iii) The overlap length

Give a neat sketch of the wall and also check for the external stability of the wall. The properties of the foundation soil are: $\gamma = 18$ kN/m^3, and $\varphi = 30°$, $c = 15$ kN/m^2. (20)

Q.4 [a] What is electroosmosis? What are its applications? What factors affect electroosmosis? Describe the mechanism and working of electroosmosis. Derive the necessary expression to show that this technique is highly effective for soils of low hydraulic conductivity. **(10)**

[b] Describe the mechanism of installing stone columns for ground improvement. How load bearing capacity of a stone column can be computed? Describe various load-settlement relationships for stone columns. **(10)**

Q.5 A geogrid reinforced retaining wall is 7 m high and is backfilled with a granular soil having $\gamma = 17$ kN/m^3, and $\varphi = 35°$. The wall carries a uniform surcharge of 15 kN/m^2 on the surface. Given for geogrid: coverage ratio = 0.8; interaction coefficient = 0.75; ultimate tensile strength = 156 kN/m. Design: (i) the vertical spacing of geogrid; (ii) the length of geogrid. Draw the neat sketch of the wall giving details. Also check for external stability; the properties of foundation soil are: $\gamma = 17.5$ kN/m^3, and $\varphi = 36°$. **(20)**

Q.6 [a] A soil having a specific gravity of solids as 2.67 is subjected to a standard Proctor compaction test in a mould of volume 950 cm^3. The following observations were taken:

Moisture content, %	7.7	11.5	14.6	17.5	19.7	21.2
Mass of wet soil, g	1739	1919	2081	2033	1986	1948

Make necessary calculations to draw (i) the compaction curve, (ii) the 100% saturation line. Show the maximum dry unit weight and optimum moisture content. (iii) Calculate the degree of saturation at optimum moisture content.

[b] How will you calculate the maximum dry density and optimum moisture content when the soil contains oversized particles? **(6)**

Q.7 [a] What is the mechanism of filtration through a geotextile, and what is its purpose? Give neat sketches with details showing various applications of geotextile as filter. **(8)**

[b] For a vibroflotation work, the backfill to be used has the particle size characteristics as: $D_{50} = 1.8$ mm; $D_{20} = 0.72$ mm; $D_{10} = 0.25$ mm. Determine the suitability number of the backfill. How would you rate the material? **(4)**

[c] Describe, use of cement as stabilizer for different soil types; how quantity of water and cement can be decided; how durability tests are carried out and what is the criteria for satisfactory performance? What is field construction method for cement stabilization? **(8)**

----------END----------

USEFUL DATA

$\varphi°$	N_c	N_q	N_γ
36	50.59	37.75	56.31
30	30.14	18.40	22.40

Total No of Pages 01 Roll. No.....

SEMESTER-SECOND M.TECH(END-SEM)

"END SEM THEORY EXAMINATION" MAY-2019

CE 6811 AND CE-621 IN GIS

APPLICATION OF [redacted] GEOTECHNICAL ENGG AND WATER RESOURCES

Time: 03: 00 Hours Max.Marks: 100

Attempt any five questions. All questions carry equal marks.
Assume any missing data if any.

Q No. 1	a)	Write down the limitations of raster data. How the raster data is captured?	10
	b)	Explain various types of raster data structure.	10
Q No. 2		Define any five of the following:	20(4*5)
	a)	Run Length coding.	
	b)	Block coding	
	c)	Chain coding	
	d)	Quadtress	
	e)	Georeferencing Raster Data	
	f)	Control points	
Q No. 3	a)	What is vector data model? What is topology?	10
	b)	Explain various types of topography orientations.	10
Q No. 4	a)	Define fundamental functional capabilities	10
	b)	Show a neat sketch the use of GIS in Govt and Public service.	10
Q No. 5	a)	State various type of Dams based on construction material? Draw a neat sketch showing upstream, and downstream.	10
	b)	What are the function of Dams and their requirements?	10
Q.No.6	a)	What are the various components of GIS in detail.	10
	b)	Explain various types of GIS Model and Modelling process.	10
Q.No.7	a)	What is Geodesy.	10
	b)	What is Spatial Data. Define primary and secondary data. Also source of Spatial Data.	10

7 Particulars given below refer to a levee proposed for flood control in a certain river. Obtain height of the levee at a distance 1.5 Km upstream. (15)

Distance upstream (In Km)	0	1.5	3
Area of river x-section (in m^2)	3000	1000 (1) 1500 (2)	1100 (1) 1000(2) 300 (3)
Wetted perimeter (in m)	720	400 (1) 315 (2)	360 (1) 300 (2) 90 (3)
Design flood (in cumecs)	5000	5000	5000
High flood level (in m)	185.0	?	?
KE correction factor (α)	1.15	?	?
Average ground level (in m)	181	181.5	182.2
Manning's n	0.023	0.040 (1) 0.022 (2)	0.040 (1) 0.022 (2) 0.046 (3)

Note: (1) & (3) are on flood plains
(2) is in the main channel

Total No. of Pages 4 *Roll No. .....*

M Tech (Hydraulics & Water Resources Engineering) II SEMESTER

END SEMESTER EXAMINATION *May-2019*

CE- 6821 DESIGN OF FLOOD CONTROL & RIVER TRAINING WORKS

Time: 3:00 Hours *Max. Marks : 100*

Note :Question Nos 1 and 2 are compulsory. Answer four other questions.
Assume suitable missing data, if any.

1 Answer **ten** parts of the question.

[a] Compare working of attracting type of Groyne with the deflecting type.
[b] The river training works are safe and effective on which type of rivers? How do you ensure the safety parameter in field conditions?
[c] What is Embayment? What is its importance?
[d] Discuss in brief different steps which make Levees more economical as flood control works.
[e] How do you select a suitable site for a bridge on an alluvial river in its flood plain?
[f] What is Dominant discharge of a river? How do you obtain it?
[g] Compare the utility of permeable and impermeable type of Groynes.
[h] What is energy correction factor? Explain its importance in light of the current subject.
[i] With the help of a suitable sketch explain the eddy currents and sediment transport in a meandering river.
[j] Define and explain importance of terms: Retrogression and Afflux.
[k] Compare the flood control measures with anti-water logging measures.
[l] Write a brief note on application of flow duration data of a river in analysis and control of floods. (2x10)

2 Answer **ten** parts of the question.

[a] Write a short note on utility of sediment transport knowledge in river training works and in flood control works.
[b] Enlist the various types of river training works which may be required in a river valley. Discuss one case related to river Ganges in Varanasi.

[c] Comment on applicability of Manning's equation in alluvial streams. What modifications do you suggest, if needed? What could be the use of such equations?

[d] Discuss in brief different steps which make Levees more economical as flood control works.

[e] Compare utility of permeable & Impermeable Groynes. Discuss case study of one permeable type of Groyne.

[f] Write a brief note on different mode of sediment transport in alluvial channels.

[g] Write a brief note on problems of flood prone areas. How can you address them under non structural measures?

[h] Write a brief note on performance of T Groynes in field conditions with the help of a suitable example.

[i] With the help of a suitable sketch explain the eddy currents and sediment transport in a meandering river.

[j] Write a brief note on river morphological study and its utility in flood management works..

[k] Explain the improvements observed in Lower Mississippi river after the cut offs were introduced as river training programme.

[l] Write a brief note on conditions required for the success of artificial cut off as a river training work. (2x10)

-99-

3 (a) A canal has to be designed to have R = 2.6 m and S = 1.8×10^{-4}. The sediment on the bed has a median size of 0.30 mm. Find: (i) bed condition expected (ii) the height and spacing of undulations and (iii) the advance velocity of undulations. Assume depth of flow as 2.8 m and velocity of flow as 1.0 m/s. (8)

(b) Compute the transverse bed slope for a rectangular river section having a fixed outer bank from the following data :
Discharge Q = 3800 m^3/s, outer radius r_0= 2500 m , $S_0=11 \times 10^{-5}$, C= 40 $m^{1/2}/s$, B=1000 m , $d=0.5 \times 10^{-3}$m , Δ =1.5 (7)

4 (a) Design a guide bank to train a river with the following data:
Maximum discharge = 6000 cumecs
High flood level = 104.7 m
River bed level = 100 m
Average diameter of river bed material =0.14 mm
Compare this design with design criteria followed in other departments Like Railways. (5+3)

(b) Design an armour for the strengthening of an embankment. The typical drawing for the details of pitching and launching apron are also to be shown. The data pertaining to the design as follows:
Discharge = 7400 m^3/s
Lacey's silt factor =0.80
Low water level is 2 m below high flood level.
Height of pitching above HFL=0.65 m.
Comment on limitations of the design. (5+2)

5(a) Give reference of BIS codes that you will use for design of river training works. (8)

(b) How can you optimise cost of flood control project in an area which has reservoirs on both tributaries of river causing the flood. (7)

OR

5 The maximum annual floods for river Tapti for 93 years were statistically analysed and 17 highest annual floods are given (in cumec $\times 10^{-3}$) as 21.2, 21.8, 30.2, 24.9, 23.6, 21.8, 22.6, 25.5, 20.0, 22.8, 29.3, 24.2, 18.3, 19.6, 37.3, 22.6, 42.5 .Determine:
(i) Recurrence interval (R. I.) of highest flood.
(ii) Flood Magnitude of 200 years R. I.
(iii) Probability of occurrence of flood 3700 cumecs flood once in 10 years (15)

6 Work out benefit cost ratio for the data available in the table below and suggest the peak stage corresponding which you would like to provide protection against the flood level. (15)

Peak stage (m)	Total damage below Indicated stage (Rs in millions)	Return period (years)	Annual cost of project (Rs in millions)
9	0	7	0.8
10	8	10	1.2
11	20	15	1.6
12	40	22	2.0
13	64	30	2.6
14	90	70	3.2
15	120	150	3.6
16	160	300	4.0

(b) Compute the weight matrix for a 4-neuron Hopfield net with the single fundamental memory $\xi_1 = [1, -1, -1, 1]$ stored in it. 6.

(c) Discuss the architecture and benefits of blackboard systems. 8.

7. (a) Imagine you are working in the human resources department of a big company and have to hire people. You get to screen a lot of applications and have arrived at the following model: Whether a person will perform well on the job (random variable J) depends on whether he is responsible and well organized (random variable R). The latter will, of course, also influence how well the person has learned during his studies (random variable L) and that in turn has had an impact on his grades (random variable G).

Assume random variable grade G has three possible values 0 (poor), 1 (medium), 2 (good) and all other random variables are binary with 0 indicating the negative and 1 the positive state.

The probabilities tables are given below

P(G = 0|L = 0) = 2/3	P(L = 0|R = 0) = 2/3	P(J = 0|R = 0) = 2/3	P(R = 0) = 1/3
P(G = 1|L = 0) = 1/3	P(L = 1|R = 0) = 1/3	P(J = 1|R = 0) = 1/3	
P(G = 2|L = 0) = 0			
P(G = 0|L = 1) = 0	P(L = 0|R = 1) = 1/3	P(J = 0|R = 1) = 1/3	P(R = 1) = 2/3
P(G = 1|L = 1) = 1/3	P(L = 1|R = 1) = 2/3	P(J = 1|R = 1) = 2/3	
P(G = 2|L = 1) = 2/3			

(i) Draw a Baysian network for the model and write down the joint probability as a product of conditionals and priors.

(ii) Consider $P(J = 1)$. What does it mean? Calculate it along with all relevant messages. 12.

(b) Consider the following grammar. Draw RTN and check whether the following sentence is grammatically correct or not.

"The fog kissed a naughty boy"

S → NP, VP
NP → DET, N
NP → N
VP → V, ADV
VP → V, PP
VP → V, NP, PP
VP → AUX, V, PP
PP → PREP, NP
DET → ART, ADJ
DET → ART

8.

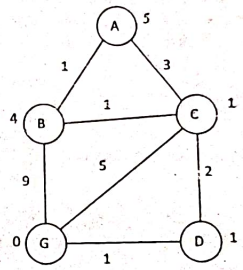
Total no. of pages: 4 Roll No:

Artificial Intelligence and Expert Systems

Time: 3 Hours Paper code: CO-6022
Max. Marks: 100

Note: Attempt five Questions.

1. Consider the graph shown below where the numbers on the links are link costs and the numbers next to the states are heuristic estimates. Note that the arcs are undirected. Let A be the start state and G be the goal state.



(a) Simulate A* search with a strict expanded list on this graph. At each step, show the path to the state of the node that's being expanded, the length of that path, the total estimated cost of the path (actual + heuristic), and the current value of the expanded list (as a list of states). 5.

(b) Is the heuristic given admissible? Explain. 5.

(c) Is the heuristic given consistent? Explain. 5.

(d) Did the A* algorithm with strict expanded list find the optimal path? If it did find the optimal path, explain why you would expect that. If it didn't find the optimal path, explain why you would expect that and give a simple (specific) change of state values of the heuristic that would be sufficient to get the correct behavior. 5.

2. (a) Convert the following into clause form

(i) $\neg\forall x\ \exists y\ P(X) \wedge R(X, Y)$

(ii) $\forall X\ \forall Y$ eats $(X, Y) \wedge \sim$killed $(X) \rightarrow$ food (Y)

10.

(b) Consider the following sentences

Whoever can read is literate
Dolphins are not literate
Some Dolphins are intelligent
Using resolution prove that some who are intelligent cannot read.

10.

3. (a) Suppose we have the following rule R1:

if (P1 and P2 and P3) or (P4 and not P5 then C1 (0.7) and C2 (-0.5)

and the certainty factors of P1, P2, P3, P4, P5 are as follows:

CF(P1) = 0.8,
CF(P2) = 0.7,
CF(P3) = 0.6,
CF(P4) = 0.9,
CF(P5) = -0.5,

What are the certainty factors associated with conclusions C1 and C2 after using rule R1?

12.

(b) Consider an object that may be colored in only one of three colors, red (R), green (G) or yellow (Y). If the mass values for the hypotheses in the power set are

$m(R) = 0.24$, $m(G) = 0.16$, $m(Y) = 0.33$,
$m(R \text{ or } G) = 0.03$; $m(R \text{ or } Y) = 0.06$, $m(G \text{ or } Y) = 0.06$.

Find the Belief and plausibility of R, G and Y.

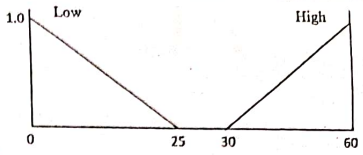
8.

4. (a) What is the main difference between the probability and fuzzy logic ?

8.

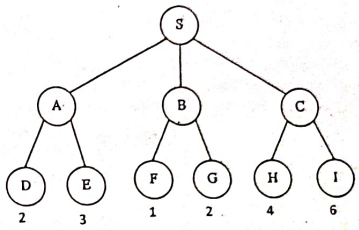
(b) In an industrial control set up, water temp t is described by a fuzzy set {cold, warm, hot} and pressure p is described by the fuzzy set {low, medium, high}. Depending on the state of t and p, the valve setting v is adjusted which is also a fuzzy variable. Given the rules:

R1: if t is warm and p is low set v to high
R2: if t is hot and p is medium then set v is low
Work out the crisp value for valve setting, for a situation where t is {0.8, 0.4, 0} and p is {0.6, 0.2, 0} and v is shown below:



12.

5. (a) Consider the game tree shown below. The top node is a max node. The labels on the arcs are the moves. The numbers in the bottom layer are the values of the different outcomes of the game to the max player.



(i) What is the value of the game to the max player?
(ii) What first move should the max player make?
(iii) Assuming the max player makes that move, what is the best next move for the min player, assuming that this is the entire game tree?
(iv) Using alpha-beta pruning, consider the nodes from right to left, which nodes are cut off ? Circle the nodes that are not examined.

8.

(b) How is the hidden layer of a RBF network different from the hidden layer in a MLP? Explain this difference in terms of: (i) what the hidden nodes compute when feeding data to the network ? (ii) how the hidden nodes are trained ?

6.

(c) Write a short note on Boosting.

6.

6. (a) In back propagation network with N_i input neurons, N_h hidden layer neurons, and N_o output neurons: (i) how many neurons will there be in the network, and (ii) if $N_i = 4$, $N_h = 3$, and $N_o = 2$, draw a diagram showing the connectivity of the network. Do not forget the bias unit.

6

Total No. of Pages 2

Roll No..... .....

II –SEM/IV SEM (P/T)
END SEMESTER EXAMINATION

M.Tech.(CSE)
May- 2019

CO-6032 WIRELESS & MOBILE COMMUNICATION

Time: 3:00 Hours

Max. Marks: 100

Note: Answer all questions by selecting Any Two parts from each question.
Assume suitable missing data, if any.

Q.No. 1 2X10=20

A) Why do we need different MAC frame format in mobile environment? Draw the Protocol architecture of WLAN IEEE 802.11 standard and explain subfields of MAC frame of IEEE 802.11.

B) Differentiate the functionalities of foreign agent and home agent, explain packet delivery mechanism in mobile IP network, and illustrate agent discovery and registration mechanism.

C) Explain GSM architecture and its services and list out the steps of Mobile call origination and Termination in a cellular system.

Q.No. 2 2X10=20

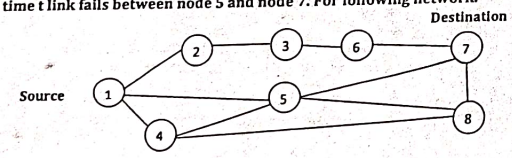
A) If a particular FDD cellular telephone system has a total bandwidth of 33 MHz, and if the phone system uses two 50 KHz simplex channels to provide full duplex voice and control channels, compute the number of channels per cell if N (number of cells in a cluster)= 12. If 1 MHz of the allocated spectrum is dedicated to control channels, determine an equitable distribution of control channels and voice channels in each cell for each of the system.

B) Differentiate between DCF and PCF operation modes in context to WLAN and discuss physical layer convergence protocol (PLCP) in DSSS & FHSS mode.

C) How hidden and exposed terminal problems can be solved in infrastructure less network? Explain Power management & synchronization mechanisms in wireless networks.

Q.No. 3 2X10=20

A) Explain the route creation and route maintenance using TORA assuming that at time t link fails between node 5 and node 7. For following network.



B) What are the various mechanism used to improve the TCP performance in mobile networks? Explain and differentiate between I-TCP and Mobile TCP.

C) What is Bluetooth? Describe the general format of packet and packet header in Bluetooth technology. Differentiate between Piconet and Scatternet.

Q.No. 4 2X10=20

A) What is the role of WSP and WTLS in WAP protocol stack. Explain wireless application protocol architecture.

B) What is difference between care of address (CoA) and co-located CoA? Describe encapsulation and tunnelling in Mobile IP.

C) Differentiate between AODV& DSR and describe the Route discovery and Route maintenance mechanisms of Adhoc on demand Distance vector (AODV) Routing Algorithm.

Q.No. 5 2X10=20

A) Explain the working of CSMA/CA with RTS and CTS of IEEE 802.11 assuming that source node having more fragments to transfer. How CSMA/CA is Different from CSMA/CD? Explain.

B) What are the Data management issues in mobile wireless environment? How Data Management is done in this environment?

C) Explain following
a. Location updatation in cellular system.
b. Authentication & ciphering in GSM.

Total no. of Pages: 02 *Roll no:.... .....*

End Semester Examination **May-2019**

Second Semester **M.Tech.(CSE)**

Paper Code: CO601 Information and Network Security

Duration: 3 Hrs. **Max Marks: 100**

NOTE: *Attempt all the questions. Assume the missing data, if any.*

Q1. Answer the following questions in brief: **(10x2=20)**

a) Define the three security goals.
b) What is asymmetric-key cryptosystem?
c) List two transposition ciphers.
d) Distinguish between a stream and block cipher.
e) How many Ex-OR operations are used in DES cipher?
f) Define a state in AES. How many states are there in each version of AES?
g) Discuss the algorithm for Rail Fence Technique.
h) What are the typical contents of Digital Certificate?
i) What is the role of a CA and a RA?
j) What is electronic money?

Q2. a) Define the role of a firewall and draw a diagram that shows where a firewall should be positioned with relation to protecting a local network. In defining the role of a firewall, you should discuss the techniques that a firewall uses at different levels to prevent external attacks on the network and control traffic flow through the firewall. **(8)**

b) What are the benefits of remote access VPNs? **(6)**

c) What are the problems associated with exchange of public keys? **(6)**

Q3. a) When is a Demilitarized Zone required? How is it implemented? **(8)**

b) Why is the SSL layer positioned between the application layer and the transport layer? **(6)**

c) Why is SHA more secure than MD5? **(6)**

Q4. a) Describe the Triple Data Encryption Standard with two DES Keys. **(10)**

b) Explain the architecture and working of Kerberos. **(10)**

Q5.Define the following terms (any four): **(4x5=20)**

a) PGP
b) Spoofing
c) SET
d) Digital certificates
e) IDEA

END

Total No. of Pages 03 *Roll No. .....*

SECOND SEMESTER **M.Tech. (FT)**

END SEMESTER EXAMINATION ***May-2019***

CO-611/CO6523 SOFTWARE TESTING

Time: 3:00 Hours ***Max. Marks: 100***

Note: Question 1 is compulsory. Answer any *FOUR* questions from the remaining questions. Assume suitable missing data, if any.

1[a] Define error, fault, bug and failure. Explain all four using with the help of examples. (5)

[b] Discuss the significance of V-shaped software life cycle model and also establish the relationship between development and testing part. (5)

[c] List and explain atleast five types of web-based testing techniques. (5)

[d] What is mutation testing? What is the purpose of mutation score? Why are higher order mutants not preferred? (5)

2[a] Consider a program for the determination of the nature of roots of a quadratic equation. Its input is a triple of positive integers (say a, b, c) and values may be from interval [0, 100]. The output may have one of the following words:
[Not a quadratic equation, Real roots, Imaginary roots, Equal roots]
Develop a decision table and generate test cases (10)

[b] Differentiate between the following:
i. Alpha and Beta Testing
ii. Verification and Validation
iii. Test, Test Case and Test Suite
iv. Load and Stress Testing
v. Development Testing and Regression Testing (10)

Total No. of Page 3

Roll No. .....

M.Tech. (SWE)/PH.D 2ND SEMESTER

END SEMESTER EXAMINATION (MAY-2019)

SOFTWARE QUALITY & METRICS CO-6124

Time: 3 hrs Maximum Marks: 100

Note: Answer any FIVE questions.
Assume suitable missing data, if any.

Q1 Define the following:

i. ISO-9001
ii. Software Metrics
iii. Measures of Central Tendency
iv. CMM
v. Internal Logical Files
vi. Weyuker's properties
vii. Information flow metrics
viii. Defect Management
ix. Defect Density
x. Putnam Model

[10X2=20]

Q2 a) Differentiate between Software Quality Assurance and Software quality control with suitable example.

b) Explain in detail the McCall's factor model with the help of a diagram.

c) What is software error? Classify the causes of software errors according to the stages of the software development process.

[4+8+8=20]

Q3 a) Write a short note on the Raleigh model with the help of a diagram.

b) "Software testing is a confidence booster to bring down the risk of failing the software" Justify the statement. Explain the difference between validation and verification with suitable examples.

c) Explain the concepts of IEEE Standard 1028 and IEEE Standard 1012.

[4+8+8=20]

Q4 a) The need to carry out work by a team demands additional investment in coordination of the team members. Discuss whether these managerial efforts could be saved if the work were performed as a "one-man job".

b) Consider the function to check if an integer is odd or even. List out the operators and operands and also calculate the values of software science metrics.

```
int main ()
{
int num, even;
if(num%2==0)
{
even=1;
}
else
{
even=0;
}
return even;
}
```

c) Differentiate between the following with suitable example:

i. Usability Metrics and Testing Metrics
ii. Coupling Metrics and Cohesion Metrics

[4+8+8=20]

Q5 Identify the contribution of the CASE tools in the following:

i. Client-developer communication failures
ii. Logical design errors
iii. Coding errors
iv. Shortcomings in the testing process
v. Documentation errors **[5x4=20]**

Q6 a) Explain the software metrics and categorize them along with their examples.

b) Consider a project with the following components. EI(simple)=30, EO(average)=20, EQ(average)=35, ILF(complex)=08, ELF(complex)=05. In addition, the system requires significant end-user efficiency, moderate distributed data processing, critical data communications, and other GSCs are incidental. Compute the function points for this system using FPA.

c) List and explain the software quality factors of the following:

i. Product operation
ii. Product revision
iii. Product transition
iv. Data flow testing

[4+8+8=20]

END

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Total No. of Pages 02 *Roll No. .....*

SECOND SEMESTER **M.Tech. (SWE)**

END SEMESTER EXAMINATION **MAY-2019**

CO-6134 REAL TIME SYSTEMS

Time: 3:00 Hours *Max. Marks: 70*

Note: Answer **ALL** questions. All questions carry equal marks. Assume suitable missing data, if any.

1 Attempt all

[a] Discuss Flight control hierarchy with neat diagram. [4]

[b] Explain Task Graph with suitable example. [4]

[c] Differentiate between Dynamic Versus Static Systems [3]

[d] Define the terms: Hyper period, Sporadic jobs, Rate Monotonic System. [3]

2 Attempt all

[a] "There exist scheduling anomalies in Priority Driven System". Justify with suitable example. [4]

[b] Differentiate between Rate Monotonic and Deadline driven systems with suitable example and neat diagram. [4]

[c] Explain LRT algorithm with suitable example. [3]

[d] Explain Deferrable server with suitable example [3]

3 Attempt any **Two**.

[a] "Slack stealer can be used in Deadline Driven Systems to schedule Aperiodic jobs". Justify for Periodic Task, T1=(2.0, 3.5, 1.5) and T2=(6.5,0.5). Aperiodic job A1 has the execution time 1.7 released at 2.8 and another aperiodic job A2 has execution time 2.5 and released at time 5.5. [7]

[b] Discuss Basic Priority Ceiling protocol with suitable example. [7]

[c]Explain Stack Based Preemption Ceiling Protocol with example [7]

4 Attempt any **Two**

[a] Write a note on :

i) MPCP model ii) Inter process Communication architecture **[3.5+3.5]**

[b] Deadlock can be avoided by Priority-Ceiling protocol? Justify. [7]

[c] Explain Multi Processor Priority Ceiling Protocol with example. [7]

5 Attempt any **Two**

[a] Write a short note on: i) RTOS, ii) Thread Control Block. [7]

[b] Explain Switched Network and Multihop Switched Network. [7]

[c] Explain RSVP(Resource-Reservation Protocol) in detail with a neat figure. [7]

********** END **********

Total No. of Pages 03 *Roll No. .....*

SECOND SEMESTER **M. Tech. (CSE)**

END SEMESTER EXAMINATION ***May-2019***

CO-6511 OPTIMIZATION TECHNIQUES

Time: 3:00 Hours *Max. Marks: 100*

Note: Answer *ALL* questions. Answer any two parts of each equation. Assume suitable missing data, if any.

1[a] Consider the following linear programming problem: **[10]**

Minimize $Z = X_1 - X_2$

Subjected to $X_1 + X_2 \geq 2$

$X_1 + 2X_2 \leq 8$

$X_1 \geq 0, X_2 \geq 0$

Identify the feasible region on a graphical representation and answer the following questions:

What is the optimal solution?

(i) to the given problem.

(ii) When the objective function is Maximize $Z = X_1 + X_2$.

(iii) When X_1 and X_2 are unrestricted in sign.

[b] Illustrate the simplex method with an example and demonstrate its advantage over algebraic method of finding optima. **[10]**

[c] Consider the following linear programming problem: **[5+5]**

Maximize $Z = 6X_1 + 3X_2$

Subjected to $X_1 + X_2 \leq 4$

$2X_1 + X_2 \leq 4$

$X_1 \geq 0, X_2 \geq 0$

Solve above problem with simplex method and answer the following questions:

(i) Verify whether the point (1, 2) is optimal?

(ii) Is the problem degenerate at the optimum?

2[a] Maximize $Z = 4X_1 - 3X_2 + 2X_3 - X_4$

Subjected to $2X_1 + X_2 + 3X_3 + X_4 \leq 3$

$X_1 - X_2 + 2X_3 - 3X_4 \leq 7$

$X_1 \geq 0, X_2 \geq 0, X_3 \geq 0, X_4 \geq 0$

Write the dual to the above problem and verify the (2, 0) is a feasible solution to the dual. **[10]**

[b] Six students have given preferences to from teams (of two) to take part in a competition. The preferences are (1, 4), (1, 5), (1, 6), (2, 3), and (3, 4). What is the maximum number of groups that can be formed? Write the dual of the above LP problem and solve the dual by applying the complimentary slackness conditions. **[10]**

[c] State and prove weak duality theorem and main duality theorem with the help of appropriate arguments. **[10]**

3[a] Explain the concept of memorization and show how it is used in dynamic programming with help of Fibonacci function. **[10]**

[b] Consider a knapsack with capacity 7 kg, and there four object with values and weights as given in Table-I. Find the combination of objects which can be accommodated (without breaking) in knapsack in order to get maximum value. Give the formulation of problem and use dynamic programming with bottom up approach to obtain the optimal solution. **[10]**

Table-I

Item	*Weight*	*value*
1	2	16
2	3	19
3	4	23
4	5	28

[c] Consider the following optimization problem: **[10]**

$$\text{Maximize} \quad 45X_1 + 48X_2 + 35X_3$$
$$\text{Subjected to} \quad 5X_1 + 8X_2 + 3X_3 \le 10$$
$$X_i \in \{0, 1\}, \quad i = 1,2,3$$

Find optimal solution using Depth-First Brach and Bound algorithm. Use linear relaxation to find estimates.

4[a] Minimize $X_1^2 + 3X_2^2 - 2X_1X_2 - 6X_1 - 8X_2$ using nonlinear optimization method. Comment on sufficient condition about nature of optimum point. **[10]**

[b] Describe the exploitation and exploration phenomenon in Particle Swarm Optimization (PSO) along with adequate mathematical expressions. **[10]**

[c] Minimize the following using two-phase method **[10]**

$$Z = -3X_1 + X_2 - 2X_3$$
$$\text{Subjected to} \quad X_1 + 3X_2 + X_3 \le 5$$
$$2X_1 - X_2 + X_3 \ge 2$$
$$4X_1 + 3X_2 - X_3 = 2$$
$$X_1, X_2, X_3 \ge 0$$

5[a] Consider a single server queuing model with infinite length queue. Let arrivals follow Poisson distribution with mean λ and service is exponential with mean μ. Show that probability of none in the system is given as: (assume that $\frac{\lambda}{\mu} < 1$) **[10]**

$$p_0 = 1 - \left(\frac{\lambda}{\mu}\right)$$

[b] In a dental clinic, patients arrive at the rate of 5/hour (Poisson) and are served by dentist at the rate of 6/hour (exponential). **[4+6]**

(i) Find the probability that the dentist is idle.

(ii) assume that the maximum allowed number of patients in the system is 10, what is expected length of patient queue.

—END—

Total No. of Pages 2 *Roll No.....*

II -SEMESTER *M.Tech.(SE)*
END SEMESTER EXAMINATION May- 2019

CO-6615 WIRELESS & MOBILE COMMUNICATION

Time: 3:00 Hours Max. Marks: 100

Note: Answer all questions by selecting Any Two parts from each question.
Assume suitable missing data, if any.

Q.No. 1 2X10=20

A) "MAC protocol designed for infrastructure based wireless network may not work satisfactory in an infrastructure less environment"- justify and explain the MAC frame format of IEEE 802.11.

B) Explain in detail the Bluetooth technology and protocols and how can it be complemented with WLAN?

C) Discuss various components of the cellular system architecture. What are the functions of HLR and VLR? Explain the authentication & ciphering procedures in cellular system.

Q.No. 2 2X10=20

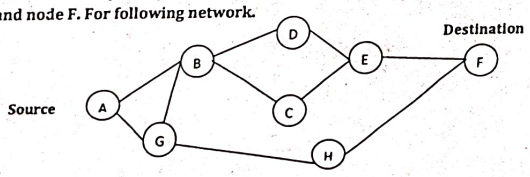
A) How frequency reuse Distance $D = \sqrt{(3N)} \times R$ is calculated? Explain. Given the minimum distance between two cochannels D=81 meters, and Radius of a cell R =3 meters, find the reuse factor of the network.

B) Explain the Destination Sequenced Distance Vector Routing with suitable example and differentiate it with Adhoc-on-Demand. Distance Vector Routing in brief.

C) Explain Packet flow in mobile IP, if two nodes communicate and both are in foreign networks (FNs). Explain agent discovery and registration mechanism also.

Q.No. 3 2X10=20

A) Describe features of TORA and explain the route creation and route maintenance by using TORA assuming that at time t link fails between node E and node F. For following network.



B) What is WAP? What is the role of WSP and WTLS in WAP protocol stack. Explain WAP architecture.

C) Explain mobile call termination in cellular system and if a certain city has an area of 1200 square miles and is covered by a cellular system using 7-cell reuse pattern. Each cell has a radius of 4 miles and the city has 33 MHz spectrum with a full-duplex channel bandwidth of 60 KHz. Find the number of cells in the service area.

Q.No. 4 2X10=20

A) Describe the Route discovery and Route maintenance mechanisms of Adhoc on demand Distance vector (AODV) Routing Algorithm and compare it with DSR algorithm.

B) What is the basic purpose of Agent Advertisement in packet forwarding? Explain the message format of the Agent Advertisement packet with ICMP and mobility extension, with giving suitable diagram.

C)

i. Why only seven active devices at a time can communicate to a master deice in Bluetooth?

ii. Explain the working of CSMA/CA with RTS/CTS in DCF mode of operation.

Q.No. 5 2X10=20

A) What kind of problems may arise if TCP is implemented over mobile wireless Networks? Explain and also discuss different approaches for TCP improvement over mobile wireless environment.

B) What are the Data management issues in mobile wireless environment? How Data Management is done in mobile environment? Explain it by giving suitable example.

C) Explain following

i. physical layer convergence protocol (PLCP) in DSSS & FHSS mode
ii. Cluster & 3- cell clustering in cellular system

– 112 – A

Total No. of Pages 02 *Roll No .....*

2th SEMESTER **M. Tech. [CSE)**

END SEMESTER EXAMINATION ***May/June-2019***

CO-6623 Neural Network & Fuzzy Logic

Time: 3:00 Hours ***Max. Marks : 100***

Note : Answer any five question. Q.1 is compulsory
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1 a) Compare Supervised learning with Unsupervised learning. [2]
b) Give some of the applications of ANN. [2]
c) Draw a perceptron model. [2]
d) Classify different types of neurons. [2]
e) What is Associative Memory? [2]
f) Define the term "learning". What is Hebbian Learning ? [2]
g) Explain the stability analysis in terms of Hopfield network. [2]
h) Elaborate "BAM Energy Function". [2]
i) Name some of the properties of fuzzy sets. [2]
j) What is the role of membership function? Draw some membership functions. [2]

Q.2[a] Explain briefly the operation of biological neural network with a simple sketch. [10]

[b] Explain the terms a. Fuzziness b. Power set. c. Union of two sets. d. Complement of two sets. e. Difference of two sets. [10]

Q.3[a] Discuss supervised learning and unsupervised learning. [10]

[b] Discuss the various special features of the membership function. [10]

Q.4 [a] Define an activation function? What are the various types of neuron activation function? [10]

[b] Write short notes on the following terms? (i) α-cuts of a fuzzy set? (ii) α-cuts of a fuzzy relation? [10]

Q.5 [a] Distinguish between the feed forward and feedback neural networks. Compare their input-output mapping. [10]

[b] Design a fuzzy control system for an air conditioning system. [10]

Q. 6 [a] Explain briefly the back propagation technique. State the advantages and disadvantages of back propagation. [10]

[b] Explain the various applications of neural network and fuzzy logic? [10]

Q.7 [a] Define defuzzification and explain the different defuzzification methods. [10]

[b] Difference between probability and possibility. Explain Uncertainty. [10]

Total No. of Pages 02 *Roll No. .....*

Vth SEMESTER **M.Tech. (SWT)**

END SEMESTER EXAMINATION ***MAY-2019***

CO721.3 - INFORMATION THEORY & CODING

Time: 3:00 Hours *Max. Marks: 100*

Note: Answer Any **FIVE** questions. All questions carry equal marks. Assume suitable missing data, if any.

1[a] The probability distribution function for a discrete random variable X is

$$f(x) = \begin{cases} 2k, & x = 1 \\ 3k, & x = 3 \\ 4k, & x = 5 \\ 0, & \text{otherwise} \end{cases}$$

where k is some constant. Please find

(a) k. (b) $P(X>2)$ (c) $E(X)$ and $Var(X)$.

[b] Prove that $0 \leq H(\Omega) \leq \log_2 K$.

2[a] A Memory less source emits six messages with probabilities {0.4, 0.2, 0.2, 0.1, 0.1}. Find the Huffman code and determine its efficiency.

[b] A binary source is emitting an independent sequence of 0's and 1's with the probabilities P and (1-P) respectively. Plot the entropy of the source versus probability [0 < P < 1]. Write the conclusion.

3[a] A discrete source emits one of five symbols once every milliseconds with probabilities 1/2, 1/4, 1/8, 1/16 and 1/16. Find the source entropy and information rate.

[b] Define channel capacity. Derive an expression for the channel capacity of a binary symmetric channel.

4 [a]What are the properties of linear block code. How would you generate a linear block code?

[b] Show that (0000, 1100, 0011, 1111) is a linear code.What is minimum distance of this code?

5 [a] Define G and H matrix and show that $G \cdot H^T = 0$.

[b] Prove that the channel capacity of a channel width "B"Hz, with additive Gaussian noise of power spectral density No/B and limited in bound limited to B is $C=B\log_2(1+P/NoB)$.

6[a]What are cyclic codes? Assume the (7,4) cyclic code with generator polynomial $g(x)=x^3+x^1+1$. Let data d= (1110). Find the corresponding systematic code word.

[b]Define BCH code. The (15,11) single error correcting binary BCH code has $g(x)=x^4+x^1+1$. Show that α, α^2, α^3 are roots of g(x) but α^3 is not a root, where α is primitive field element of GF(24). Find the fourth root of g(x)

7 Write notes on any two:-

[a] Source coding Theorem.

[b] Prefix Code.

[c] Group of conjugates in Galoi Fields.

*****END*****

Total No. of Pages 2 — 116 —

Roll No. .....

FIFTH SEMESTER

M.Tech. (Samsung)

END SEMESTER EXAMINATION

(May-2019)

CO-7223 Intellectual Property Rights

Time: 3 Hours

Max. Marks: 100

Note: Answer any FIVE questions.
Assume suitable missing data, if any.

1. a) Explain the following
   i. Name any two legitimate rights of a patent owner.
   ii. What is meant by infringement of patents?
   iii. Discuss any two provisions of the TRIPS agreement.
   iv. What is the importance of PCT?
   v. "Creativity leads to innovation"-Elucidate.

[2X5=10]

b) Imagine that you have been asked to establish intellectual property laws for a new country. What would you create for this new government's intellectual property laws? Would you keep patents, trademarks, copyrights? Would you keep the same length of protection for these areas of law? Justify with suitable examples! [10]

2. a) Explain the role of copyrights in the World Wide Web. What are ways of proving that an infringer had access to a copyrighted work? [5+5=10]

b) Discuss the procedure for registration of copyright and its effects. How does a copyright owner prove ownership of a copyrighted work? [5+5=10]

3. a) Discuss the importance of the trade secret. What are the ways to protect trade secrets under state law? [5+5=10]

b) How does a nondisclosure agreement protect a trade secret? Consider that the building where you attend class has been transformed into a software business. What steps would you take to preserve trade secrets at the location? [5+5=10]

P.T.O →

4. a) Discuss the role of trademark and trademark rights in marketing. Explain the registration procedure of the trademark in India. **[5+5=10]**
   b) What do you understand by trademark infringement? How can you transfer the trademark to a third party? **[5+5=10]**
5. a) Discuss industrial design and Hague System for industrial design. Elaborate the conditions for registration of an industrial design in India. **[5+5=10]**
   b) Discuss the registration procedure and criteria for granting patents. **[5+5=10]**
6. a) What is the importance of Geographical Indication? Discuss registration process of Geographical Indication. **[5+5=10]**
   b) What do you understand by the patent? What are the differences between a design patent and a copyright? Explain by suitable example. **[2+6+2=10]**
7. Write short notes on any TWO:
   a) Madrid agreement
   b) WIPO
   c) GATT **[10X2]**

Total No. of Pages - 1 Roll No.....

II SEMESTER M.Tech.(IS)

END SEMESTER EXAMINATION May-2019

IT-601 Network Management & Security

Time: 3 Hrs Max. Marks : 100

Note :All questions carry equal marks. **Attempt all.** Assume suitable missing data, if any.

Q.1

a) Considering the FCAPS model, what do the accounting and performance management function provide to a network manager. Explain. [10]

b) How Inbound and Out of bound management affects the network architecture. Explain. [10]

Q.2

a) Encrypt the plain text "HELP"using hill cipher with the key $key = \begin{vmatrix} 5 & 8 \\ 17 & 3 \end{vmatrix}$ Also decrypt it and verify the encryption and decryption text. [10]

b) Explain the RSA algorithm . In a RSA system it is given that p=7,q=11,e=17,M=8. Find the cipher text "c" and decrypt c to plain text M. [10]

Q.3 Explain the purpose of Wireshark tool from network administrator's perspective .Describe how it works with the unique features of the tool. [20]

Q.4

a) Define active and passive attacks. Is Phishing a wireless attack. Explain. Discuss the following attacks with suitable diagram/example

i. Man in middle attack

ii. Dos attack [4+6=10]

b) Explain the architecture of IPsec. How confidentiality is provided at network layer through security associations. Explain. [10]

Q.5 Explain the following with example:

i. Kerberos

ii. Any two approaches of digital signature

iii. Zombie

iv. Vulnerabilities and threat [5*4=20]

Total No. of Pages _02__ Roll No. .....

_Second_SEMESTER M.Tech [ISY]

END SEMESTER EXAMINATION ***May-2019***

IT-6024 SOFTWARE VERIFICATION VALIDATION & TESTING

Time: 3:00 Hours *Max. Marks: 100*

Note: Answer **any five** questions out of seven
Assume suitable missing data, if any.

Q.1 [a] What is system testing? What are the parameters to be monitored for the system acceptance? Demonstrate how it could be done using a suitable example.

[b] Discuss the role of smoke testing and its advantages? Three integer values are to be read by the program from the slandered input, that are to be interpreted as the lengths of the sides of a triangle. The program prints a message that states whether the triangle is scalene, isosceles or equilateral. Design the test cases for above program statement using decision table-based testing method. (8+12)

Q.1 [a] Analyse why integration and system testing assumes special importance for an object-oriented system? And also what role would test data generators play in testing object oriented systems?

[b] Why do we have to retest subclasses that are instantiated from an existing data, if the existing class has already been thoroughly tested? Can we use the test case design for the existing classes? Consider a class that nested five level deep and each level just redefine one method. What kind of problem do you anticipate in testing such classes and the instantiated objects? (8+12)

Q.3 [a] Write short notes on: 1) Functional testing 2) Stress Testing

[b] A program calculate the total salary of an employee with the condition that if the working hours are ≤48, then give normal salary. The hours over 48 on normal working days are calculated at the rate of 1.25 of the salary. On holidays or Sunday, the hours calculated at the rate of 2.00 time of the salary. Draw the cause effect graph for the given problem and find all the possible test cases. (8+12)

Q.4 [a] What are the goals of software testing based on defects removal, faults, failure verification?

[b] Differentiate between fault & failures. What are the different types of causes of failure?

[c] How software testing effects quality of software testing? Justify this using an example. (7+7+6)

Q.5 Describe the following in detail with suitable examples.

[a] Technical Review.

[b] Structured walkthrough and walkthrough. (10+10)

Q.6 [a] Discuss test automation and its process model? What are some of the challenges in automating the test of GUI portion of application? How do these compare with the automation of back-end testing?

[b] What are the different types of debugging approach? Illustrate how are these helpful for test case design of software modules? (10+10)

Q.7 [a] What is Verification and Validation? Suppose you are the member of development team of a software; strategize on how you can perform software verification and validation planning.

[b] What do you mean by mutation testing? Also discuss application of it during software testing. (10+10)

Total No. of Pages: 1 Roll No.....

2nd SEMESTER [M.TECH. – I year]

END SEM EXAM (MAY- 2019)

IT-6035 Secure Coding

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

Note:	Attempt any 5 Questions. Each Question Carry Equal Marks. Assume suitable missing data, if any.

Q.1 (a) Review the TCP/IP protocol by TCP, IP header analysis. [20]

(b) Describe the process of email communication. Discuss various protocols involved?

Q.2 (a) What is a variadic function? Discuss various macros associated with it. [20]

(b) What is a buffer overflow? Explain with an example, How a buffer overflow attack is performed.

Q.3 (a) What is integer overflow? Discuss various techniques to mitigate Integer overflow problem. [20]

(b) Write short notes on:

1. Cross site scripting
2. Magic URLs

Q.4 (a) Discuss WEP and WPA. How WPA addresses the WEP vulnerabilities? [20]

(b) Enlist various network security protocols available at application, transport and Network Layer of an OSI model.

Q. 5 (a) Discuss various types of breakpoints giving examples. [20]

(b) Differentiate between Kernel vs User-Mode Debugging in detail.

Q.6 (a) What is AnserverBot? How does it work? [20]

(b) Briefly discuss various android malwares and their characteristics.

-END-

Total no. of pages: 03 Roll No._____

SECOND SEMESTER **M.Tech. (ISY)/Ph.D.**

END SEMESTER EXAMINATION **MAY 2019**

IT-6516 MACHINE LEARNING AND APPLICATIONS

TIME: 3 Hours ***Max. Marks: 100***

Note: *Attempt any FIVE questions.*
Assume suitable missing data, if any.

Question No. 1 [4x5=20]

[a] Outline the key features of inductive learning.
[b] Describe reduced SVD
[c] Define Hierarchal Learning
[d] Identify the differences between Hierarchal and Partitional Clustering

Question No. 2 [20]

A data Table 1 consists of various symptoms of Flu, and these symptoms are Temperature, Headache, and Motion Sickness.

Table 1

Day $S^{(i)}$	Temperature x_1	Headache x_2	Motion Sickness x_3	Flu y
$S^{(1)}$	High	Yes	No	Yes
$S^{(2)}$	Very High	Yes	Yes	Yes
$S^{(3)}$	Normal	No	No	No
$S^{(4)}$	High	Yes	Yes	Yes
$S^{(5)}$	High	No	Yes	No
$S^{(6)}$	Normal	Yes	No	No
$S^{(7)}$	Normal	No	Yes	No

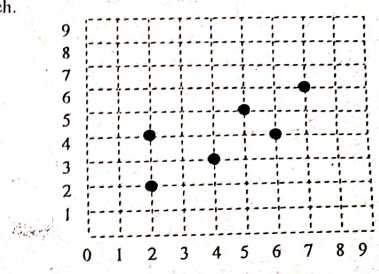
Determine the followings:

[a] Information gain for attributes x_1, x_2 and x_3.
[b] Choose the root node for the decision tree
[c] Grow the decision tree till all nodes are pure.

Question No. 3 [20]

[a] State and explain the K-Mean Clustering Algorithm and also identify the stopping criterion of K-Mean Clustering.

[b] Consider the data points as given in below figure, perform the hierarchal clustering and develop Dendrogram using single link matrix distance approach.



Question No. 4 [20]

Design a two layer feedforward neural network with two inputs x_1 and x_2, one hidden unit (z). and one output unit (y). This network has Five weights $(w_1, w_2, w_0, v_1, v_0)$ where (w_0, v_0) represents the bias terms for two units with sigmoidal activation function for hidden layer and liner function. These weights are initialized as (0.1, 0.1, 0.1, 0.1, 0.1) and determine their values after each of the first two training iterations of the backpropagation algorithm. The learning rate is 0.3, and the training examples are as follows:

x_1	x_2	y
1	0	1
0	1	0

Question No. 5 [20]

Training data has been collected from a Computer Store for customers who are buying a computer and are given in Table 2. The data instances are described by attributes such as Age (x_1), Income (x_2), Student (x_3), and Credit Rating (x_4). Develop a Naïve Bayes Classification model from the available training data and classify a test sample x: (x_1 = "≤30", x_2="*medium*", x_3="*yes*", x_4="*fair*") of buying a computer.

Table 2

Instances ($S^{(i)}$)	Age (x_1)	Income (x_2)	Student (x_3)	Credit Rating (x_4)	Buy Computer (y)
$S^{(1)}$	≤ 30	High	No	Fair	No
$S^{(2)}$	≤ 30	High	No	Excellent	No
$S^{(3)}$	31..40	High	No	Fair	Yes
$S^{(4)}$	> 40	Medium	No	Fair	Yes
$S^{(5)}$	> 40	Low	Yes	Fair	Yes
$S^{(6)}$	> 40	Low	Yes	Excellent	No
$S^{(7)}$	31..40	Low	Yes	Excellent	Yes
$S^{(8)}$	≤ 30	Medium	No	Fair	No
$S^{(9)}$	≤ 30	Low	Yes	Fair	Yes
$S^{(10)}$	> 40	Medium	Yes	Fair	Yes
$S^{(11)}$	≤ 30	Medium	Yes	Excellent	Yes
$S^{(12)}$	31..40	Medium	No	Excellent	Yes
$S^{(13)}$	31..40	High	Yes	Fair	Yes
$S^{(14)}$	> 40	Medium	No	Excellent	No

Question No. 6 [20]

Write short notes on followings:

[a] Receiver Operating Characteristics
[b] Feature Representation using Run Length Coding
[c] Support Vector Machine
[d] Elements of Reinforcement Learning

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Total no. of pages: 1 Roll No.....

SECOND SEMESTER M. Tech. [ISY]

END SEMESTER EXAMINATION MAY- 2019

IT-6521 Advances in Information System

Time: 3:00 Hours Max. Marks: 100

Note: Answer any 5 questions. Drawn neat diagram wherever necessary. Assume suitable missing data, if any.

1 [A] Discuss how can e-logistic be helpful in achieving customer satisfaction. [10]

[B] Explain the term Supply Chain Management and also discuss the challenges associated with it. [10]

2 [A] Discuss the security and privacy issues relating to electronic cash in an online banking system. [10]

[B] With example explain different network security problems with solutions. [10]

3 [A] Discuss the scope of the Internet and web technologies in e-commerce in India. [10]

[B] Explain various models of e-commerce [10]

4 [A] Define E-agriculture. Discuss the benefits and challenges to employ ICT in agriculture sector. [10]

[B] Explain the role of servers in ever expanding markets size of e-commerce. [10]

5 [A] What is the significance of E-governance. Discuss the administrative and managerial activities involved in G2G [10]

[B] Discuss various risks involved in E-banking [10]

6 [A] Describe the process of payment with a credit and debit card. [8]

[B] Why Information on Internet is Vulnerable discuss. [8]

[C] Define the importance of EDI(Electronic Data Interchange) [4]

Total No. of Pages 2 *Roll No. .....*

SECOND SEMESTER **M.Tech. (PS/C&I)**

END SEMESTER EXAMINATION *(May-2019)*

EE-601/611 Micro-controller and Embedded Systems

Time: 3:00 Hours *Max. Marks: 70*

Note : Answer **ALL** questions.
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1 [a] What is an Embedded system. What are its components? Discuss various microprocessors and microcontrollers used in embedded development. (7)

[b] What is the role of RTOS in embedded systems? Explain the Structure of RTOS Kernel with diagram. (7)

Q.2 [a] Write the different steps involved in assembling and running the 8051 program. Discuss various data types and directives in 8051. (7)

[b] Explain the pin diagram of PIC Microcontroller. Discuss the Architecture of PIC. (7)

Q.3 [a] Write a program to convert a series of ASCII numbers to packed BCD. Assume that the ASCII data is located in ROM locations starting at 300H. Place the BCD data in RAM locations starting at 60H. (7)

```
ORG       300H
MYDATA:   DB        "87675649"
```

[c] Write an 8051 C program to send letters "R', 'W, 'A', 'D' to the LCD using delays. (7)

Q.4 [a] What are the SFRs used in serial communication of 8051? Explain. Write a program to receive the data which has been sent in serial form and send it out to port 0 in parallel form. Also save the data at RAM location 70H. (7)

[b] Write an 8051 C program to send two different strings to the serial port. Assuming that SW is connected to pin P2.0, monitor its status and make a decision as follows:

SW = 0: send your first name

SW = 1: send your last name

Assume XTAL = 11.-692 MHz, baud rate 06 9600, 8-bit data, 1 stop bit. (7)

Q.5 [a] Explain the working of DPTR, STACK, PC, Registers banks in 8051. Write a 8051 C program to toggle all the bits of P0, P1 and P2 continuously with a 250 ms delay. (7)

[b]What is the difference between LCALL and ACALL, explain with examples. Write a program to create a square wave that has a high portion of 1080 micro second and a low portion of 20 micro second. Assume XTAL=22MHz, Use Timer 0. (7)

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Total No. of Pages Roll No. .....

SECOND SEMESTER M.Tech. (Power System)

END SEMESTER EXAMINATION May-2019

EE-6021 EHV AC POWER TRANSMISSION

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

Note : Answer ANY FIVE questions. All questions carry equal marks.

Assume suitable missing data, if any.

Q1. a. Justify: 'Given a positive charge Q_1 and a sphere of radius R, with Q_1 located external to the sphere, whose centre is at a distance S_1 from Q_1, the sphere can be made to have a zero potential on its surface if a charge of opposite polarity and magnitude $Q_2 = (Q_1R/S_1)$ is placed at a distance $S_2 = R^2/S_1$ from the centre of the given sphere towards Q_1'. **10**

b. A 735kV line has 4 sub conductors each with radius 0.0176 m and spacing of 0.4572 m for the bundled conductor of each phase. The line height and phase spacing in horizontal configuration are 15m each. Calculate maximum surface gradients on the centre and outer phases using Mangoldt formula. **10**

Q.2. a. Explain how the travelling waves gets attenuated due to Corona. **10**

b. A 400 kV line has the following details: $N = 4$, $d = 3$ cm, B = bundle spacing = 45.72 cm, height $H = 20$ m, phase separation $S = 14$ m in horizontal configuration, the maximum conductor surface voltage gradients are 21 kV/cm and 19 kV/cm for the centre and outer phases, respectively. Calculate the SPL or AN in dB(A) at a distance of 30 m along ground from the centre phase (line centre). Assume that the microphone is kept at ground level. Using this as the AN level of the line, calculate the day-night equivalent if daytime is 12 hrs and the penalty for the night is 10dB(A). **10**

Q.3.a. Justify: 'Positive corona pulses are responsible for RI." Also explain the formation of positive corona pulses. **10**

b. Explain CIGRE formula for the calculation on RI due to transmission lines. Explain the rules for the addition of RI levels for a double circuit line. **10**

Q.4. a. A 1150 kV D line has conductors at heights 26 m and 44 m with 24 m spacing between the lowest conductors. Each phase is equipped with 8 × 46 mm diameter conductor on a circle of 1.2 metre diameter. At 1200 kV, calculate the electrostatic field at ground level at a distance of 13 metres from the line centre. **10**

b. Justify: 'In recent years, the ground wires may also be utilized for carrier communication, protection and to tap power at a voltage lower than transmission voltage. **10**

Q.5. a. What is the basic concept behind the Compensation of transmission lines? Explain with suitable examples. **10**

b. List the dangers resulting from series capacitor compensation on long lines, and the remedies taken to counteract them. **10**

Q.6.a. Derive the expression for the voltages induced in an energized line due to nearby energized line. **10**

b. A 400 kV line supplies a load of 600 MW over a distance of 400 km. Its conductors are 2×3.18 cm dia. with a resistance of 0.03 ohm/km per phase. It carries an average load of 400 MW over the year (66.7% load factor).
(*a*) Calculate annual energy loss of the line.
(*b*) If the average corona loss is 20 kW/km for the 3-phases for 2 months of the year, calculate the annual energy loss due to corona. **10**

Q.7. Write short notes on **(any TWO)** **2x10=20**

a. Audible noise due to corona
b. Excitation function
c. FACTS Devices

Total No. of Pages ___ Roll No.....

II SEMESTER M.Tech.[PSY]

END SEMESTER EXAMINATION *May/June-2019*

EE 6032: POWER SYSTEM OPERATION AND CONTROL

Time: 3:00Hours *Max. Marks : 100*

Note : Answer any five.
All questions carry equal marks.
Assume suitable missing data, if any.

Q.1[a]The incremental fuel cost in $/MWhr for five generating units in a power station are

$IC_1 = 0.012P_{G1} + 9$, $IC_2 = 0.0096P_{G2} + 6$, $IC_3 = 0.008P_{G3} + 8$,
$IC_4 = 0.0068P_{G4} + 10$ and $IC_5 = 0.0054P_{G5} + 12$.

Assuming that all five units operate to meet the total plant load of 120 MW, find the output of each unit for economic dispatch. Neglect transmission losses. What is the incremental fuel cost of the power station ?

12

[b]Derive, from first principles, the conditions for the optimal dispatch of three generating units in a power plant, including transmission losses. 8

Q.2[a]Draw the s-domainblock diagram (governor-turbine-generator-load) for a two-area system operating on ACE. Assume standard notations. 8

[b]A generating unit is operating in steady-state at 50 Hz. Its characteristics are:

Rated capacity: 500 MW, operating load: 250 MW, D = 1.8 p.u, H = 5 secs.

The unit has 5 % regulation (governor droop 5 %) based on the generating unit capacity.

Find the final steady state frequency in Hz along with the increase in generationfollowing a 30 MW increase in load (i) without governor (ii) with primary frequency control and (iii) with secondary frequency control.

12

Q.3[a]Derive the expression of the power transfer capability of a transmission line with a SVC connected at the mid-point of the line. 8

[b] Two power control areas have the following characteristics:

Area 1: Rated MVA = 1500, speed regulation 'R' = 0.02 p.u, damping coefficient 'D' = 0.8 p.u.

Area 2: Rated MVA = 500, speed regulation 'R' = 0.025p.u, damping coefficient 'D' = 0.9p.u.

Determine the new steady-state frequency in Hz and the tie-line power change in MW following a load decrease of 120 MW in Area 1. 12

Q.4[a]A SSSC is connected in series with a transmission line. The SSSC is installed at the line sending end. Derive an expression for the reactive power exchanged by the SSSC converter with the line.

8

[b]A lossy STATCOM is connected to a load bus as shown in the equivalent circuit of Fig. 1.

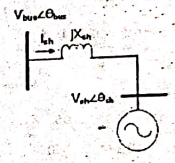

Fig. 1: Equivalent circuit of a STATCOM connected to a load bus

The STATCOM delivers a reactive power of 0.3 p.u. to the bus while absorbing an active power of 0.02 p.u to feed its losses. The load bus voltage is $V_1 = 0.98\angle 10^0$p.u while the leakage reactance of the coupling transformer is 0.15 p.u. Compute the STATCOM fundamental output voltage $V_{sh}\angle\theta_{sh}$.

12

Q.5[a] Elucidate, with V-I characteristics and P-δ curves, how a STATCOM is better than a SVC.

8

[b]Fig. 2 below shows a lossless UPFC, connected at the sending end of a transmission line between buses 1 and 2.

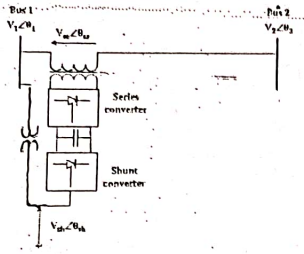

Fig. 2: UPFC connected at sending end of a line

The line reactance is 0.2 pu and the series converter coupling transformerleakage reactance is negligible. The bus voltages at the sending andreceiving end are $V_1 = 0.99\angle 12^0$ and $V_2 = 0.99\angle 4^0$.

(a)If the UPFC transmits0.85 p.u active power to the receiving end of theline at unity power factor, find $V_{se}$and θ_{se}.

(b)If the UPFC shunt converter delivers 0.2 p.u reactive power to the sending end bus, find V_{sh}. **12**

Q.6[a] Explain, with neat diagrams, why a UPFC is better than a SSSC. **8**

[b] Draw the three-phase physical connection diagram of a UPFC installed at the receiving end of a transmission line between two buses. **12**

Q.7 Write short notes on (any four): **4 x 5**

[i] How SSSC is immune to SSR, unlike TCSC

[ii] P-δ characteristics of a SSSC

[iii]Primary and secondary frequency control

[iv] Need for tight control of frequency and voltage around nominal values.

[v] Area control error

Total No. of Pages 2

Roll No. .....

M.Tech (C&I) SECOND SEMESTER

END SEMESTER EXAMINATION (May-2019)

EE-6123 NONLINEAR CONTROL THEORY

Time: 3 Hours *Maximum Marks : 100*

Note : Question No.1 is compulsory. Answer **ANY Four** from remaining questions.
Assume suitable missing data, if any.

1[a] Draw the output of the following nonlinear elements, whose input (x) vs output(y) characteristics are shown in Fig.1. Assume sinusoidal input $x(t) = X\sin t$.

(i) (ii)

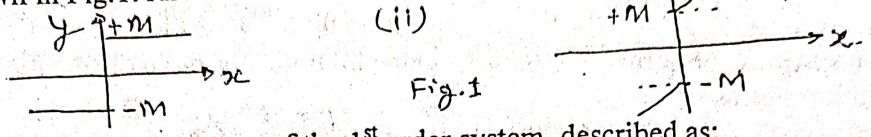

Fig.1

[b] Draw the phase plane trajectory of the 1st order system described as:

$$x + \dot{x} = 0.$$

[c] Check whether the LTI system described as:

$$A = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix}$$

Is stable or unstable?

[d] Write the Describing function for square type nonlinearity

$y=kx^2$.

[e] Find the sign of definiteness of the scalar function;

$V(x) = x_1^2+x_2^2+2x_1x_2$

[f] Write the P matrix for following scalar function and find sign of definiteness.

$V(x)= -x_1^2-3x_2^2-5x_3^2+2x_1x_2-4x_2x_3-2x_1x_3$

[g] Write the Lyapunov equation of stability for a LTI system.

[h] Find the singular point and state the type of singularity in the system described as :

$\dot{x}_1 = x_2; \dot{x}_2 = -x_1$

[i] Describe with help of appropriate equation 'Chaos' behavior in nonlinear systems.

[j] Describe the 'bifurcation' behavior in the nonlinear systems. **2×10**

2[a] For the nonlinear system described by the input output charactristics shown in Fig.2, derive the describing function, where y is output and x is input. **10**

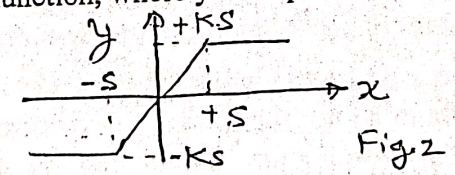

Fig.2

[b] Develop a state space model of the following nonlinear system:

$$\ddot{x} + 2x^2\dot{x} + 3(\dot{x})^2 + x = 0$$

And linearize the system about operating point (0.5, 1) and determine the stability in the neighborhood of the operating point. Identify the type of singularity in the system. **10**

3 Using Delta method sketch the phase plane trajectory on a linear graph paper and investigate the behavior of the following nonlinear system.

$\ddot{x} + x\dot{x} + 4x = 0$: assuming starting point (4,2).

20

4 Use Variable gradient method to construct a proper Lyapunov function for the nonlinear system described as:

$$\dot{x}_1 = -x_1 + 2x_1^2 x_2 \; ; \; \dot{x}_2 = -x_2$$

Assess the stability of equilibrium state of the system. **20**

5. Consider the system shown in Fig.3. The controller is a nonlinear controller . Assuming there is no input signal and the system is subjected to only the intial condition. Write the differential equation of the system for the following cases.

(i) the control signal $u = \pm 1$,(ii) The control signal can assume any value between 1 and -1.Find the equilibrium point of the system in both cases and determine the type of singularties. **20**

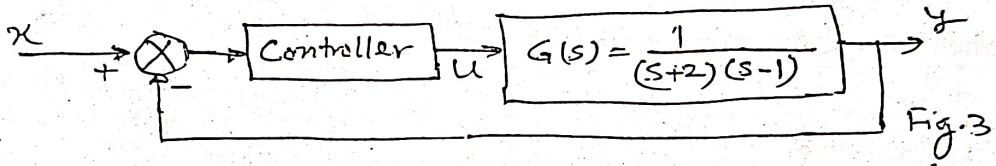

Fig.3

6 Determine the value of 'K' that exhibits a self-sustained oscillations in the system shown in Fig.4 ? If so what would be the frequency and amplitude of oscillations? Derive the describing function for nonlinear element also. **20**

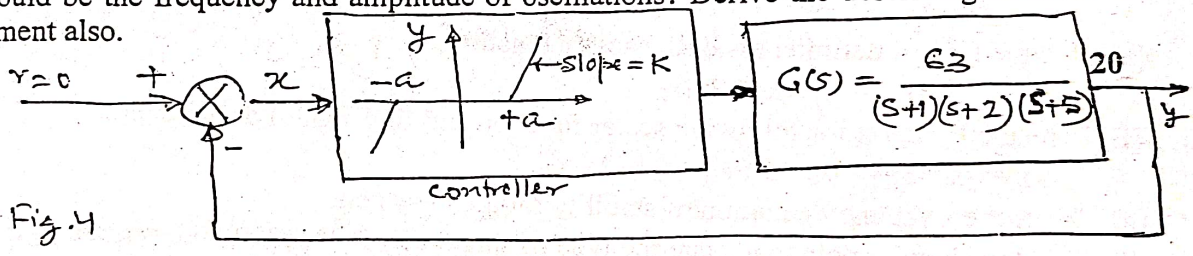

Fig.4

7. [a] Develop a suitable Lyapunov function for the LTI system described by.

$$\dot{X} = \begin{bmatrix} -1 & 1 \\ -1 & -1 \end{bmatrix} X + \begin{bmatrix} 1 \\ 1 \end{bmatrix} r$$

And determine stability of the system using Lyapunov direct method.

10

[b] Using polar coordinate system assess the existence and stability of limit cycle in the following nonlinear system.

$$\dot{x}_1 = -x_1 + x_2 + x_1(x_1^2 + x_2^2)$$
$$\dot{x}_2 = -x_1 - x_2 + x_2(x_1^2 + x_2^2)$$

10

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Total No. of pages 2 *Roll No. ....*

SECOND SEMESTER **M.Tech.(C&I)**

END SEM EXAMINATION **MAY 2019**

EE-6131 COMPUTER, COMMUNICATION AND CONTROL

Time: 3 Hours *Maximum Marks: 100*

Note: Question No. 1 is compulsory. Answer any four questions from remaining. All questions carry equal marks. Assume suitable missing data if any.

1. Write true or false and justify your answer : (10x2)

(a) Suppose a process error lies within the neutral zone with p = 50%. At t =0, the error falls below the neutral zone. If K = +2% per second, output will saturate after 20 seconds.

(b) There is an advantage in designing control systems many times faster than the process lag.

(c) Floating control mode is not suited to self-regulation processes.

(d) 'Interrupt' is a data conditioning technique.

(e) Three displays are used in DCS.

(f) RS-485 standard interface will be most suitable for system with following requirements:

(i) 1 transmitter & 1 receiver

(ii) 50 m line length

(g) Asynchronous transmission is cheaper and is useful to transfer low volumes of data Only.

(h) Small PLCs are used to control a plant with upto 500 I /O's and memories upto 10 Kbytes.

(i) All power plant control systems have six control subsystems.

(j). There are two factors which are considered for selection of PLC.

2. (a) A 5 m diameter cylindrical tank is emptied by a constant outflow of 1.0 m^3/min. A two position controller is used to open and close a fill valve with an open flow 2.0 m^3/min. For level control, the neutral zone is 1m and the set point is 12 m. (10)

(i) Calculate the cycling period

(ii) Plot the level vs time graph

(b) What is the role of computers in process control? Explain the elements of computer-aided process control system. (10)

3.(a) Classify computer-aided process control system based on architecture. Explain hierarchical computer control systems in detail. (15)

(b) Explain the benefits of using computers in process control. (5)

4. (a) What are main parts of a general purpose computer? Explain its working with a block diagram & schematic diagram also. Describe CPU in detail. (10)

(b) Explain various buses to be used in a computer. (10)

5. (a) Explain Analog to Digital converters. What are their types? Which one is suited for process control applications. (10)

(b) Consider a 3-bit ADC with an input voltage range of ± 10V. Convert the 6V, 7V and 14 V analog input values into digital values. (6)

(c) Consider a 12-bit DAC with an input voltage range of ± 10V. Convert the integer numbers 620 & 2000 into analog values. (4)

6. (a) Explain ISO reference model. Describe the layers which are used for process control applications. (10)

(b) Explain the design of software for process control systems in brief. (10)

7. (a) Define PLC. Explain the functional components of PLC. (5)

(b) If two of a three phases give supply to three –phase induction motor. Motor will work with poor efficiency. This condition is known as single phasing. To achieve this condition, design a ladder logic diagram (Any two phases out of thee phases may be connected at a time to operate the motor). (7)

(c) Describe overview of a Distributed Control System with diagram. Explain operator's console also. (5)

(d) Explain the computer control of liquid level system. (3)

Total No. of Pages 2

Roll No. .....

M.Tech (EE)

SECOND SEMESTER

END TERM EXAMINATION (MAY-2019)

EE-6511 ADVANCED POWER SYTEM DYNAMICS AND STABILITY

Time: 3 Hours

Maximum Marks : 100

Note : Answer any FIVE questions.
Assume suitable missing data, if any.

1(a).A 50Hz four pole turbo generator rated 20MVA ,11kV has an inertia constant H=9kW s/KVA.Find the kinetic energy stored in the rotor at synchronous speed.Find the acceleration, if the input rotational losses is 26800 HP and the electric power developed is 16 MW. (10)

1(b).Elaborate and justify the following statement: (10)

i)Voltage sensitivity depends upon network configuration

ii)Short circuit ratio has importance with respect to the performance of the machine and its cost.

iii)Reactive power close to load buses and critical buses is essential to overcome voltage instability.

iv)The quadrature shift can be achieved by providing suitable connection to the booster,called phase shifting transformer.

2(a).What are the factors influencing transient stability. Explain how the excitation improves the transient stability limit? (10)

2(b).A power station with four generators each 80MVA,8 MJ/MVA is in proximity with another power station having three generators each rated 200 MVA ,15 MJ/MVA.Determine the inertia constant of a single equivalent machine for use in stability studies.Assume a base value of 100MVA. (10)

3(a).Elucidate the small signal stability on multi machine system in the context of inertia constant. (10)

3(b).In which situation full load rejection technique employed for stability improvements.(10)

4(a).) A load of (15+ j10)MVA is supplied with power from a generating station from a line at 110kv 3 –phase 50 Hz.. The line is of 100 km length. The line is represented by π model with the parameters: R= 26.4 ohms, X= 33.9 ohm, B= $219 * 10^{-6}$ mho. Voltage at the generated in 116 kv. Determine the power supplied by the generating system. (10)

4(b).Explain the stability of loads leading to voltage collapse in interconnected power system. (10)

5.Write short note on any two of the following: (10*2=20)

i) IEEE definition of frequency stability
ii) Effect of damping torque components
iii) Problem of Multi machine stability

6.Answer the following questions and illustrate with suitable example if any . (5*4=20)

i) How does real and reactive power changes during system dynamics leading to voltage instability

ii)How to control actions of ULTC and generator limiters impact voltage stability.

iii)Explain the specific situation when load shedding become essential for transient stability improvement.

iv)Are shunt switch capacitors effective in remeding voltage collapse?

7(a).A generator rated 75MVA,delivering 0.8pu power to a motor through a transmission line of reactance j0.2pu.The terminal voltage of generator is 1.0pu and motor is also 1.0pu.Determine the generated emf behind the transient reactance.Also find out the maximum power that can be transferred. (10)

7(b).How does real and reactive power changes during system dynamics leading to voltage instability and method to mitigate the problem? (10)

Total no. of pages :02 Roll No._____

_____II_____SEMESTER M.Tech (Power Systems)

End Semester Examination MAY-2019

EE-6522 High Voltage DC Transmission

Time : 3 hours Max. Marks: 100

Note: Q1 is compulsory. Answer any 5 questions out of the remaining. All symbols have usual meaning. Assume missing data, if any.

Q1 Answer briefly:

a Show schematically how gating pulses can be generated for HVDC converters

b Discuss short circuit ratio and its impact on ac/dc system interaction.

c Draw and explain equivalent representations of rectifier model for (i) source impedance is neglected (ii) source impedance is considered

d Compare the voltage profile of the ac line vs HVDC link

e List the main features and application of VSC-HVDC system (5x4=20)

Q2a Compare the technical performance of HVDC systems over EHVAC systems.

b Compute the reactive power demand for HVDC converter if it is transmitting 1200MW at a DC link voltage of 500kV, assume $\alpha=15°$, $\gamma=18°$, $R_{cr}=R_{ci}=6\Omega$. Also discuss which reactive power sources may be chosen. (8+8)

Q3a Derive expressions for DC output voltage for HVDC converter with B bridges and transformer tap ratio, T. Hence compare six pulse vs twelve pulse HVDC converter system.

b The ac line voltage of a 3ph bridge rectifier is 150kV when delivering a DC power of 300MW. Assuming a delay angle of 30° and commutating reactance of 10 Ω, find the DC current in the link and the DC voltage on load. (8+8)

Q4a Draw a complete block diagram indicating basic control implementation for rectifier and inverter.

b The ac side line voltage of a 3phase bridge inverter is 160kV with $\gamma=20°$, $\mu=20°$, what is the DC link voltage. Also calculate the new extinction angle if the dc side voltage changes to 180kV with μ and ac side voltage remaining the same. (8+8)

Q5aExplain basic modes of converter control with suitable equations and diagrams. Also show how a converter can be controlled from rectifier mode to inverter mode.

b Prove: $\cos\phi \simeq 0.5 * (\cos(\alpha) + \cos(\alpha + \mu))$ where ϕ, α, μ denote the power factor angle, extinction delay angle and overlap angle respectively and have their usual meanings. Write a similar expression for inverter end. (8+8)

Q6a Derive the expression for impedance of a double tuned filter. Discuss how reactive power supplied by the filter can be computed.

b What is the role of dc filters in HVDC transmission? An HVDC converter station with DTF has the following parameters. $C_1 = 1.39\mu F, L_1 = 12.38mH, C_2 = 6.11\mu F, L_2 = 54.78mH$. Estimate which order harmonics are eliminated by this filter.

(8+8)

Q7a A dc transmission link connects two ac systems via converters and supplies 1000MW at Dc link voltage of 500kV at the inverter end. The effective reactance per phase of each converter is 15Ω and the loop resistance of the link is 10Ω. Converter I is operating as a rectifier on CC with α=15°, and converter II as inverter operating on CEA mode with ɣ=15°. Compute the pf and reactive power demand on the inverter bus. Also compute the rms value of L-L ac voltage, fundamental line current and reactive power demand on the rectifier bus. If the rectifier side ac bus voltage dips by 25%, will the controls shift. Discuss and compute the new reactive power demand on the inverter end taking current margin as 10%

(16)

-End-

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SECOND SEMESTER **M.Tech. [C&I]**

END SEMESTER EXAMINATION ***May-2019***

EE-6612 Intelligent Instrumentation

Time: 3:00 Hours ***Max. Marks: 100***

Note: Answer **ALL** question in Sequence. All questions carry equal marks. Assume suitable missing data, if any.

Q.1[a] Explain what the following are: (a) thermocouple, (b)continuous thermocouple, (c)thermopile, and (d)digital thermometer.

[b] The hot junction of a bare copper-constantan thermocouple is suddenly immersed in an oven at $200°C$ at constant temperature with its cold junction kept at $0°C$. The static sensitivity of the thermocouple is $40\ \mu V/°C$. The response of thermo- couple is shown in Fig.1. The step response of the thermocouple is given by $y(t) = K(1 - e^{-t/\tau})$. If the time constant of the thermocouple is $2\ s$, determine the dynamic error at $3\ s$. At what time will the dynamic error reduce to 1% of true value?

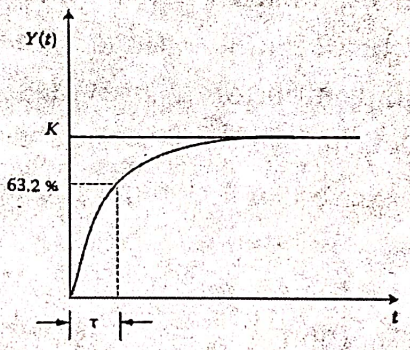

Fig.1

Q.2[a] Explain the working principles of a semiconductor thermal sensor and a Hall effect sensor. How do they work and what are they used for?

[b] An integrated circuit (IC) temperature sensor is connected to a measurement specimen surface with a contact area of $10\ cm^2$ and a gap of $0.5\ cm$ from the heating point. The heat developed is $5\ W$ with a heat conduction coefficient of $10\ W/m\,K$. If the temperature of the specimen is $75°C$, determine the thermal impedance of the specimen and input impedance of the sensor. Find the temperature at the sensor surface also.

Q.3[a] Explain the principle of operation of Resistance Temperature Detectors (RTDs) with Different methods of connection of RTDs.

[b] Velocity of electro neuro gram (ENG) signal of ulnar nerve of a human subject is determined by using two concentric needle electrodes positioned

over the wrist and just below the elbow (distance 62.5 cm). An electrical pulse of 100 mV amplitude and 100 μs duration is applied to the nerve and the signal sensed by the needle electrodes are filtered, amplified, and then converted to digital format by a 12-bit ADC with a sampling frequency of 500 Hz. The reference voltage is +5.0 V. Two sets of sampled data are shown below:

$E_1(n) = [5.2\ 5.3\ 5.1\ 5.4\ 6.5\ 6.2\ 5.5\ 4.7\ 4.3\ 4.4\ 4.3\ 4.2\ 4.1\ 3.8\ 3.5]\mu V$

$E_2(n) = [3.5\ 3.8\ 4.2\ 4.9\ 5.2\ 5.5\ 5.9\ 6.1\ 6.3\ 6.4\ 5.5\ 5.2\ 5.1\ 4.8\ 4.3]\mu V$

For n = 1–14, the peak detection and cross-correlation operation were performed on the samples data to determine the ENG velocity. Calculate (1) Cut-off frequency of LPF required to filter any high-frequency noise picked up by the electrode (2) ENG velocity by peak detection method (3) ENG velocity by CCF method (4) Amplification factor needed to amplify the signals for applying to the ADC

Q.4[a] Explain certainty factor of the decision table and coverage factor of the decision rule, also write their expression used in Rough Set Theory.

[b]Compare two sensors based upon their detection levels and gain settings. The following table of gain settings and sensor detection levels with a standard item being monitored provides typical membership values to represents the detection levels for each sensors.

Gain setting	Sensor 1 detection levels	Sensor 2 detection levels
0	0	0
20	0.5	0.35
40	0.65	0.5
60	0.85	0.75
80	1	0.90
100	1	1

The universe of discourse is $X = \{0, 20, 40, 60, 80, 100\}$. Find the Membership functions for the two sensors (1)$\mu_{s1 \cup s2}(x)$ (2) $\mu_{s1 \cap s2}(x)$ (3) $\mu_{s1}(x)$ (4) $\mu_{s2}(x)$ (5) $\mu_{\overline{s1} \cup s1}$ (6) $\mu_{\overline{s1} \cap s1}$ (7) $\mu_{s1 \cup \overline{s1}}$ (8) $\mu_{s1 \cap \overline{s1}}$

Q.5[a] Explain Autoregressive Moving Average with Exogenous Input models (1) FIR model (20 AR model (3) MA model (4) ARMA model (5) ARX model (6) ARMAX model (7) Box-Jenkins Model

[b] An optical rotational sensor produces a signal of frequency 1–5 kHz. Determine the measurement time and the counter sizes to measure the frequency by a micro- controller with 12-bit resolution.

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Total No. of Pages 02 *Roll No. .....*

SECOND SEMESTER

M.Tech.(C&I)

SUPPLEMENTARY EXAMINATION **May- *2019***

EE-6623 INTELLIGENT CONTROL

Time:3:00 Hours *Max. Marks :100*

Note: Attempt any FIVE questions. All questions carry equal marks. Assume suitable missing data, if any.

Q1[a]: [a] Explain Fuzzy P, Fuzzy PI, Fuzzy PD and Fuzzy PI+D controller. 10+10

[b] Explain the soft computing and hard computing terms. Give some examples of hard and soft computing.

Q2[a] Define 1-norm, 2-norm and ∞-norm of signals, vectors and matrices. Define local Lipschitz property also. 10+10

[b] What are the induced 1-norm, 2-norm and ∞-norm of the vector X and matrix A.

$$X=\begin{bmatrix}-9\\5\\6\end{bmatrix}$$

A= [2 1 -4; 3 7 2; 5 8 3]

Q3 Derive the equations of inverted pendulum system. Explain how the fuzzy logic controller can be implemented on inverted pendulum system using fuzzy logic toolbox. 20

Q4 [a] Explain the terms Regulation and Tracking used in control system. Give some examples also.

[b] Explain the neural network toolbox used in control system with the help of one example? 10+10

Q5 Explain the Rule list used in fuzzy logic toolbox. Take a washing machine example and derive the rule list. Take two inputs Grease and Dirt and one output. Use three trapezoidal linguistic variables for inputs and output. Draw all graphs and diagrams neatly. 20

Q6 [a] Explain Pre-processing, Fuzzification, Fuzzy Rule Base, Fuzzy Inference Engine, Defuzzification and post processing in Fuzzy logic controller. 10+10

[b] Discuss the term Intelligence and also Johnson and Picton's model with the help of neat diagram.

Q7 A fuzzy logic controller has inputs as error and change in error. Universe of discourse for error and change in error are from -5 to 5 and -2 to 2 respectively. Universe of discourse for output is from -10 to 10. All the membership functions are triangular. Linguistic variables for inputs and output are NB, Z and PB. Rule base is shown in table-1. 10+10

Table-1: Rule Base

Error	Change in error	Output
NB	NB	NB
Z	NB	NB
PB	NB	Z
NB	Z	NB
Z	Z	Z
PB	Z	PB
NB	PB	Z
Z	PB	PB
PB	PB	PB

Use Centre of area method to calculate crisp control signals u(t) when the error E(t) and rate of change of error CE(t) have the following values.

(a) E(t)=1, CE(t) = 1.5
(b) E(t)= -4, CE(t) = -1

Total No. of pages 01 Roll No.

SECOND SEMESTER M. Tech.[MOCE]

END SEMESTER EXAMINATION MAY-2019

EC-601 DIGITAL MICROWAVE COMMUNICATION

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

Answer Any FIVE Questions

Assume suitable missing data, if any

1. (a) Enumerate the characteristics of digital radio communication system highlighting the disadvantages of microwave transmission (10)
   (b) What are the challenges and opportunities for digital microwave communication? (10)

2. (a) Draw the inner structure of the outdoor unit and explain each block in detail (10)
   (b) Explain the major performance indexes of the transmitter and the receiver (10)

3. (a) Compare two passive relay stations? (05)
   (b) Derive an expression for propagation loss of electric waves in free space (05)
   (c) Explain the influence of ground reflection on receiving level? (10)

4. (a) Explain the different fading's caused by several atmospheric and earth effects (10)
   (b) Differentiate between microwave and optical fiber communication? (10)

5. (a) Derive an expression for SNR of a PCM system for a sinusoidal input. A PCM system uses a uniform quantizer followed by a 7 bit binary encoder. The bit rate of the system is 50 Mbps. What is the maximum message bandwidth for which the system operates satisfactorily? What is the SNR for a full load sinusoidal signal? (10)
   (b) We wish to transmit the data sequence 1 1 0 1 0 0 0 1 0 1 1 0 by a binary DPSK. Let $s(t)= A\cos(2\pi f_c t+\theta)$ represent the transmitted signal in any signaling interval of duration T. Give the phase of transmitted signal for the data sequence. Begin with $\theta=0$ for the phase of the first bit to be transmitted. If the data sequence is uncorrelated, determine and sketch the power spectrum density of the signal transmitted by DPSK. (10)

6 (a) Explain the working of QPSK transmitter and receiver with a neat circuit diagram (10)
   (b) Explain the operation and sketch of transmitter and receiver of a Delta modulation. (10)

7 Write short notes on any **TWO** of the following (2x10=20)
   (a) M-ARY PSK
   (b) QASK
   (c) Network topologies
   (d) Frequency converters

Total no. of Pages 02 *Roll No.....*

Second Semester **M.Tech.[MOC]**

END TREM EXAMINATION **May-2019**

Optical Communication System (Code: EC-6021)

Time: 3:00 Hours **Max. Marks : 100**

Note: Attempt any five questions. All questions carry 20 marks.

Q1: Compare the performance of UPSRs and BLSR/2s in cases where all the traffic is between a hub node and the other nodes. Assume the same ring speed in both cases. Is a BLSR/2 any more efficient than a UPSR in traffic-carrying capacity in this scenario? **20**

Q2: Design and explain reconfigurable OADM architectures using **10+10**
(a) A partially tunable OADM using a serial architecture with fixed-wavelength transponders.
(b) A fully tunable OADM using a parallel architecture with tunable transponders.

Q3: (a) What are the different elements of a SONET infrastructure? Show different SONET configurations including point-to-point, linear add/drop and ring configurations. **10+10**
(b) Explain the process of mapping of lower-speed asynchronous streams into virtual tributaries in SONET.

Q4: (a) Draw the block diagram of wavelength-routing PON (WRPON). What is the mechanism to route different wavelengths to different ONUs in the downstream direction, without incurring a splitting loss ? **10+10**
(b) Describe four types of fiber access networks? In which type remote node is located at the central office itself ?

Q5 (a) Explain the Optical CDMA architecture. Also design prime sequence based 1D and 2D encoder and decoder of OCDMA system. **10+10**
(b) Draw the structure of dual fiber bus topology. Explain its advantages and drawbacks.

Q6 (a) Explain the impact ionization in Avalanche photodiodes. Define photo multiplication factor and cutoff wavelength of the photodiode. 1
(b) Briefly describe linear scattering losses in optical fiber with respect to Rayleigh scattering and Mie scattering.

END SEMESTER EXAMINATION May - 2019

Paper Code: EC 6032 **RF MICROWAVE & MILLIMETER CIRCUITS**

Time : 3Hrs. *Max Marks : 100*

Note : Answer Any five questions.
Assume suitable missing data if any.
Use of Scientific Calculator is permitted.

Q. 1 [20]

Using Swartz christoffel transformation find the characteristic impedance of a symmetric strip transmission line. Give some idea how the characteristic impedance of a micro strip line can be found out using conformal mapping.

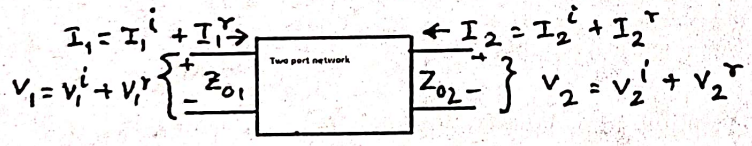
Q. 2 (20)

Using the concept of mode voltage and mode currents, show that for a lossless TE mode guide can be represented by a transmission line model with series inductance X=ωμ and shunt susceptance

$$B = \omega\epsilon - \frac{k_c^2}{\omega\mu}$$

Q.3 (6+7+7)

For the network shown.



Show that

i) $[S] = [Z-Z_0]\,[Z+Z_0]^{-1}$ where $[Z_0] = \begin{bmatrix} z_{01} & 0 \\ 0 & z_{02} \end{bmatrix}$

ii) $[T] = \begin{bmatrix} S11 - S22\,S11/S12 & S22/S12 \\ -S11/S12 & 1/S12 \end{bmatrix}$

iii) If the above network is reciprocal, show that

$$T_{11}T_{22} - T_{12}T_{21} = \frac{Z02}{Z01}$$

P.T.O.

Q.4 (20)

If an arbitrary cavity is excited by electric current density j at a frequency w, then show that the excited field at the frequency ω is given by

$$E = \sum_i \{ j\omega E_i / (\omega^2 - \omega_i^2) \} \iiint J . E_i^* dv$$

$$H = \sum_i \{ j\omega H_i / (\omega^2 - \omega_i^2) \} \iiint J . E_i^* dv$$

Where ω_i is the resonant frequency for the ith mode and E_i, H_i are the corresponding normalized field.

Q.5 (20)

A rectangular cavity is excited by a probe with current

$$J_x = I \frac{sink(d-a)}{sinkd} \delta(y-b')\delta(y-c') \quad x < d$$

$$0 \quad x > d$$

The normalized mode vector of the dominant mode is

$$E_0 = a_x \frac{2}{\sqrt{(\epsilon abc)}} \sin\frac{\pi y}{b} \sin\frac{\pi z}{c}$$

Find the input impedance and draw the equivalent circuit for the probe fed cavity in the vicinity of resonance

Q. 6 (5x4)

a) A lossless transmission line (l=0.6λ, z_0=50Ω). Is terminated in a load impedance (z_L= 40+j20) find the reflection coefficient at the load end, input impedance, VSWR on the line.

b) A lossless transmission line is terminated with a 200 Ω load. If the VSWR on the line is 2.0, find the possible value for the line's characteristic impedance.

c) A 50 Ω micro strip transmission line needs to be designed using a sheet of material ϵ_r=10 with h=1.02 mm. determine W, λ and ϵ_{ff}.

d) For a lossless transmission line, terminated in a reactive load Z_L=jx. Find the reflection coefficient and VSWR. What is $|\Gamma|$?

Total No. of Pages 2 Roll No. .....

SECOND SEMESTER M.Tech. (VLSI)

END SEMESTER EXAMINATION (MAY.-2019)

EC-611 EMBEDDED SYSTEMS

Time: 3 Hour *Max. Marks: 100*

Note: Answer ***Any Ten*** questions. All questions carry equal marks

Assume suitable missing data, if any.

Q1 (a) what is branch penalty? explain with reference to PIC. Find the size of the delay of the code given below assume that the clock frequency is of 4MHz.

			Instruction Cycle
DELAY	MOVLW	D '100'	1
	MOVWF	MYREG	1
HERE	NOP		1
	NOP		1
	NOP		1
	NOP		1
	NOP		1
	DECF	MYREG, F	1
	BNZ	HERE	2
	RETURN		1

(b) Explain the function of the following – Oscillator Start-up Timer (OST), Brown-out Reset (BOR).

Q2. (a) Write an assembly language program for PIC that finds the number of 1's in a given byte.

(b) With suitable diagram explain the architecture of a typical IO port of PIC. Also write suitable instructions to drive logic '0' at one of the port pins and show the path for driving logic 0 in the port architecture

Q3(a) Assuming that crystal frequency of 10 MHz. Write an assembly language program to generate a square wave with period of 10 ms on pin PORTB.3 of PIC 18 using Timer0

(b) Compare the pros & cons of two bus-protocols used in SSP module of PIC.

Q4(a) Compare the two external interrupts available in ARM ?

(b) With the help of suitable timing diagram explain the minimum interrupt latency in ARM.

Q5(a) Write an assembly language program for ARM that add the content of two 64-bit variable *value1* & *value2* and store the result in variable *Result1*.

(b) Explain the Full descending definition of Stack in ARM and write suitable instructions for push and pop operation for this Stack.

Q6(a) Explain Thumb mode architecture of ARM controller along its features? Write down its application?

(b)Explain the suitable set of instructions that facilitates ARM-Thumb Interworking.

Q7(a)What are pipeline hazards? How it affects the ARM7TDMI performance what is the solution adapted in ARM9TDMI architecture ?

(b) Does PIC support pipelining? Justify your answer with architectural feature & suitable timing diagram of PIC.

Q8(a)What is a cache memory? Discuss the operation of direct-mapped cache memory.

(b)List out the various configuration & control Components of MMU in ARM and explain the function of Translation Look-aside Buffer?

Q9(a)Compare the SHARC architecture with Princeton architecture.

(b) Explain the purpose of banked registers available in ARM core.

Q.10(a) Explain the advantages of conditional execution feature of ARM instruction set. Given below is a piece of code

```
        CMP     r0, #5
        BEQ     BYPASS
        ADD     r1, r1, r0
        SUB     r1, r1, r2
BYPASS  ..
```

Replace this code with the code having conditional execution feature.

(b)Why ARM instruction set is called as an open instruction set architecture explain?

Q11With the help of suitable diagram explain the architectural features of TI-C54x DSP.

Q12(a) Explain the PWM mode of CCP module in PIC microcontroller.

(b) Explain the most common features of DATA PATH of DSP.

Total No. of Pages *Roll No. .....*

M.TECH. (VLSI and Embedded Systems)

End Semester Examination **May, 2019**

EC-6122: Analogue Filter Design

Time: 3 Hours *Max. Marks: 100*

Note: Answer any five questions. Any missing data may be reasonably assumed. Symbols have their usual meanings.

Q.1 Assuming ideal op-amps determine an expression for $\frac{V_0(s)}{V_{in}(s)}$ and hence determine the condition(s) to realize (i) low pass filter (ii) high pass filter (iii) band pass filter (BPF) (iv) notch filter and (v) all pass filter. Also design BPF for the bandwidth of 5 KHz and cut-off frequency 10 KHz. (10+5+5)

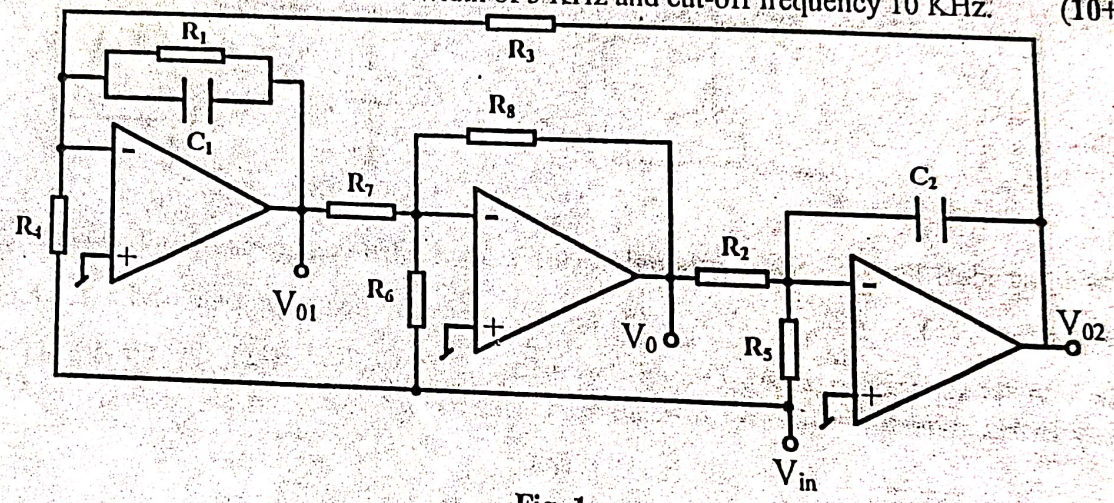


Fig. 1

Q.2 Derive the expressions for $\frac{I_{01}}{I_{in}}, \frac{I_{02}}{I_{in}}$ and $\frac{I_{03}}{I_{in}}$ for the circuit shown in Fig. 2. What modifications are required in the circuit so that the current mode transfer functions of notch and all pass responses can also be obtained and thus design the notch filter for cut-off frequency of 1MHz. (10+5+5)

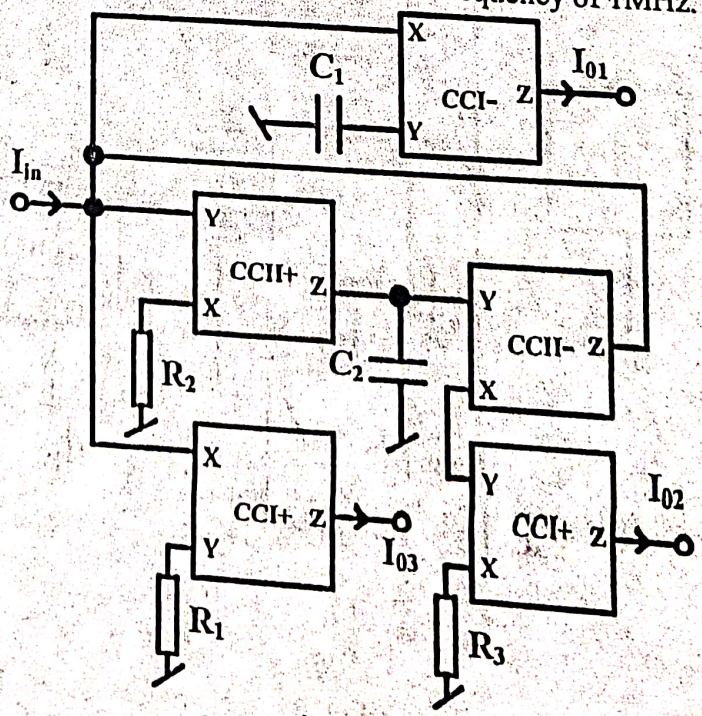


Fig. 2

Q.3 Determine V_0 in terms of input voltages (assuming ideal bipolar OTAs) hence obtain the condition(s) to realize (i) low pass filter (ii) high pass filter (iii) band pass filter (BPF) (iv) notch filter and (v) all pass filter (Fig. 3). Also design BPF for the bandwidth of 5 KHz and cut-off frequency 10 KHz. Given $\pm V_{CC} = \pm 9V$, $R_{b1} = R_{b3} = 20k\Omega$, $R_{b2} = R_{b6} = 25k\,\Omega$ and $V_{BE} = 0.7V$. (10+5+5)

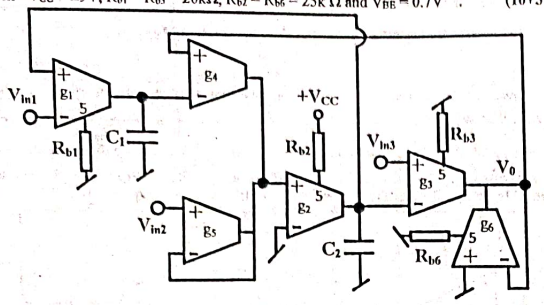


Fig. 3

Q.4 Assuming ideal bipolar second generation current controlled conveyors (CCCII±) determine the expressions for $T_1(s) = \frac{V_{01}}{V_{in}}, T_2(s) = \frac{V_{02}}{V_{in}}, T_3(s) = \frac{V_{03}}{V_{in}}$ and hence the type of the filters realized by these transfer functions (Fig.4). Design the realized LPF for R_6 = 1kΩ, Q_0 = 0.707 and cut-off frequency 1MHz given $I_{B1} = I_{B2} = 2.75\mu A$, $I_{B3} = I_{B4} = I_{B5} = 20\mu A$. (10+10)

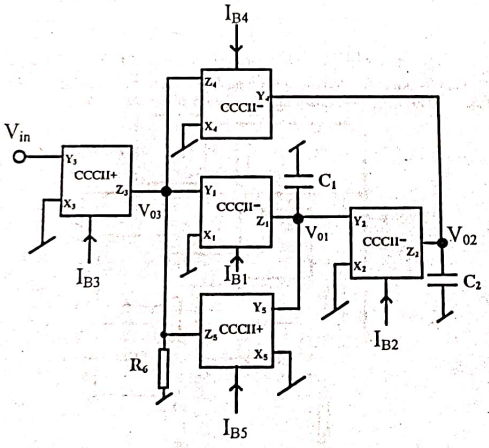


Fig. 4

Q.5 (a) Draw the switched-capacitor equivalence of the circuit shown in the Fig. 5 and hence determine the function performed by this equivalent circuit. (3+7)

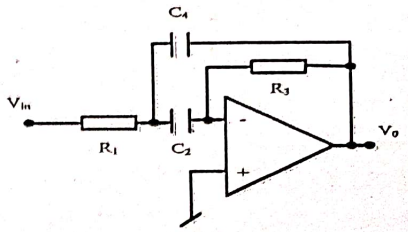


Fig. 5

(b) Determine V_0 as a function of V_{in1} and V_{in2} (assuming MOSFETs to be identical operating in triode region) and hence the function performed by the circuit of Fig. 6. (10)

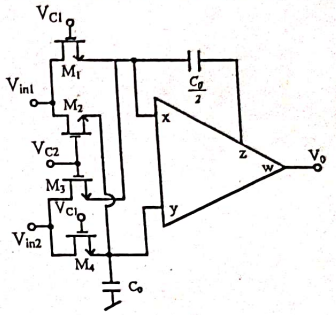


Fig. 6

Q.6 (a) Describe elimination of gain bandwidth conflict in current conveyor based inverting amplifier as compared to an inverting amplifier using conventional op-amp (5+5)

(b) Using Bruton's transformation design an optimal active filter based upon the passive proto type shown in Fig. 7. Show complete op-amps circuit with element values. Perform appropriate impedance scaling. (5+5)

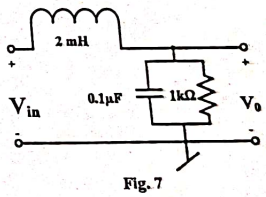


Fig. 7

Total No. of Pages-2 *Roll No.....*

SECOND SEMESTER **M.TECH.(VLSI Design & Embedded System)**

END TERM EXAMINATION

(May 2019)

EC-6131 DEEP SUBMICRON VLSI DESIGN

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

Note: Answer any **FIVE** questions.
Assume suitable missing data, if any.

1.

(a) Compute the gate sizes y and z to minimize delay in the path depicted by arrowed line in Fig. 1. **10**

(b) Compute rising and falling logical effort of a pseudo NMOS inverter. **5**

(c) Design adiabatic two input NAND gate and explain its operation in context of power saving. **5**

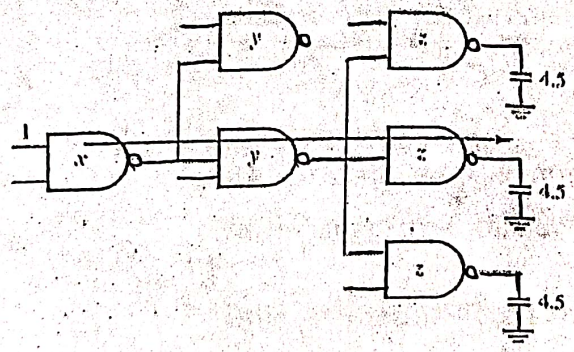


Fig. 1

2.

(a) Design a 16-bit linear square root carry select adder. Compute worst case delay and discuss the data flow from input to output. **10**

(b) How does modified Booth recoding help in improving multiplier performance? **5**

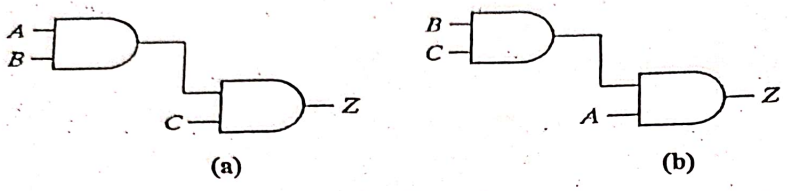
(c) Design a 4 bit barrel shifter using pass transistors. **5**

3.

(a) How does slack borrowing improve the performance of latch based clocking scheme? Aid your answer with suitable example. Can slack borrowing be used in register-based clocking? **10**

(b) Draw boolean decision diagram for Y = AB + BC + CA and synthesize it using MUXs. **5**

(c) Given that p(A) = 0.5, p(B) – 0.2, p(C) = 0.1, Compute probability of 0 to 1 transition for the circuits given in Fig. 2. 5



(a) (b)

Fig. 2

4. (a) Give architectural description of charge recycling bus and design the bus driver and receiver circuits using MOS transistors. Asses its power efficiency. 10

(b) How does memory bank partitioning and pulsed word line/ reduced bitline swing help in reducing power consumption in SRAM? Aid your answer with suitable diagrams. 5

(c) Considering same throughput from a parallel and pipelined processing system, which system will have better power efficiency and why? 5

5.

(a) Design a precomputation logic based 4-bit comparator. How does universal quantification help in identifying precomputation inputs. 10

(b) The pipelining improves throughput of the system. What is its effect on power efficiency? 5

(c) What are the criteria for deciding on locations of buffer insertion points (BIPs) in a clock tree? 5

6

(a) Design a double edge triggered flip flop and explain the percentage power reduction it achieves with respect to single edge triggered flip flop? Aid your answer with suitable mathematical formulation. Comment on effective throughput of single and double edge triggered flip flop. 10

(b) A 64 bit off-chip bus operating at 3.3V at 1GHz clock rate is driving a capacitance 0g 25pF/bit. Thirty-two most significant bits have toggling probability of 0.2 per clock cycle while for remaining bits the value is 0.3. What is the power dissipation in operating the bus? 5

(c) Determine the class of N, P and NPN equivalent Boolean functions of two variables. 5

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

SECOND SEMESTER
END SEMESTER EXAMINATION

M. Tech (SP&DD)
MAY 2019

EC-6225 Wavelet and Biomedical Analysis

TIME:03 Hrs **Maximum Marks:100**

Note:-
1) **Attempt any FIVE questions.**
2) **Assume suitable missing data, if any.**

1[a] What are the different types of EEG? Explain the different parameters of EEG. (8)

[b] Explain opening and closing operation of image with applications. Calculate opening and closing operation for (12)

$$A = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix} \qquad B = \begin{vmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{vmatrix}$$

2[a] Apply histogram equalisation to given image (6)

$$\begin{bmatrix} 7 & 1 & 5 & 1 \\ 3 & 0 & 0 & 6 \\ 2 & 4 & 4 & 7 \\ 4 & 0 & 1 & 3 \end{bmatrix}$$

[b] Calculate number of bytes required for a 256 x 256 Binary. Gray and Coloured image if 03 bits are used for intensity levels. (6)

[c] Prove that a mean filter can be used as low pass filter. (8)

3[a] Draw and explain structure of Double Density DWT. Write all conditions related to analysis and synthesis filter design, advantages and disadvantages of Double Density DWT. (8)

[b] Draw standard ECG waveform with different peaks/waves, segments and interval. Explain different waves, segments and interval with their duration and description. (12)

4[a] Draw and explain structure of Dual Tree Complex DWT. Write all conditions related to analysis and synthesis filter design, advantages and disadvantages of Dual Tree Complex DWT. (8)

[b] Draw different sub-bands of EEG waveform with different types of EEG. Explain different variables used in the classification of EEG activity. (12)

5[a] Explain different ECG and EEG artifacts in terms of their source, frequency range, relative amplitude, waveform and effect on ECG/EEG waveform. (10)

[b] What are the applications of derivative operators for edge detection in image? Explain the limitations of the derivative operators for edge detection in case of noisy image. (10)

6[a] Write short note on followings :- (12)

i. Separable filters and their advantages.
ii. Different approaches for dealing with edge problem of image.

[b] Explain the properties of the mask, used in following cases: -

i. Horizontal line detection
ii. Vertical line detection
iii. $+45^{\circ}$ line detection
iv. -45° line detection (8)

Total no. of Pages 1 *Roll No. .....*

SECOND SEMESTER **M.Tech. (SPDD)**

END SEMESTER EXAMINATION ***(MAY-2019)***

Blind Estimation Using Higher Order Statistics
(EC 6233)

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

Note : Answer ***Any Five*** questions.
Assume suitable missing data, if any.

1(a) Write the properties of cumulants.

1(b) Describe inverse modelling of a nonminimum phase system.

2(a) Describe Sato, Constant modulus, Benveniste Goursat and stop and go algorithms.

2(b) Compare the four algorithms given in 2(a).

3(a) Describe the Tricepstrum Equalisation algorithm.

3(b) Describe the decomposition of non minimum phase channel and channel estimation.

4(a) Describe the steps of EVA (eigen vector approach).

4(b) Describe the general BSS (blind source separation) problem and its assumptions for waveform preserving solution.

5(a) Describe two BSS methods based on second order statistics.

5(b) Describe in detail two BSS methods based on HOS (higher order statistics).

6 Define the following:- (a) Measure of source waveform preservation (b) Quality of the estimated mixing matrix (c) Interference of signal ratio (d) Degree of statistical independence (e) Computational complexity (f) Measure of tail lengths (g) Measure of asymmetry (h) AGTM (i) LMS (j) LTS.

Total No. of Pages: 2 -157-

II (Second) SEMESTER M.Tech. (ECE)

END-TERM EXAMINATION

EC 6512 (Photonic Switching and Networks)

May, 2019

Time: 3:00 Hours *Max. Marks: 100*

1. Consider a 8x8 Benes switch made up of 2x2 crossbar switches. For the following Input-Output connections, draw the Benes switching network and indicate the states of the crossbar switches (cross/bar) if a non-blocking switch is desired:

   1 - 7' 2 - 2' 3 - 4' 4 - 5'
   5 - 3' 6 - 8' 7 – 6' 8 – 1' [10]

2. What are the key attributes/features that should be evaluated while choosing an OADM for a particular WDM network? With the help of suitable figures, explain the classifications of the various OADMs employed in WDM networks. [10]

3. (a) Differentiate between circuit switching and packet switching based on the different kinds of delays encountered during the transfer of information. [5]

   (b) Explain the frame format for SONET (for STS-1) clearly indicating the fields, their lengths, and their functions. [5]

4. Design a (Δ, D) de-Bruijn graph where $\Delta = 2$ and $D = 4$, elaborating the labelling scheme of all nodes. Indicate all possible directed links between the nodes and label the links using $(D + 1)$ Δ -ary digits. [10]

5. Explain, with the help of suitable diagrams, the scheme of 'Dynamic Time-Wavelength Division Multiple Access' (DTWDMA) in WDM networks. [10]

6. (a) What is the difference between a strict sense and a wide sense non-blocking photonic switch? [5]

   (b) Prove that a Clos Switching Network is a strict sense non- blocking switch. [5]

7. Discuss the working principle of a Diffraction Grating as a WDM demultiplexer. Give appropriate diagrams and equations. [10]

   OR

Describe in detail the working principle of a Fabry Perot filter. [10]

8. Consider a network topology shown below where the cost of every path is indicated on the edge connecting two nodes. Apply the Djikstra's algorithm to find the shortest routes from Node '0' to all other nodes in the network. [10]

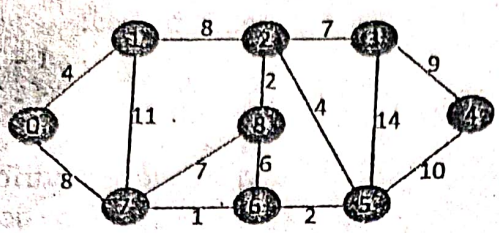


Fig. for Q. 8

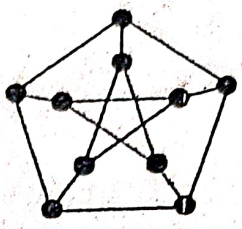
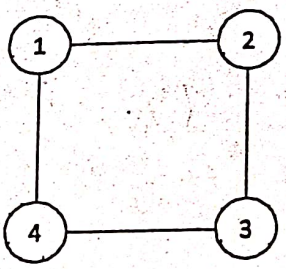


Fig. for Q. 9

9. Consider the auxiliary graph given above for a WDM network, where each node designates an edge in the virtual topology, and two nodes are connected if they have overlapping routes on the physical topology. Using the Graph Coloring Algorithm, assign different wavelengths to each node, to avoid collisions. [5]

10. Consider the following traffic matrix and physical topology for a 4-node network:

$$\begin{pmatrix} 0 & 0.60 & 0.20 & 0.50 \\ 0.45 & 0 & 0.90 & 0.10 \\ 0.15 & 0.10 & 0 & 0.80 \\ 0.25 & 0.75 & 0.35 & 0 \end{pmatrix}$$



** Each link in this physical topology is a bidirectional link (with one fiber running in both directions)*

It is given that each node has three transmitters and three receivers, and two wavelengths are available per fiber. Design a virtual topology for this network by employing Minimum Delay Logical Topology Design Algorithm (MLDA). [10]

11. Draw a (p,k) Shufflenet with p =2 and k = 4. Draw a table to indicate the number of nodes which are 'h' hops away where the values of 'h' vary from 1 to '2k-1'. [10]

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

SECOND SEMESTER M.Tech . (MOC)/PhD

END SEMESTER EXAMINATION (*May-2019*)

EC 6522 OPTICAL ELECTRONICS

Time: 3 Hour *Maximum Marks: 100*

Note: *Attempt all questions. Assume suitable missing data, if any.*

1. (a) Define optical parametric oscillators. Find the condition for parametric amplifier to become an oscillation. [5]

   (b) In media possessing centro-symmetry, the second order nonlinearity is absent. Comment on this statement. Write down the special consequences of nonlinear media. [5]

   (c) Why magnitude of nonlinearity in optical fiber is much higher than that in bulk material. [5]

   (d) Calculate the reduction in the efficiency of SHG generation with following inputs. [5]

   n_2-n_1 = 0.01, λ= 1μm and z = 1 cm

2. (a) Show that a slight deviation from the phase matching angle can lead to significant reduction in the SHG conversion efficiency. [10]

   (b) Show that the process of non-linear second harmonic generation follows the conservation of photons. [10]

3. (a) Briefly explain the acoustooptic effect. Show that the under Raman-Nath diffraction amplitudes of m^{th} order diffracted waves at angle $sin^{-1}\left(\frac{m\lambda_0}{n_a\Lambda}\right)$ are given by $E_0 J_m(\phi_1)$. [10]

   (b) Define optical parametric oscillator. Also derive the expression for required threshold power for designing the singly resonant optical parametric oscillators. [10]

4. (a) Explain the propagation of the light having power P through a medium showing third-order nonlinearity under all possible conditions: ($P > P_{cl}$, $P < P_{cl}$, $P = P_{cl}$) using suitable ray diagram. Find out the mathematical expression of minimum power (P_{cl}) needed for this action. [10]

(b) Light from a high-power laser source of power 10 MW enters into an optical fiber having core diameter 5 μm and $n_2 = 3.2\times10^{-20}$ m^2 W^{-1}. Calculate the maximum change in the refractive-index at the centre of the core. [5]

(c) Explain the phenomenon of self-phase modulation. Calculate the minimum power required for the change in the phase of the incident light by a factor of π with following inputs (Symbols have their usual meanings).

L =1 m, A= 10^{-2} mm^2, $n_2 = 10^{-10}$ cm^2/W, $\lambda = 1$ μm. [5]

5. (a) What do you mean by parametric interactions? Write down the Master equation for three wave mixing. Establish the Manley Rowe condition for three wave mixing. [10]

(b) The KDP crystal is a uniaxial in the absence of an applied field

$$\epsilon_0 \sum_{i,j=1}^{3} K_{ij} x_i x_j = 1$$

Find out the index ellipsoidal in the presence of external applied field, if the electro-optic coefficient $r_{lk} = 0$ except for r_{41}, r_{52} and r_{63} and $n_x = n_y = n_o$ and $n_z = n_e$. [5]

(c) Explain the longitudinal or transverse arrangement for the modulation. Under this modulation, find out the relative change in the refractive-index along new $x' - y'$ axis. [5]

Total No. of Pages: 01
M.Tech. (VLSI Design)
End Term Examination

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Roll No.....
Second Semester
May-2019

EC-6613: RF CIRCUITS IN CMOS TECHNOLOGY

Time: 03 hours **Max. Marks: 100**

Note: All Questions are compulsory.
Assume suitable missing data, if any.

1. [a] State five different effects of non-linearity which are observed in radio frequency circuits in CMOS technology. [5]
   [b] Compare and contrast cross modulation and intermodulation. [15]

2. [a] Derive expression for AIIP3 for cascaded nonlinear stages. [10]
   [b] Can cross modulation occur when the interferer is a FM signal? Prove mathematically. [10]

3. [a] Derive Friis equation. [10]
   [b] Explain constant-LO downconversion mixing and constant-IF downconversion mixing. Which is better and why? [10]

4. [a] What is the difference between an active RFID tag and a passive RFID tag? Explain how data is transferred between an RFID tag and a reader? [10]
   [b] What is cognitive radio? Explain its importance w.r.t. the modern RF wireless communication systems. [10]

5. Write short notes on: [10]
   [a] IoT technology
   [b] 5G technology [10]

-END-

Total No. of Pages:02

Roll No. :

M.TECH/PH.D (VLSI & EMBEDDED SYSTEM DESIGN)

SECOND SEMESTER

END SEMESTER EXAMINATION

MAY 2019

EC-6623: TESTING AND DIAGNOSIS OF DIGITAL SYSTEM DESIGN

Time:03 Hours

Maximum Marks:100

(Answer any five questions from the following. All questions carry equal Marks .Answer should indicate the Question No. & its part ,if any. Preferably all the parts of the same Question may be answered together.)

Q1: (a) Define Singular Cover, Propagation D-cube, Primitive D-cube of a fault as per D- algorithm.

(b)Enumerate the four important steps of the PODEM algorithm.

(c) Explain the advanced concepts of FAN algorithm based on Bound-lines, Free & Head-lines.

(d) Cite the important differences between PODEM & FAN algorithms.

Marks:3+6+8+3=20

Q2: (a) Explain why the designing of Checking Experiments in a Moore-model FSM is a difficult problem. How an augmented machine with one extra input & one extra output terminal be used to incorporate a Mealy-machine with counter-cycle which can overcome the difficulties mentioned above. Also, justify how would the fault that increases the number of states of the machine be detected & diagnosed.

Marks:20

Q3: (a) What is the Stuck-open fault in CMOS digital integrated circuit, illustrate the same for a two input CMOS NOR gate.

(b) What do you mean by Reed Muller Canonic expansion of a switching function. Obtain the RMC form of the Boolean function: f(W,X,Y)=WX+W'Y+X'Y'. Justify & cite the test set patterns to detect the all possible stuck-at faults in the RMC form of digital circuits.

Marks:8+12=20

Q4: (a) Illustrate the work flow of simulation in the design process and narrate the design verification and fault analysis part of the logic simulation.

(b) How would you tackle the fault insertion, fault mapping, and fault coverage in the Behavioral fault simulation case.

Marks:8+12=20

Q5 (a) Explain what is called BIDCO. By drawing a neat diagram of a BILBO, explain its function in four modes of operation.

(b) Illustrate the principle of Generic BIST Scheme. Also indicate the advantages of the BIST over the conventional testing.

Marks:10+10=20

Q6: (a) Illustrate the work flow for designing the hardware with BIST.

(b)Illustrate the principle of scanning in embedded system with one internal scan register & two boundary scan registers. What is IEEE 1149.1 standard TAP. How does this standard be useful for the purpose of the above mentioned scanning.

(c) Explain with suitable diagram how do the scan design adopts the separation of the combinational modules from the memory modules for the ease of testing.

Marks:5+10+5=20

Q7: Write a short notes on any TWO of the following:

(a) BIST for RAM and ROM.

(b) Designing of the Totally Self Checking Circuits.

(c) Syndrome in Logic circuits & Principle of Syndrome testing.

Marks: 10+10=20

Total No of Pages 02 Roll. No.....

II[ND] SEMESTER M.TECH (SPDD)

END SEMESTER EXAMINATION MAY-2019

EC-6713 Object Tracking

Time: 03: 00 Hours Max.Marks: 100

Note: *Answer any five questions.*

Q1(a) What are the major issues in single object Tracking? What are complexities involved when we try to track multiple objects? (8)

(b) What are various tracking parameters? What is significance of Precision & Recall? (8)

(c) Differentiate between deterministic and non-deterministic tracking methods? (4)

Q2 (a) What are the performance criterion for any edge detector? What are the major problems encountered in edge detection process? What is the difference between first and second order detectors? Explain the Canny edge detector in brief. (12)

(b)What are linearly separable filters? Explain with suitable example. Are Gaussian filters linearly separable. (3)

(c) Apply following operations on given 2D matrix using 3x3 sampling window (5)

i) Median filtering

ii) Average filtering

5	3	0	1	2	1
7	2	7	2	2	3
1	0	1	0	1	0
1	7	1	0	2	2
2	5	3	1	2	5
1	1	4	4	6	0

Q3. (a) What do you mean by affine transformation? Write the matrices in homogenous form for following affine transforms in 3D:

i) Translate ii) Scale iii) Shear iv) Rotation about x-axis (10)

(b) What is SIFT feature descriptor? How scale invariance is achieved in SIFT ? What is the advantage of scale invariance? (10)

Q4(a) Explain the RANSAC algorithm for detection of lines. Can RANSAC give different results every time it is run on the same data set? What are the strength and limitations of RANSAC? (10)

(b)What is probabilistic framework for tracking objects with linear motion? What are the main steps in implementing Kalman filter? How the noise and measurement error influence the prediction of next state in Kalman filter? (10)

Q5(a) What is HOG feature descriptor? How HOG can be used for human detection in an image? (10)

(b) What is PCA? How it can be used for face representation or recognition? (10)

Q6.How objects with non-linear motion can be tracked? Explain the particle filter based method in detail and compare the particle filter with other options. What are the major problems encountered in particle filter implementation? How these problems are solved? (20)

-END-

Total No. of Pages :02 Roll no _____

II-SEMESTER M.Tech (SPDD)

END SEMESTER EXAMINATION May 2019

EC- 6723 PATTERN ANALYSIS AND MACHINE INTELLIGENCE

Time: 3:00 Hours Max. Marks: 100

Note: Answer any FIVE questions.
Assume suitable missing data, if any.

1. a) What are the various applications of pattern Recognition Systems? Also discuss the various issues involved in Pattern recognition systems.

b) Derive the probability of misclassification for the two-class problem.

c) Find the SVD of given matrix A.

$$A = \begin{pmatrix} 3 & 2 & 2 \\ 2 & 3 & -2 \end{pmatrix}.$$

d) Consider the data items bought in a supermarket. The features include cost of the item, size of the item, colour of the object and the class label. The data is shown in the following table. Which feature would you like to use for classification? Why?

Item no.	Cost in rs	Volume in cm3	Color	Class Label
1	10	6	Blue	Inexpensive
2	15	6	Blue	Inexpensive
3	25	6	Blue	Inexpensive
4	150	1000	Red	Expensive
5	215	100	Red	Expensive
6	178	120	Red	Expensive

(5+5+5+5=20)

2. a) Consider the k-observed feature variables, such that

$$r_k = m + n_k, \quad k = 1,2,\dots,K$$

Where m is unknown and n_k are statistically independent zero mean Gaussian random variables with unknown variance, σ^2.

(i) Find the maximum likelihood (ML) estimates for m and σ^2, respectively.

(ii) Is ML estimate unbiased?

b) Find a basis and rank for the row space of the given matrix A.

A= [3, 4, 0, 7; 1, -5, 2, -2; -1, 4, 0, 3; 1, -1, 2, 2]

c) Write short notes on unbiased estimator. **(10+5+5=20)**

3. a) Given two different classes, w1(5x2) and w2(6x2) have (n1=5) and (n2=6) samples respectively. Each sample in both classes is represented by two features as follows. Compute the linear discriminant projection of the two-dimensional data set.

w1=[(1,2) (2,3) (3,3) (4,5) (5,5)]

w2=[(4,2) (5,0) (5,2) (3,2) (5,3) (6,3)]

b) Explain how support vector machine can be used to find optimal hyperplane to classify linear as well as nonlinearly separable data. Give suitable examples. **(10+10=20)**

4. a) With suitable example describe the various methods used to measure the similarity between clusters.

b) Discuss briefly on divise and agglomerative clustering.

c) Describe briefly about Gaussian Mixture model. **(6+8+8=20)**

5. a) What are the various methods to evaluate the classifier performance.

b) To which category of clustering schemes does the *k*-means algorithm belong? What is its major advantage? Which are the factors that influence the computational duration of this algorithm? Apply K-means algorithm on given data for k=3, use c1(2), c2(16), c3(38) as initial cluster centers. **Data:** 2,4,6,3,31,12,15,16,38,35,14,21,23,25,30

c) When do we use KNN algorithm? How does KNN algorithm works? **(4+10+6=20)**

6. a) What do you mean by Reinforcement learning? How it is different from supervised and unsupervised learning?

b) Define ICA. Also Mention the difference between PCA and ICA.

b) Find PCA of the given data.

(x, y) = {(2.5,2.4), (0.5,0.7), (2.2,2.9), (1.9,2.2), (3.1,3.0), (2.3,2.7), (2,1.6), (1,1.1), (1.5,1.6), (1.1,0.9)} **(8+4+8=20)**

Total No. of Pages-02 Roll No.....

COURSEWORK **Ph. D 2019**

END SEMESTER EXAMINATION ***May 2019***

HU-703 ECONOMETRICS

Time: 3:00 Hours *Max. Marks: 60*

Note: Attempt any three questions.
All questions carry equal marks.

1. What is serial correlation? What are the nature, causes, consequences, detection mechanisms and remedies of serial correlation?

2. What is heteroscedasticity? What are the nature, causes, consequences, detection mechanisms and remedies of serial correlation?

3. What are autoregressive models? Explain. What is the difference between autoregressive and moving averages processes?

4. You are given the following regression results:

$\hat{Y}t = 16{,}899 - 2978.5X2t \qquad R2 = 0.6149$

$t = (8.5152) \quad (-4.7280)$

$\hat{Y}t = 9734.2 - 3782.2X2t + 2815X3t \qquad R2 = 0.7706$

$t = (3.3705) \quad (-6.6070) \quad (2.9712)$

Find out the sample size underlying these results? Explain how you reached these results.

5. From data for 101 countries on per capita income in dollars (X) and life expectancy in years (Y) in the early 1970s, Sen and Srivastava obtained the following regression results*:

$\hat{Y}i = -2.40 + 9.39 \ln Xi - 3.36\ [Di(\ln Xi - 7)]$
se = (4.73) (0.859) (2.42) $R2 = 0.752$
where $Di = 1$ if $\ln Xi > 7$, and $Di = 0$ otherwise. *Note:* When $\ln Xi = 7$, X= $1097 (approximately).

i. What might be the reason(s) for introducing the income variable in the log form?

ii. How would you interpret the coefficient 9.39 of $\ln Xi$?

iii. What might be the reason for introducing the regressor Di $(\ln Xi - 7)$? How do you explain this regressor verbally? And how do you interpret the coefficient −3.36 of this regressor (*Hint:* linear piecewise regression)?

iv. Assuming per capita income of $1097 as the dividing line between poorer and richer countries, how would you derive the regression for countries whose per capita is less than $1097 and the regression for countries whose per capita income is greater than $1097?

v. What general conclusions do you draw from the regression result presented in this problem?

Total No. of Pages- 1 Roll No.----------

First Semester Ph. D. Course Work (Elective)

END SEMESTER EXAMINATION May 2019

HU - 702: Engineering and Technology for Inclusive Growth

Time: 3 Hours Max Marks: 60

Note: Answer any five questions.
Assume suitable Missing data, if any

1.	What do you mean by Sustainable Development Goal (SDGs)? How it is different from Millenium Development Goal (MDGs)? Discuss.	6+6=12
2.	Why technology is required by the lower strata of the society? Discuss a framework through which State after liberalization and globalization can provide technology to them? Discuss.	8+4=12
3.	What do you mean by Inclusive Growth? Discuss role of engineering and technology in Inclusive Growth.	4+8=12
4.	Discuss theories of Economic Growth which suits a labour surplus country like India.	12
5.	Critically examine the role of University Social Responsibility (USR) for inclusive growth.	12
6.	Why there is need of discussing issues of agriculture to achieve inclusive growth in India? Suggest some technological measures which may be taken in agriculture to achieve inclusive growth.	6+6=12
7.	Discuss issues of a developing country like India which needs help and assistance from the International organisations to achieve inclusive growth? Discuss with suitable examples.	12

-End-

Total no of pages: 01
Course Work
END SEMESTER EXAMINATION

Roll no.....
Ph.D
MAY 2019

HU-704/ Criticism in Practice

Max. Marks:70

Time: 03 Hours

Answer the following questions:

1. Show your acquaintance with any two of the following:(10x2=20)
   a) Historical sense in appreciation of poetry
   b) Impersonality theory of art
   c) Lihaaf as a metaphor
   d) Setting of the novel, *The Color Purple*

2. Evaluate Eliot as a modernist critic with special reference to his essay, "Tradition and Individual Talent". (20)

   OR

   Bring out the major arguments contained in Said's *Orientalism.*

3. Write a critical note on the European bias with special reference to Chinua Achebe's "Colonialist Criticism". (20)

   OR

   Attempt a critique of the essay, "Imaginary Homelands" by Salman Rushdie.

4. "*The Color Purple* by Alice Walker is a critique of racism and sexism". Comment. (10)

   OR

   Attempt *Mitro Marzani* by Krishna Sobti as a feminist reading.

-END-

Total no of pages: 01
Course Work
END SEMESTER EXAMINATION

Roll no.....
Ph.D
MAY 2019

HU-706 Retellings of Indian Myths and History

Max. Marks:70 **Time: 03 Hours**

Answer the following questions:

1. Write a critical note on the retellings of myth with special reference to the texts prescribed in your syllabus. **(15)**

   OR

   Comment on the creative significance of retellings of myth.

2. *"Ahalya* is a creative work of inversive stereotyping". Comment. **(20)**

   OR

   Comment on reimagining of Sita in *Sita Sings the Blues.*

3. Critically evaluate the character of Karn as portrayed in Dinkar's *Rashmirathee*. **(20)**

   OR

   Write a note on the narrative style of Amish Tripathi with special reference to his *Sita: The Warrior of Mithila*.

4. Show your acquaintance with <u>any two</u> of the following: **(7.5x=15)**
   a) Cinema as a medium of rewriting history
   b) History on Screens: To be or not be?
   c) Character of Khilzi
   d) Critique of the movie, Mughal-E-Azam

-End-

Total No. of Page 03 *Roll No. .....*

SECOND SEMESTER **M. Tech. (PE)**

END SEMESTER EXAMINATION *May-2019*

ME-601 Theory Of Metal Cutting

Time: 3:00 Hours ***Max. Marks: 100***

Note: Answer any FIVE questions.
Assume suitable missing data, if any.

1a Explain Lee and Shaffer's slip line method of determining the shear plane angle. State the assumptions made. 10

1b What are ploughing forces? Show that in metal cutting when the normal rake angle is zero, the ratio of the shear strength of the work material τ_s, to the specfic cutting energy P_s is given by: 10

$$\frac{\tau_s}{P_s} = \frac{(1-\mu r_c) r_c}{1+r_c^2}$$

where μ = coefficient of friction
r_c = cutting ratio

2a What is Stabler's chip flow rule? Discuss the various methods employed to determine the chip flow angle. 7

2b Why is cutting ratio in oblique cutting slightly different from that in orthogonal cutting? In an oblique cutting operation the angle of obliquity is 20° and the rake angle ground on the tool is 10°. Determine the effective rake angle. 7

2c What are the characteristic features of lapping and honing? 6

3a Evaluate the average shear plane temperature for machining mild steel at a cutting speed of 2m/sec with a 10° rake angle tool, the width of the cut being 2 mm and the undeformed chip thickness 0.25mm. The apparent shear strength of the material is $400 \times 10^6 N/mm^2$. Given $\rho = 7200 Kg/m^3$, $C = 502 J/Kg°C$, $\mu = 0.5$ and fraction of heat going into the chip = 0.85. 5

3b What are the various methods for measuring the chip tool interface temperature? Explain the tool work thermocouple technique with a neat sketch. 7

3c State some of the limitations of using cutting fluid. Why are cutting fluid filter systems becoming more common and what are their advantages? 8

4a Which cutting fluid would you recommend for the machining of the following materials? 8
(i) Cast Iron
(ii) Aluminium
(iii) Copper alloys
(iv) Stainless steel

4b Discuss the different mechanisms of tool wear. Show diagrammatically the variation of flank wear of cutting tool with time and explain its importance from the tool life point of view. 12

5a What is Tool life criteria? An automatic lathe is to be used to machine brass components 75 mm long x 50 mm diameter using a depth of cut of 1.25 mm. Assume that 10
Labour + Overhead rate = Rs. 5/hr
Reconditioning cost of the tool edge = Rs 0.25/edge
Loading and unloading time of the workpiece =15 sec.
Tool change time =5 min.
Feed =0.2 mm/rev.
Tool life relationship $= VT^{0.25} = 300$
Calculate
(i) Optimum cutting speed for minimum cost
(ii) Corresponding tool life
(iii) Optimum cutting speed for maximum production rate and,
(iv) Corresponding tool life

5b What are the restrictions that are imposed on optimum cutting conditions? Explain the effect of restrictions with the help of a figure. 10

6a How is the hardness of the wheel affected by grinding conditions? Derive the expression used. 8

6b Why are specific energy values so much higher in grinding than in traditional metal cutting processes? 6

6c Grinding creates high temperatures. How is temperature harmful in grinding? What is the role of cutting fluid in grinding? 6

7 Write short notes on any FOUR of the following 2
(i) Merchant's modified theory
(ii) Friction in metal cutting
(iii) Methods of applications of cutting fluids
(iv) Grinding wheel wear
(v) Salient features of cutting tool materials
(vi) Machinability criteria

-END-

Total No. of Pages 02

Roll no.....

SECOND SEMESTER

M.Tech.

END SEMESTER EXAMINATION

May-2019

ME-6021 Industrial Quality Control

Time: 3:00 Hours

Max. Marks : 100

Note: Answer any **FIVE** questions; assume missing data if any.

1a For a company manufacturing casting for automobile sector, develop a cause and effect diagram of casting defects. With a suitable hypothetical data, perform pareto analysis. 10

1b Develop Affinity diagram of the expectations regarding quality education of post graduates students of engineering in the university. 10

2a Explain Producer's Risk and Consumer's Risk. What is Ideal OC curve? Draw the flow chart and OC Curve of Double Sampling Plan. 10

2b What is Average outgoing quality (AOQ)? With the help of a diagram explain the concept of AOQ level and discuss its shape. 10

3a Design a Sequential sampling plan for the following parameters 10

$\alpha = 0.05$ $\beta = 0.25$

$p_1 = 0.10$ $p_2 = 0.35$

Also compute:

(i) Average outgoing quality when $p=p_1$

(ii) Minimum number of items inspected for accepting the lot

(iii) Minimum number of defectives for rejecting the lot.

3b What is six sigma methodology? Explain Gage R&R and Box Plot. 10

4a Define Maintainability and availability and compare it with reliability. Explain bathtub phenomenon and correlate it with Weibull distribution. 10

4b The time to wear for a cutting tool is distributed normally with a mean of 2.8 hour and standard deviation of 0.6 hour. Find the probability that the tool will wear out in 1.5 hours. Calculate the reliability for 1.5 hours. How often the cutting edge of the tool must be replaced in order to keep the failure less than 10 percentage? 10

5a In a Double Sampling Plan- N=5000; n1= 100; c1= 0; n2= 100; c2= 2 10

(i) Compute the probability of acceptance of 1% defective lot

(ii) Calculate Average Total Inspection per lot

5b Calculate the probability of survival of a piece of equipment that is to operate for 500 hours and which consists of four subsystems having the following MTBFs 10

Subsystem A	MTBF= 5,000 hours
Subsystem B	MTBF= 3,000 hours
Subsystem C	MTBF= 15,000 hours
Subsystem D	MTBF= 15,000 hours

6a Briefly discuss the Kano model of understanding the customer needs. 5

6b Apply the following steps with justification of Quality Function Deployment (QFD) for any product or process of your choice: 15

(i) Voice of the customer

(ii) Company Measure/ Voice of the manufacturer

(iii) Correlation matrix of company measures

(iv) Relationship matrix of customer requirements and company measures

7a Briefly discuss the principles of quality management as given in ISO 9000:2015. 10

7b What do you understand by Risk Based Thinking? Discuss in the context of ISO 9000: 2015. 10

Total no. of pages: 01 -177- Roll No._____

II SEMESTER M.Tech (ME)

END SEMESTER EXAMINATION MAY-2019

ME-6031 Advanced machining processes

Time: 3 Hours Max. Marks: 50

Note: Attempt any five questions. All questions carry equal marks.
Assume missing data, if any.

1 (a) Explain the working principle of abrasive jet machining (AJM) process with neat diagram. Why AJM is not recommended for machining of ductile materials?

(b) Enlist the requirements that demand the use of advanced machining processes. Discuss the important factors that should be considered during the selection of an unconventional machining process for a given job.

2 (a) Describe the working principle of ultrasonic machining (USM) process with neat diagram. Draw the relationship observed during USM for the following cases: (i) frequency vs penetration rate (ii) grain size vs machining rate (iii) concentration vs machining rate.

(b) With the help of neat diagram, explain the working principle of abrasive flow machining (AFM) process. How the restriction offered by passageways governs MRR? Make necessary sketches.

3 (a) Explain the working principle of magnetic abrasive finishing (MAF) with neat sketch. Clearly show line of magnetic force, magnetic equipotential lines, direction of pressure acting on the work-piece, direction of rotary motion.

(b) Describe the production of laser beam and working principle of laser beam machining (LBM). Also discuss the effect of focussing on the performance of LBM.

4 (a) With the help of neat sketch, explain the mechanism of material removal in electric discharge machining (EDM). Sketch the effects of following parameters on MRR during EDM (i) resistance (ii) current density (iii) pulse energy (iv) capacitance.

(b) Explain the working principle of electric discharge diamond grinding (EDDG) with neat sketch. Also describe the mechanism of material removal in EDDG.

5 (a) Briefly describe the working principle of electrochemical machining (ECM) with neat diagram. Also discuss the mechanism of material removal in ECM.

(b) Derive an equation for maximum permissible feed rate during ECM. Also deduce the relationship for electrolyte temperature change for a given feed rate of tool.

6 Write short notes on any four of the following-

(a) Chemical machining

(b) Biochemical machining

(c) Effect of hydrogen bubble on work-piece surface in ECM

(d) Wire EDM

(e) Electron beam machining

Total No. of Pages 02 Roll No. ----------

Second Semester

M.Tech. (THE)

END SEMESTER EXAMINATION May-2019

ME-611- Advanced IC Engines

Time: 3:00 Hours **Max. Marks : 100**

Note: Answer ANY FIVE questions. All questions carry equal marks. Answer to each question must start on a fresh *page*. Answers to all subparts of a question must be answered at one place. Draw properly labeled diagrams wherever necessary. Assume missing data suitably; if any.

Q.1 a. Discuss requirements of fuel air combustion and explain how they are fulfilled in the IC engines?

b. Explain the importance of fuel quality in IC engine Combustion and emission control.

Q.2 a. What are the advantages of fuel injection in IC engines? Explain in brief the concept of CRDI and how it affects the performance of IC engines?

b. Describe the necessity of scavenging in two stroke engines. Also explain the working principle and working of cross flow scavenging system.

Q.3 a What is meant by knocking in IC engines? Discuss the impact of various engine operating parameters on knocking.

b. Discuss the requirement of valves in IC engines and main valve design .parameters. Also compare various types of valve arrangements in IC engines.

Q.4 a. Discuss the requirement of a fuel injection system in CI engines and the impact of fuel injection parameters on fuel spray characteristic.

b. A four cylinder CI engine develops 100kW power output at 2200 rpm. The calorific value of the fuel is 43000kJ/kg and its composition by mass is 85%C, 14%H and 1 % non combustibles. The absolute volumetric efficiency is 86%, Thermal efficiency is 38% and mechanical efficiency is 80%. Estimate the volumetric composition of dry exhaust gas and determine the bore and stroke of the engine taking a stroke/boreratio as 1.2.

Q.5 a. What is ignition delay? Discuss the effect of various engine operating and fuel quality parameters on ignition delay

b. Carbon monoxide in stoichiometric mixture with air is burnt adiabatically at constant volume. If the initial pressure is 7 bar and temp is 525K. The maximum temp attained is 2000K and the products are at equilibrium. Find he mole fraction of CO converted to CO_2 and the final pressure of the products.

Q.6. Write short notes on the following: **(ANY FOUR)**

a. Evaporative cooling
b. Spark plug fouling
c. Blue/white/Grey smoke
d. Surface ignition engines
e. MPFI
f. Turbocharger

Total No. of Pages -2 *Roll No. .....*

IInd SEMESTER **M.Tech**

END SEMESTER EXAMINATION **MAY-201**

ME-6122 **TURBOMACHINERY II**

Time: 3 Hours ***Max. Marks: 10***

Note: Attempt any Five questions. Assume suitable missing data, if any. Use of Steam table and Mollier chart is allowed.

1 (a) Describe briefly various methods employed to recover the heat of exhaust gases for further use in a steam cycle from a gas turbine plant. 10

(b) Why it is necessary to govern steam turbines? How it is achieved? 10

2 (a) Draw the velocity diagram for a three stage velocity compounded impulse turbine at the entry and exit stages for maximum utilization factor. 10

(b) Discuss the various methods employed for cooling gas Turbine stages. Compare and contrast each one of them with specific application. 10

3 In a gas turbine plant the air at 50°C and 1 bar is compressed to 10 bar with compression efficiency of 85%. The air is reheated in a regenerator and combustion chamber till its temperature is raised to 850°C and during the process pressure falls by 0.4 bar. The air is then expanded in the turbine and passes to the regenerator which has effectiveness of 87% and causes a pressure drop of 0.1 bar, Determine the thermal efficiency of the turbine. Take Isentropic efficiency of turbine as 85%. 20

4 (a) Discuss the various variables on which the efficiencies and output of Gas turbine cycle depend. 10

(b) What is the role of an accessory in Gas Turbine plant? Discuss the relative merit and demerit of incorporating of an accessory. 10

'5 (a) Discuss briefly the various losses occurring in an inward flow radial turbine stage and possible remedial measures. 8

(b) A ninety degree IFR turbine stage ha the following data: 12

Total to static pressure ratio P_{01}/P_3		= 4.0
Exit Pressure		= 1 bar
Stagnation temperature at entry		= 723°C
Blade to isentropic ratio	σ	= 0.65
Rotor diameter ratio	d_3/d_2	= 0.5
Rotor speed	N	= 18000
Rotor exit angler	α_n	= 22.5°
Nozzle efficiency	η_n	= 0.95
Rotor width at entry	b_2	= 4.5 cm

Assuming constant meridional velocity, axial exit, determine (a) Rptor Diameter (b) Rotor blade exit air angle (c) mass flow rate (d) Power developed (e) hub and tip diameter at exit.

OR

A regenerative steam cycle operates between the limits of 220 bar 877°C and 0.07 bar. If three extraction points occurs from the turbine at 60 bar, 30 bar and 10 bar with 90%, 80% and 85% effectiveness respectively, determine the percentage of total flow to be extracted at each extraction point if the pressure drop in each extraction is 3%.

6 Explain the method of achieving matching performance characteristics of single shaft gas turbine with that of compressor. Also draw the equilibrium running lines and the region of safe operation. 20

Total No. of Pages -2 *Roll No.* .....

IInd SEMESTER **M.Tech. / Ph.d**

END SEMESTER EXAMINATION **MAY-201**

ME-6133 Computational Methods in Thermal & Fluid Engineering

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

Note: Attempt any Five questions. Assume suitable missing data, if any.

1 (a) Explain applications of CFD in various engineering sciences. 10

(b) Differentiate between conservative and non conservative form of governing equations and its impact on CFD. 10

2 (a) Write down the most generic form of a partial differential equation used in CFD and explain the significance of each term 10

(b) Identify the nature of the following systems of partial differential equations: 10

$\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ and $\frac{\partial u}{\partial y} = v$ where u and v are the two dependent variables.

3 Explain the importance of various forms of fluid models with neat sketches and when do we use respective models to derive governing equations of fluid flow. How do these models effect CFD methodology. 20

4 (a) Discuss the mathematical and physical behavior of flows governed by parabolic equations with an example of boundary layer flows. 10

(b) Explain suitable grid for moving body problems and grid quality parameters with neat sketches 10

5 (a) Define finite volume discretization and explain the features which distinguish the interpretation of finite volume methods from the finite difference approach 10

(b) Discuss briefly about multi block and non conformal grids with neat sketches with applications. 10

6 (a) What are different types of errors and stability of solution? Explain 10

(b) Give advantages and its disadvantages of PISO over SIMPLE and SIMPLEC algorithms. 10

Total No. of Pages 2
SECOND SEMESTER
END SEM EXAMINATION

Roll No. ....
M.Tech.(Computational Design)
May,2019

ME-631 FINITE ELEMENT METHOD

Time: 3 hr

Max Marks : 100

Note: Answer any five questions.
Assume suitable missing data, if any.
All questions carry equal marks.

1(a) Find global stiffness matrix and force vector for the 1-d modelling of rod shown in Fig. 1. Find displacements of nodes and reaction at fixed end.

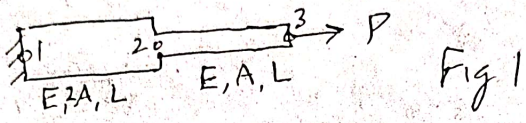

Fig 1

(b) For the bar shown in Fig. 2, find unknown displacement and support reactions. Use the given truss element stiffness matrix.

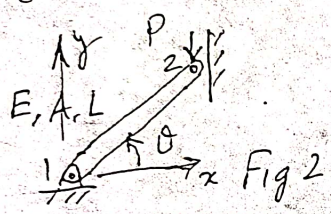

Fig 2

$$K^{(e)} = \begin{bmatrix} c^2 & cs & -c^2 & -cs \\ cs & s^2 & -cs & -s^2 \\ -c^2 & -cs & c^2 & cs \\ -cs & -s^2 & cs & s^2 \end{bmatrix}$$

2(a) For the cantilever in Fig. 3, calculate the end displacement. Use a single element. Use the given beam element stiffness matrix.

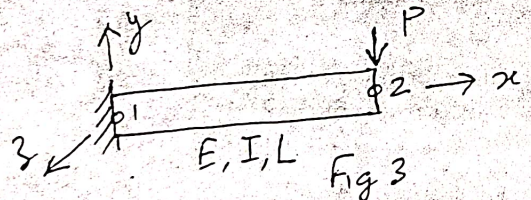

Fig 3

$$K^{(e)} = EI \begin{bmatrix} 12/L^3 & 6/L^2 & -12/L^3 & 6/L^2 \\ 6/L^2 & 4/L & -6/L^2 & 2/L \\ -12/L^3 & -6/L^2 & 12/L^3 & -6/L^2 \\ 6/L^2 & 2/L & -6/L^2 & 4/L \end{bmatrix}$$

(b) Consider the rod in Fig. 4 rotating at constant angular velocity w rad/s. Determine the nodal displacements and axial stress at Gauss points in the rod using two linear elements. Consider only centrifugal force. Ignore bending of the rod. Use parameters E, ρ, A, L to describe the geometric and material properties of the bar.

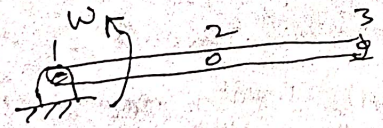

Fig. 4

Q 3(a) Fig. 5 shows a 4-node element. The values of nodal temperatures are $q = \{10, 20, 30, 40\}$. Find coordinates and temperature of the point corresponding to local coordinates $\xi = 0, \eta = 0$.

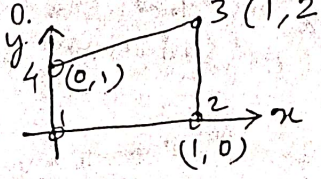

Fig 5

(b) Find area of the quadrilateral in Fig. 5 using Gauss quadrature.

Q 4(a) Develop expressions for mass matrix and stiffness matrix for a bar undergoing axial dynamic loading. Use 1-d linear interpolation. Use parameters E, A, L to describe the geometric and material properties of the bar.

(b) Heat conduction equation for 2-d is given as

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$$

Boundary conditions on the sides are (Fig. 6)

$$\begin{aligned} T &= 0 \quad \text{at} \quad x = 0 \\ \frac{\partial T}{\partial y} &= 0 \quad \text{at} \quad y = 0 \\ -k\frac{\partial T}{\partial x} &= q \quad \text{at} \quad x = L \\ -k\frac{\partial T}{\partial y} &= h(T - T_\infty) \quad \text{at} \quad y = H \end{aligned}$$

Develop expressions for element stiffness matrix and force vector.

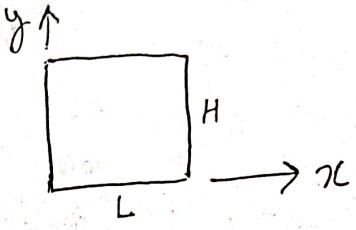

Fig 6

5(a) For the plane stress situation, derive expressions for stiffness matrix and force vector. Assume constant body force.

(b) For a unit square element, find one term of stiffness matrix using bilinear interpolation. Find force vector for the element.

6(a) Determine the variational functional for a cantilever with an external moment applied at the end (Fig. 7). State essential boundary conditions. Extract differential equation of motion and natural boundary conditions.

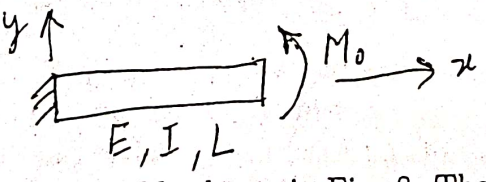

Fig 7

(b) Consider the prestressed cable shown in Fig. 8. The variational functional is

$$\Pi = \frac{1}{2}\int_0^L T(\frac{dw}{dx})^2 dx + \int_0^L \frac{1}{2} k w^2 dx - P w_L \qquad (1)$$

where w is the transverse displacement and w_L is the transverse displacement at $x = L$. Establish the differential equation of equilibrium and state all boundary conditions.

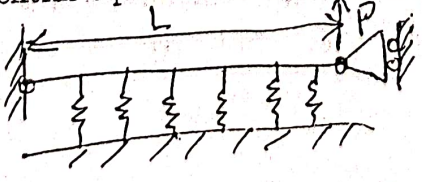

Fig 8

Cable on distributed vertical springs of stiffness k/unit length of cable

7(a) Describe the process of finite element analysis.

(b) Distinguish between strong and weak formulations. Describe different ways you can model and analyse the cantilever problem using FEM.

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Total No. of Pages(02)

Roll No. .....

SECOND SEMESTER

M.Tech. (CDM)

END SEMESTER EXAMINATION ***May-2019***

ME-6331 Reliability Engineering

Time: 3:00 Hours *Max. Marks: 100*

Note: Answer any *FIVE* questions. Assume suitable missing data, if any. Use of statistical tables is allowed.

1[a] Explain Bath Tub curve. Also discuss various causes of failures in different phase of life. (6)

[b] The reliability of a turbine blade can be represented by the following:

$$R(t)=\left(1-\frac{t}{t_0}\right)^2 \qquad 0\le t\le t_0$$

where t_0 is the maximum life of the blade

i) Compute the MTTF as a function of the maximum life.

ii) If the maximum life is 2000 operating hours, what is the design life for a reliability of 0.90? (7)

[c] A cutting tool wears out with a time to failure that is normally distributed with a mean of 10 working days and a standard deviation of 2.5 days.

i) Determine its design life for a reliability of 0.99.

ii) Determine the probability that the cutting tool will last one more day given it has been in use for 5 days. (7)

2 [a] Show that the low level redundancy has more reliability as compared high level redundancy. (6)

[b] Which of the following two systems is better for 200 operating hours with reliability considerations?

i) System-A consists two components following exponential distribution arranged parallel configuration each having a mean time to failure of 2000 hr.

ii) In system-B, first component follows Weibull distribution with a shape parameter of 2 and a characteristic life of 12,000 hr and the second component has exponential behaviour with failure rate of 0.0001. Both the components are arranged in series in System-B. (7)

[c] The time to failure for a machine was found to be lognormal with s=1.25. Specifications call for a reliability of 0.95 at 1000 cycles.

i) Determine the median time to failure.

ii) What is the reliability during the next 1200 cycles given it has operated for 1000 cycles? (7)

3 [a] Explain the cut set method for system reliability evaluation. (8)

[b] Derive reliability and MTTF expressions for a load sharing system with two components in parallel. (12)

4[a] Define availability. Derive steady state availability for single component system following exponential distribution for failure and repair time. (6)

[b]A replaceable and repairable engine starting unit having a high failure rate has an MTBF of 10 operating hours. A backup unit is even less reliable, with MTBF of 5 hr. If repair averages 2 hr, determine the steady-state availability of the engine starting system. (7)

[c]Derive an expression for the steady-state availability for two active, identical components having a constant failure rate and sharing a single repair crew with a component repair rate of 'r'. (7)

5[a] Differentiate between preventive and condition based maintenance. (6)

[b]Explain the base allocation method for achieving system reliability goal. (7)

[c] Four units are connected in series, with reliabilities, R_1=0.85, R_2=0.9, R_3=0.8 and R_4=0.95. Calculate the system reliability. If the reliability is to be increased to a value of 0.65, how this should be apportioned among four units according to the minimum effort method. (7)

6[a] Derive an expression for reliability under preventive maintenance.

[b] The time to repair an engine module is lognormal with s = 1.21. Specifications require 90 percent of the repairs to be accomplished within 10 hr. Determine the necessary median and mean time to repair. (7)

[c] Discuss the role of parts standardization and interchangeability in maintainability design. (7)

7. Write short note on the following topic:

[a] Enumeration method for system reliability (6)

[b] Monte Carlo simulation (7)

[c] Maintainability. (7)

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Total no. of page: 2 Roll no.:.....

II[nd] SEMESTER, M.TECH. (Computational Design)
END-SEMESTER EXAMINATION, MAY-2019

Paper code-ME-632-3 **Subject: Robotics**
Max Time: 3 hrs Max Marks: 100

Note: Attempt any five questions. All questions carry equal marks. *Assume suitable missing data, if any.*

1. (a) A frame is given two rotations, one about x-axis by 60° and one about y-axis by 45°. Show that $R_y.R_x \neq R_y.R_x$. Also explain the reason. (10)
   (b) A three-link manipulator with rotation joints is shown in Fig.1. Calculate the forward kinematics of the tip of the arms as a function of joint rates. (10)

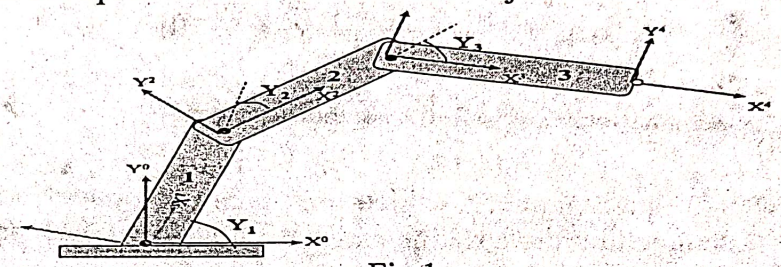

Fig.1

2. a) Find the Analytic solution of 2-link (one revolute and one prismatic) inverse kinematics as shown in Figure.2. (10)

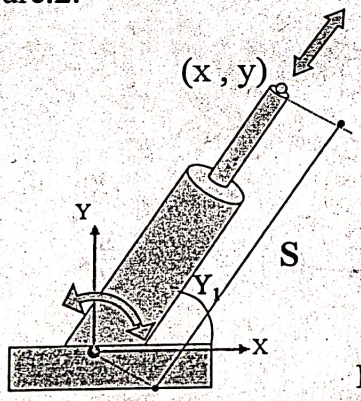

Fig.2

(b) Derive the equation of motions for two degree of freedom system shown in Figure. 3 The centre of mass for each link is at the centre of link and denoted as m_1 and m_2. The moments of inertia are I_1 and I_2 and length of links are l_1 and l_2. (10)

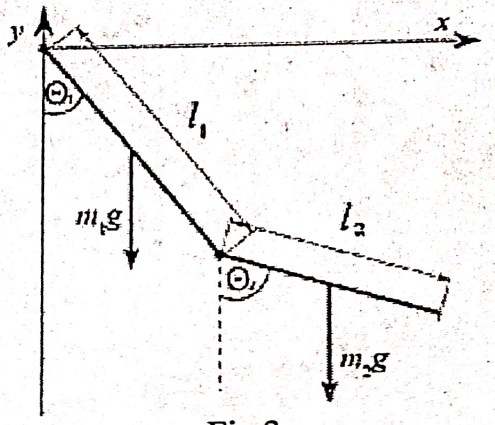

Fig.3

3. (a) Distinguish between electrical, pneumatic and hydraulic actuators with some suitable examples. Why hydraulic actuators are more powerful than any other actuators. (6+4)
(b) Discuss in details various type of tactile sensors used in robotics with neat sketches. (10)

4. (a) Distinguish between trajectory control and path control. For a robot controller, it is proposed to implement partitioned Proportional Derivative control strategy. Develop the block diagram and mathematical model of it. (3+7)
(b) A single polynomial trajectory is given by $\theta(t) = 220 + 50t + 80t^2 + 70t^3 + 160t^4 + 9t^5$ and is used over time interval t=0 to t=8. What are the starting and final positions, velocities and accelerations? (10)

5. (a) Consider the mass-spring and damper system shown in Fig.4. Obtain the open loop transfer function for the system. Also find the characteristic equation of the system if unit feedback is used in close-loop system. (10)

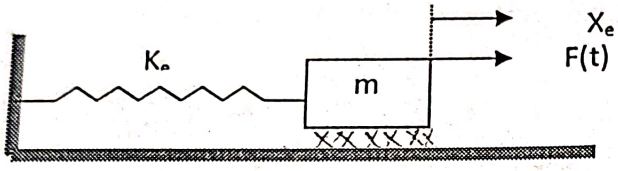

Fig.4

(b) What is D-H representation? A three-link manipulator with rotation joints is shown in Fig.5. Calculate the forward kinematics of the tip of the arms as a function of joint rates. (10)

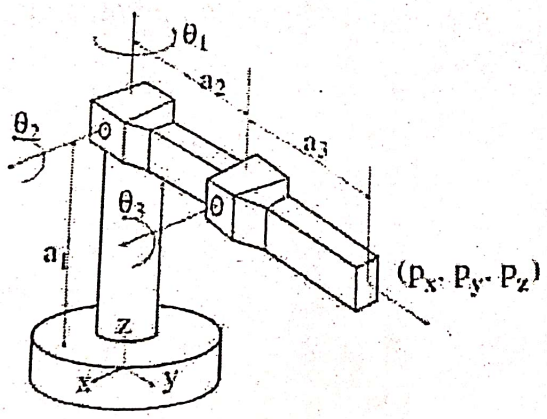

Fig.5

6. Write short notes on following: (5X4=20)

(i) Comparison of optical proximity with ultrasonic proximity
(ii) Open and close loop control
(iii) Jacobian of robot system
(iv) Encoders

Total No. of Pages: 2

Roll No.-.....

II/IV SEMESTER

M.Tech. [Prod. Engg.]

END SEMESTER EXAMINATION
NUMERICAL CONTROL MACHINE TOOLS

ME-6511

Time: 3:00 Hrs

Max. Marks: 100

Note: Attempt ANY FIVE Questions.
All questions carry equal marks.
Assume suitable missing data, if any.

Q1 a) Define with examples NC, CNC,DNC,NCMT.
b) Discuss the parameters to be considered by the Production engineering department to adopt CNC/NCMT technology for the first time in the industry.
c) Discuss advantages and limitations of using CNC and NCMT technology in the industries. 20

Q2. a) Describe in details the construction of CNC JIG BORING machine tool with a neat sketch giving specific emphasis upon the types of bearings, design of slides, types of materials which can be machined, design of magazine etc.
b) Discus the difference between CNC jig boring and CNC milling machine
c) Elaborate the applications of CNC JIG BORING machine and CNC milling machine.

20

Q3. a) Describe various types of programmings with examples used for CNC machine tools.
b) What are G codes and M codes? Give ten example of each.
c) Write APT program to turn a cylindrical component o total length of 600mm and diameters as 20,30,40mm at a

equidistance of 200mm.Turning is to be done in two passes. and material of component of mild steel. 20

Q4. a) Discuss in detail FMC and FMS with all the basic elements involved.
b) Elaborate typical control cycle used in FMS along with neat sketch.
c) Discuss various types of flexibilities.
d) Discuss various advantages and limitations of FMS used in Indian industries 20

Q5 a) Discuss various types of sensors used in industrial robots.
b) Explain the various configurations of industrial robots.
c) Elaborate the applications of industrial robots.
d) Discus computer aided design and the benefits of its integration with computer aided manufacturing. 20

Q6 Write short notes on the following :(any five)
a) Computer aided Process planning and its types.
b) Parallel programming and its advantages.
c) Group technology and its benefits.
d)Advantages and disadvantages of point to point and continuous path control systems.
e).Reverse engineering and its application.
f) Open loop and closed loop systems. 20

Total No. of Pages 02

SECOND SEMESTER *Roll No. .....*

END SEMESTER EXAMINATION **M. Tech (Production)**

ME-6521 **Metrology and Instrumentation** *May-2019*

Time: 3:00 Hours *Maximum Marks: 100*

Note: Answer any FIVE questions.

1 (a) Explain different types of standard for linear measurements. Explain wavelength standard. 12

(b) What are the various possible sources of errors in measurements? 8

2 (a) Explain the methods of manufacturing and calibration of gauges. 10

(b) Explain Reed Type comparator. What are the advantages and disadvantages of Reed Type comparator? 10

3 (a) Explain the construction and working of visual autocollimator. 10

(b) Explain the working and advantages of optical flats. 10

4 (a) Explain the construction and working of electron microscopes. 10

(b) How the parallelism and squareness is measured by interference? 10

5 (a) Explain the principles of optics used in projectors microscopes. 10

(b) What is surface roughness? How the surface roughness is measured? 10

6 (a) What is interference theory? Explain constructive and destructive interference. 12

(b) Slip gauge set M-38 consists of the following: 8

Range	Steps	Pieces
1.005	--	1
1.01 – 1.09	0.01	9
1.1 – 1.9	0.1	9
1.0 – 9.0	1.0	9
10.0 – 100.0	10.0	10

Choose the suitable slip to give the following dimensions:

(i) 59.055 mm
(ii) 127.95 mm
(iii) 32.925
(iv) 99.705

Total No. of Pages 02

2ND SEMESTER

Roll No. .....

M.Tech. (THERMAL ENGINEERING)

END SEMESTER EXAMINATION *May/June-2019*

PAPER CODE ME-6611 & TITLE OF PAPER : ADVANCED REFRIGERATION AND AIR CONDITIONING

Time: 3:00 Hours

Max. Marks: 100

Note : Answer any five questions. Use of refrigeration tables and charts are allowed. All questions carry equal marks. Assume suitable missing data, if any.

1(a) Explain the function of a LVHE (liquid vapour heat exchanger). Discuss its effect on the performance of the vapour compression refrigeration system with the help of P-h diagram. 10

(b) A 10 TR R134a vapour compression system working between evaporator temperature of -10° C and 35° C. Find mass flow rate of the refrigerant per TR, compressor power and COP of the system. 10

2. Explain snow chamber method of dry ice production. 20

3(a) What are the various types of expansion devices? Which type of expansion device is used for constant load; explain its working with a neat sketch. 10

(b) Explain the design procedure of a capillary tube. 10

4 Compare a vapour compression system with a vapour absorption system. Explain the working and modelling procedure (energy analysis) of a single effect water lithium bromide vapour absorption refrigeration system with a neat schematic diagram and ln P – 1/T diagram. 20

5(a) Explain five psychrometric properties of moist air. 10

(b) Explain the processes of (i) cooling and humidification (ii) cooling and dehumidification giving the details of apparatus used for carrying out these processes. 10

6(a) Which thermodynamic cycle is used for liquefaction of gases? Explain any one cycle for liquefaction of gases using schematic and P-h diagrams. 10

6(b) Specify the loads that must be considered for design of summer air-conditioning system. Explain. 10

7. Explain (i) Summer air conditioning (ii) Winter air conditioning using psychrometric chart. 20

8. Write short notes on any four (i) Alternative refrigerants (ii) Capacity control of compressor (iii) Transcritical CO2 cycle (iv) VFD (v) Montreal and Kyoto protocol (vi) Direct and indirect global warming 20

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Delhi Technological University

Bawana Road, Delhi -110042

M.Tech. (Thermal Engineering)	II Semester
Subject: Advanced Energy System	Paper: ME-6621
End Semester Examination	May 2018
Time Permitted : 3 hrs	Maximum Marks : 100

Note: Attempt any five questions. Attempt all parts of a question at one place and don't mix them with answers of other questions. Start the answer of a new question or part thereof on a new page.

1(a)	Write a comprehensive note on reserve and production of petroleum and natural gas in India. Also discuss the history of oil exploration in India. (10)
1(b)	What is the present installed electricity generation capacity in India? Discuss the contribution of various types of power plants. Also explain the renewable energy scenario in India. (10)
2(a)	Explain with the help of neat diagram, the construction and working of a fixed dome biogas digester. (10)
2(b)	Explain the construction and working of a producer gas engine. What design modification have been suggested to run an existing S.I./C.I. engine on producer gas. (10)
3(a)	Describe the anaerobic digestion process and list the raw materials which can be utilized in the process. What are the factors affecting the process? (10)
3(b)	Write a comprehensive note on different sources of biofuels (10)
4(a)	Explain the construction and working of Proton Exchange membrane (PEM) fuel cell. (10)
4(b)	Explain the thermodynamic aspects involved in fuel cell. (10)
5(a)	Explain seed cleaning and oil extraction mechanism from oilseeds. (10)
5(b)	What do you understand by emulsions and describe the different types of emulsions? (10)
6(a)	Compare the combustion, performance and emission characteristics of vegetable and biodiesel (10)
6(b)	Describe the fermentation mechanism of ethanol production. (10)
7(a)	Explain in detail the performance, emission and combustion characteristics of low carbon chain alcohols in SI engines.(10)
7(b)	Explain a dual fuel system with the help of neat sketch. (10).
8.	Write short note on the following: (20) a. Di methyl ether (DME) b. Improved methods of biodiesel production c. Ethanol-Diesel blends

Total No. of Pages 03

Roll No.: _____

SECOND SEMESTER

M.Tech. [Computational Design]

END SEMESTER EXAMINATION *May-2019*

ME-6811 ENGINEERING TRIBOLOGY AND BEARING DESIGN

Time: 3:00 Hours *Max. Marks :100*

Note : Answer any FIVE questions.
All questions carry equal marks.
Assume suitable missing data, if any.

1. [a] Define tribology and with the help of neat flow chart illustrate the relationship between operating conditions and type of wear.

   [b] Discuss the different layers formed on the base nascent metal after the fabrication process and exposed to environmental condition and the effect of residual stress in the material.

2. [a] With the help of sketch discuss in detail the mechanisms of corrosive and fatigue wear (Rolling & sliding contacts).

   [b] With the help of schematic diagrams, describe capillary viscometer and density measuring device used in laboratory as per international standard.

3. [a]With the help of schematic diagrams, describe pin on disc test and also write the procedure for determination of specific wear rate and coefficient of friction in fully flooded and starved condition of lubrication.

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[b] With the help of schematic diagrams, describe Linear reciprocating test and also write the procedure for determination of specific wear rate and coefficient of friction in fully flooded and starved condition of lubrication.

4. [a] Describe Full and half Sommerfeld boundary conditions.
   [b] With the help of neat sketch, describe the terminology used in hydrodynamic journal bearing and enumerate the design procedure of full journal bearing considering shaft diameter D, shaft speed ω and radial load W.

5. Write the assumptions and deduce the expression for the Generalized Reynolds Equation. Also explain all the specific terms in it i.e. Poiseuille, Couette, squeezing action etc.

6. [a] With the help of neat sketch, describe in detail the adhesive and erosive wears.
   [b] Draw and explain all the four zones of stribeck curve. How does the viscosity and speed of the shaft affect the stribeck curve?

7. Describe with the help of example on any two of the following:
   [a] Lubrication by solids [b] Mechanism of cavitation wear. [c] Mechanism of gas lubrication and [d] impact wear.

8. Estimate the performance parameters of a full journal bearing having parameters: Dynamic viscosity of lubricant (η)= 20mPa.s, Journal radius (rj)=30 mm, bearing length (L)= 25 mm, Journal speed = 3062rpm, load (W)=1000N, and Radial clearance (c)=0.00006 m. (Use the table for the solution).

Table 3.4.3.2 : Performance characteristics of full journal bearing [Raimondi and Boyd, 1958].

L/D	ε	h_{min}	θ_1	α/β	f	φ	$\frac{R_j}{c}f$	$\frac{Q}{R_jNL}$	$\frac{Q_s}{Q}$	$\frac{l'\eta N}{P}$	$\frac{P}{P_{max}}$	θ_{r-}	θ_{re}
∞	0	1.0	0	----	∞	(70.92)	∞	"	0	∞	----	0	(149.38)
	0.1	0.9	"	.308	.240	69.10	4.80	3.03	"	19.9	.826	0.0	137
	.2	.8	"	.314	.123	67.26	2.37	2.83	"	11.4	.814	5.6	128
	.4	.6	"	.328	.0626	61.94	1.52	2.26	"	8.47	.764	14.4	107
	.6	.4	"	.349	.0389	54.31	1.20	1.56	"	9.73	.667	20.8	86
	.8	.2	"	.383	.0210	42.22	.961	.760	"	15.9	.495	21.5	58.8
	.9	.1	"	.412	.0115	31.62	.756	.411	"	23.1	.358	19	44
	.97	.03	"	------	------	------	------	------	"	------	------	----	------
	1.0	0	"	------	0	0	0	0	"	∞	0	0	0
1	0	1.0	0	------	∞	(85)	∞	----	0	∞	------	0	(119)
	0.1	0.9	"	.279	1.33	79.5	26.4	3.37	.150	106	.540	3.5	113
	.2	.8	"	.294	.631	74.02	12.8	3.59	.280	52.1	.529	9.2	106
	.4	.6	"	.325	.264	63.10	5.79	3.99	.497	24.3	.484	16.5	91.2
	.6	.4	"	.360	.121	50.58	3.22	4.33	.680	14.2	.415	18.7	72.9
	.8	.2	"	.399	.0446	36.24	1.70	4.62	.842	8.00	.313	18.2	52.3
	.9	.1	"	.426	.0188	26.45	1.05	4.74	.919	5.16	.247	13.9	37.3
	.97	.03	"	.457	.00474	15.47	.514	4.82	.973	2.61	.152	7.1	20.5
	1.0	0	"	------	0	0	0	----	1.0	0	0	0	0
1/2	0	1.0	0	------	∞	(88.5)	∞	----	0	∞	------	0	(107)
	0.1	0.9	"	.273	4.31	81.62	85.6	3.43	.173	343	.523	5.8	99.2
	.2	.8	"	.292	2.03	74.94	40.9	3.72	.318	164	.506	11.9	92.5
	.4	.6	"	.329	.779	61.45	12.0	4.29	.552	68.6	.441	16.9	78.8
	.6	.4	"	.366	.319	48.14	8.10	4.85	.730	33.0	.365	17.1	64.3
	.8	.2	"	.408	.0923	33.31	3.26	5.41	.874	13.4	.267	15.3	44.2
	.9	.1	"	.434	.0313	23.66	1.60	5.69	.939	6.66	.206	11	33.8
	.97	.03	"	.462	.00609	13.75	.610	5.88	.980	2.56	.126	3.8	19.1
	1.0	0	"	------	0	0	0	------	1.0	0	0	0	0
1/4	0	1.0	0	------	∞	(89.5)	∞	----	0	∞	------	0	(99)
	0.1	0.9	"	.271	16.2	82.31	322	3.45	.180	1287	.515	7.4	98.9
	.2	.8	"	.291	7.57	75.18	153	3.76	.330	611	.489	13.5	85
	.4	.6	"	.331	2.83	60.86	61.1	4.37	.567	245	.415	17.4	70
	.6	.4	"	.370	1.07	46.72	26.7	4.99	.746	107	.334	16.4	55.5
	.8	.2	"	.414	.261	31.04	8.80	5.60	.884	35.4	.240	11.5	39.7
	.9	.1	"	.439	.0736	21.85	3.50	5.91	.943	14.1	.180	8.6	27.8
	.97	.03	"	.466	.0101	12.22	.922	6.12	.984	3.73	.108	4	17.7
	1.0	0	"	------	0	0	0	------	1.0	0	0	0	0

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SECOND SEMESTER M.Tech (CDN)END

SEMESTER EXAMINATION MAY 2019 ME-6822

COMPOSITE MATERIALS TECHNOLOGY

Time : 3 HRS Max. Marks: 100

Note: Attempt Any five questions. Assume missing data , if any

1a. Discuss in detail about different types of Matrix material used in the composites, their characteristics and engineering applications in detail. 10

1b. Write a brief note on different Reinforcement materials used for Composite materials. 10

2.In detail explain Maximum stress theory, Maximum strain theory, Tsa-Hill theory, Tsai, Wu tensor theory used in Composite materials. 20

3a. Compare exact and approximate values of Young's modulus at 45° to the fibre direction for a carbon/epoxy material having the following properties:

$E_1 = 145$ Gpa, $E_2 = 10.45$ Gpa, $G_{12} = 6.9$ Gpa, $\nu_{12} = 0.28$ 10

3b. write stress strain relation for unidirectional lamina in terms of engineering constants referred to an arbitrary coordinate system (x,y). 10

4. Discuss about any different non-destructive testing methods used for evaluating damage done to Composite materials. 20

5a. Discuss about the characterisation of composites with stress concentration. 10

5b. Discuss about off axis Uniaxial test. 10

6a. Briefly discuss about Coefficients of Hygric(Moisture) expansion. 10

6b. Discuss about the method adopted for finding Shear and Compressive properties of Unidirectional laminae. 10