

Total No. of Questions : 7]

SEAT No. :

PD-4905

[Total No. of Pages : 2

[6405]-2

M.E. (Manufacturing & Automation) (Production) (CAD/CAM)

RESEARCH METHODOLOGY

(2017 Pattern) (Semester - I) (511102)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Attempt any Five Question.*
- 2) Use of scientific calculator is allowed.*
- 3) Figures to the right side indicate full marks.*

- Q1)** a) Elaborate various objectives for doing research. [5]
b) Explain the descriptive research method. Elaborate how it is beneficial. [5]
- Q2)** a) Explain the importance of doing research. How research is beneficial to the society. [5]
b) Explain various problem solving approaches in short. [5]
- Q3)** a) Discuss different methods of research design. [5]
b) Describe various methods of Design of Experiment. [5]
- Q4)** a) Discuss on Design of Experiment. Why it is required. [6]
b) Explain content analysis in detail. [4]
- Q5)** a) Brief on devices used in data collection. Explain any two devices. [5]
b) Brief on choice of data collection methods. [5]
- Q6)** a) What is layout of research report? How its study is significant? [5]
b) Describe Analytical Hierarchy Process in detail. [5]

P.T.O.

Q7) Write a short note on Following

[10]

- a) Various layouts of research report.
- b) Techniques of interpretation in research.



Total No. of Questions : 8]

SEAT No. :

PD-4906

[Total No. of Pages : 2

[6405]-4

M.E. (Production) (Manufacturing and Automation)

INDUSTRIAL AUTOMATION

(2017 Pattern) (Semester - I) (511104)

Time : 3 Hours]

[Max. Marks : 50

Instruction to the candidates:

- 1) *Figures to the right indicate full marks.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*
- 5) *Solve Any 5 Questions.*

Q1) a) What are the most common problems encountered in hydraulic systems and how can they be prevented? [5]

b) What are the key factors to consider when selecting a hydraulic pump? [5]

Q2) a) How can you apply the principles of fluid mechanics to diagnose a performance issue in a hydraulic system of loss of pressure? Describe the steps involved in troubleshooting. [5]

b) What are the different types of hydraulic filters, and what role do they play in a hydraulic system? [5]

Q3) a) What is a sequential circuit in pneumatics, and how is it used to control the sequence of operations in an automated system? [4]

b) Draw the suitable pneumatic circuit using cascade system to actuate cylinder 'A' cylinder 'B' and cylinder 'C' as per following sequences:[6]

i) Cylinder A extends	ii) Cylinder B extends
iii) Cylinder C extends	iv) Cylinder A retracts
v) Cylinder C retracts	vi) Cylinder B retracts

P.T.O.

- Q4)** a) Explain the role of pressure regulators in a pneumatic system. [5]
b) Describe the main components of a pneumatic system and their functions. [5]
- Q5)** a) Explain P, PI and PID Controllers. [6]
b) Explain any two temperature measurement sensors. [4]
- Q6)** a) What is a Programmable Logic Controller (PLC), and what are its main components? [6]
b) With neat sketch and example explain closed loop and open loop control system. [4]
- Q7)** a) Explain Role of AI in manufacturing systems. [6]
b) Explain the role of Automated Guided vehicles in manufacturing. [4]
- Q8)** a) With neat sketch explain any three configurations of industrial robots.[6]
b) Explain the role of Artificial Neural Networks in manufacturing automation. [4]



Total No. of Questions : 8]

SEAT No. :

PD4907

[Total No. of Pages : 1

[6405]-5

First Year M.E. Production (CAD/CAM)/(Manufacturing and Automation)

COMPUTER INTEGRATED MANUFACTURING

(2017 Pattern) (Semester - II) (511305)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt Q1 or Q2, Q3 or Q4 and Q5 or Q6.*
- 2) *Q7 and Q8 are compulsory.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat self – explanatory sketches wherever necessary.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) What are the benefits of GT to the manufacturing industry? [5]

OR

Q2) Which approaches are considered in order to optimize overall efficiency and effectiveness of FMS? [5]

Q3) What is a relational database? Describe the architecture of database management system. [5]

OR

Q4) What are the different levels of Integration against evolution of CIM? Explain. [5]

Q5) What are the components of PLM software? Explain. [7]

OR

Q6) Which are the typical sensors that are normally used in robot? Explain. [7]

Q7) a) What are the components of small local area network in CIM setup? Explain. [8]

b) What are the communication interfaces used in computer-to-computer communication? Explain in brief. What are the commonly used interface cards? [7]

Q8) Write short notes on any three [18]

- a) AGV
- b) Data associated with FMC
- c) ESPRIT - CIM OSA model
- d) GKS implementation in a CAD workstation



Total No. of Questions : 8]

SEAT No. :

PD4908

[Total No. of Pages : 2

[6405]-6

First Year M.E. (Production) (Manufacturing and Automation) (CAD/CAM)
ARTIFICIAL INTELLIGENCE & ROBOTICS
(2017 Pattern) (Semester - II) (511306)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Solve Any 5 Questions.*
- 2) Neat Diagram must be drawn wherever necessary.*
- 3) Assume Suitable data if necessary.*
- 4) Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*
- 5) Figures to the right indicates full marks.*

Q1) a) Explain how robots are used in inspection tasks. **[4]**

b) Explain the role of Automated Guided Vehicles (AGVs) in material handling. **[6]**

Q2) a) Briefly explain the synthesis of mechanisms and its importance in design. **[6]**

b) Define degree of freedom (DOF) and explain its importance in mechanisms. **[4]**

Q3) a) What are the key properties of a transformation matrix? **[5]**

b) Derive arm matrix for a spherical robot. **[5]**

Q4) a) Explain the concept of a unit vector and its application in robotics. **[5]**

b) What is Jacobin of the manipulator? **[5]**

Q5) a) What are the main components of robot operating systems (ROS)? **[6]**

b) What are the approaches of Artificial intelligence? **[4]**

P.T.O.

- Q6)** a) Describe the Trajectory planning schemes. [6]
b) What are the key components of a machine vision system? [4]
- Q7)** a) Explain with neat sketch the working of optical encoder. [6]
b) Write a short note on passive sensors. [4]
- Q8)** a) How does a vacuum end effector work? List its advantages and disadvantages. [6]
b) List the key factors to consider when designing an end effector for industrial applications. [4]



Total No. of Questions : 8]

SEAT No. :

PD4909

[Total No. of Pages : 2

[6405]-7

First Year M.E. (Production) (Manufacturing and Automation)

ADDITIVE MANUFACTURING

(2017 Pattern) (Semester - II) (511109)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Solve Any 5 Questions.*
- 2) *Neat Diagram must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of Logarithmic Table, Slide rule is Electronic pocket calculators is allowed.*
- 5) *Figure to the right indicates full marks.*

- Q1)** a) What is additive manufacturing? Write different steps involved in additive manufacturing. [5]
b) Explain STL format, how it works for additive manufacturing. [5]
- Q2)** a) Write short note on role of additive manufacturing in product development. [6]
b) Explain the tool path generation in additive manufacturing. [4]
- Q3)** a) What is the role of CT scanning in creating digital models for Additive Manufacturing? [6]
b) Describe the process of converting a CAD model into a format suitable for Additive Manufacturing. [4]
- Q4)** a) Describe the process of converting medical scan data (CT, MRI) into a 3D printable model using MIMICS. [6]
b) What role does MAGICS play in the quality control and optimization of Additive Manufacturing processes? [4]
- Q5)** a) What are the key material properties that influence the performance of a 3D printed part? [5]
b) How is color achieved in Additive Manufacturing, and what materials are typically used for colored 3D printing? [5]

P.T.O.

- Q6)** a) Explain with neat sketch the Electron Beam Melting process. [5]
b) Explain how environmental factors (e.g., temperature, humidity) impact the stability of materials used in Additive Manufacturing. [5]
- Q7)** a) Explain solid ground curing process with respect to its principle, advantages, disadvantages and applications. [5]
b) With neat sketch explain the process of Selective Laser Sintering (SLS) [5]
- Q8)** a) What is Computer-Aided Tissue Engineering (CATE), and how does it relate to Bio-Additive Manufacturing? [5]
b) Explain the medical and Bio-Additive manufacturing applications, advantages and disadvantages. [5]



**Second Year M.E. (Production) (Manufacturing & Automation)
(CAD/CAM)**

**COMPUTATIONAL INTELLIGENCE IN TOOL DESIGN
(2017 Pattern) (Semester - III) (611101)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer Q1 OR Q2; Q3 OR Q4; and Q5 & Q6 are compulsory.
- 2) Assume suitable data if necessary.
- 3) Figures to the right indicate full marks.
- 4) Neat diagram must be drawn wherever necessary.

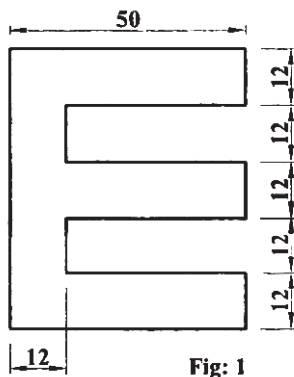
Q1) a) Discuss with suitable example following characteristics of intelligent fixture design **[6]**

- i) Automated monitoring
- ii) Applying dynamic clamping forces
- iii) Regulating control of work holding stability
- iv) Optimize fixturing parameters

b) Write short note on application of CAFD. **[4]**

OR

Q2) Design a blanking die for the component shown in fig.1. **[10]**



- a) Find the cutting force and die clearance.
- b) Design blanking die.
- c) Design and draw punch plate and also explain in short how punch is hold.

Given: sheet thickness=1mm

Shear strength = 200 Mpa

P.T.O.

Q3) Write short note on (any two)

[10]

- a) Automatic determination of parting line in forging die design.
- b) Computer aided forging die design
- c) AI for process planning of forging impression.

OR

Q4) a) For injection molding of a component having weight 0.253 kg, determine the optimum number of impression for minimum cost. Shot weight handling capacities for various injection molding machines along with machine hour rate is as given below: **[5]**

Capacity (Kg)	3	5	9	12
Machine hour rate (Rs.)	24	45	70	96

- i) Quantity to be produced = 20 Lakh
 - ii) Cycle time = 35 seconds.
 - iii) Cost of producing one impression = 2500 Rs.
- b) Elaborate different types of gating system in injection mold. **[5]**

Q5) a) Describe the die casting process for low melting point alloy with neat sketch. **[8]**

- b) Explain use of AI techniques in gating system design and analysis in die casting die design. **[7]**

Q6) a) Describe the element of the feeding system of the sand casting process using suitable example. **[7]**

- b) How the mould filling time is calculated in the sand casting process, explain with suitable example. **[8]**



Total No. of Questions : 6]

SEAT No. :

PD-4911

[Total No. of Pages : 2

[6405]-9

M.E. (Production(Manufacturing & Automation))

MECHATRONICS

(2017 Pattern) (Semester - III) (611102)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) *Q. No. 5 and Q. No.6 are compulsory.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of non-programmable calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

- Q1)** a) Discuss the components of a digital weighing machine. How do these components work together to display weight? [5]
- b) Explain the working of LVDT with a neat sketch. [5]

OR

- Q2)** a) Describe force sensor with application. [5]
- b) In a certain system, an electric heating element was found to increase the temperature of a piece of metal 10° for each ampere of current. The metal expands 0.005 in /degree and pushes on a load sensor which outputs 1 V/0.005 in of compression. [5]

- Q3)** a) Explain pin diagram of a microprocessor 8085. [4]
- b) Develop a conceptual design of a sensors based control system for a shaft speed control. Assume suitable data if necessary. [6]

OR

P.T.O.

- Q4)** a) Write the instructions to load two hexadecimal numbers 58D and 86C in the registers A and B respectively. Add the numbers, and store the result in memory location 657B. **[6]**
- b) Write a note on DAC (Digital to Analog Conversion) and how it is done? **[4]**
- Q5)** a) Construct the ladder logic diagrams for (a) the AND gate and (b) the OR gate. Also develop a truth table for both logics. **[6]**
- b) Explain application of PLC system for elevator. **[9]**
- Q6)** Write short notes on the following : **[15]**
- a) Electromechanical system model
 - b) Proportional control system
 - c) Automated Guided Vehicles (AGVs)



Total No. of Questions : 8]

SEAT No. :

PD-4912

[Total No. of Pages : 2

[6405]-10

M.E. Production (CAD/CAM)
COMPUTER AIDED DESIGN
(2017 Pattern) (Semester - I) (511301)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4 and Q.5 or Q.6.*
- 2) *Q.7 and Q.8 are compulsory.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat self-explanatory sketches wherever necessary.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) Discuss Grover,s Model of Product life Cycle for selection of CAD/CAM. [5]

OR

Q2) Discuss applications of computers for design. [5]

Q3) Write down the various techniques used for the construction and editing of solid objects. Explain any two of them in detail. [5]

OR

Q4) What is Homogeneous Co-ordinate system? Explain the necessity of Homogeneous co-ordinate system for transformation of geometric entities using suitable examples. [5]

Q5) Explain the procedure of mass property calculations in CAD software. [7]

OR

Q6) What is blending of curves? Explain how two Bezier segments can be blended with suitable numeric example. [7]

P.T.O.

- Q7)** a) What sweep representation scheme used for representation of a solid. **[8]**
b) What is Z-buffer algorithm for B-REP and CSG model? **[7]**

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

- a) Feature based segmentation
- b) Shading algorithms
- c) Virtual Realism
- d) Parametric programming



Total No. of Questions : 6]

SEAT No. :

PD-4913

[Total No. of Pages : 2

[6405]-13

M.E. (Production (CAD/CAM))

COMPUTER AIDED PRODUCTION PLANNING

(511311) (2017 Pattern) (Semester - III)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Q. No. 5 and Q. No.6 are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of non-programmable calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

Q1) a) How do seasonal trends influence the demand and supply of agricultural products? Provide an example of how supply chains adjust to meet demand during peak harvest seasons and the impact on prices. **[5]**

b) Describe the computerized method for design of facility layout. **[5]**

OR

Q2) a) Why is the rank order clustering algorithm used for group technology **[5]**

b) Discuss the significance of design rationalization. **[5]**

Q3) a) Briefly describe various measures of performance in multiple machine scheduling problem with independent jobs. **[5]**

b) Explain with neat block diagram of MRP-I and its component. **[5]**

OR

P.T.O.

Q4) a) Explain detailed capacity planning and Manufacturing resources planning. **[6]**

b) What is significance of the MRP-II in manufacturing industries? **[4]**

Q5) a) Discuss the purpose of process simulators? **[8]**

b) With suitable application explain the generic model of ERP system. **[7]**

Q6) Write short notes on the following : **[15]**

a) MRP-II

b) Time standard.

c) Process simulators



Total No. of Questions : 6]

SEAT No. :

PD4914

[Total No. of Pages : 1

[6405]-14

First Year M.E. (Printing Technology & Graphic Communication)

PROBABILITY, STATISTICS AND REGRESSION ANALYSIS

(2017 Pattern) (Semester - I) (508101)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data if necessary.

Q1) Suppose the average number of fatalities due to car accidents in a city in India on any day is 5. What is the probability that fewer than four such fatalities will occur on any particular day? **[18]**

OR

Q2) Calculate mean, median, mode, standard deviation of the above given data. Plot a box plot of the same showing the below entities. **[18]**

13,16,12,11,8, 14,12,18

Q3) What is ANOVA and what is its significance in statistical testing. **[16]**

OR

Q4) What does Quality control mean. Explain the basis of control charts. Explain any one type of control chart. **[16]**

Q5) What does Quality control mean. Explain the basis of control charts. Explain any one type of control chart. **[16]**

OR

Q6) Following are the problems observed in screen printing. State the cause of all the problems. **[16]**

- a) Pin Holes
- b) Inconsistent ink
- c) Ink spreading
- d) Mottling
- e) Ink coverage failure



Total No. of Questions : 6]

SEAT No. :

PD-4915

[Total No. of Pages : 1

[6405]-16

M.E. (Printing Technology)
MODERN TRENDS IN PRINTING
(2017 Pattern) (Semester - I) (508103)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

Q1) Explain the purpose of different Rubber Hardness & its effect on Print Quality. **[18]**

OR

Q2) Explain the Doctor blades-purpose & types. **[18]**

Q3) Compare and explain the purpose of Pneumatics and Hydraulics systems used in different Printing Processes. **[16]**

OR

Q4) Explain the working of electronic line shaft and benefits over common shaft. **[16]**

Q5) Explain raw material Handling System in printing press. **[16]**

OR

Q6) Compare and Explain the breakdown and preventive maintenance for offset printing machine. **[16]**



Total No. of Questions : 6]

SEAT No. :

PD-5234

[Total No. of Pages : 2

[6405]-18

M.E. (Printing & Graphic Communication)

COLOUR SCIENCE

(2017 Pattern) (Semester - II) (508107)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6.
- 2) Figures to the right indicate full marks.

Q1) Write short notes on:

[18]

- a) Purkinji mechanism
- b) Luminous efficiency functions
- c) Effects of Metamerism

OR

Q2) With the neat schematic diagram of human eye describes the concept of vision formation and explain the following:

[18]

- a) Factors in the eye that control internal stimulus.
- b) Image information by eye, Eye axes and eye angle.
- c) Chromatic aberration of the eye.

Q3) Explain the following terms:

[16]

- a) ICC profile construction, Reference viewing condition and medium
- b) ICC profile structure
- c) ICC profile types
- d) ICC color processing models - LUT, ICC tag types

OR

Q4) With a suitable example, explain the process of making profiles for any digital printer.

[16]

P.T.O.

Q5) With a suitable case, discuss the effect of color and the optical properties of materials for color reproduction on that material. **[16]**

OR

Q6) What impact do the surface texture and quality (in terms of smoothness, finish, etc.) make on color reproduction on the said substrate? **[16]**



Total No. of Questions : 6]

SEAT No. :

PD4916

[Total No. of Pages : 1

[6405]-19

First Year M.E. (Printing Technology & Graphic Communication)

WEB HANDLING ON PRESS

(2017 Pattern) (Semester - II) (508108)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*

- Q1)** a) Explain the procedure for splicing in case of Zero speed web splicer. State its advantages over flying speed. [9]
b) Why treatment is important? Explain any one methodology of treatment done for plastic films. [9]

OR

- Q2)** Write short notes on : [18]
a) Factors influencing tension in printing unit of the flexo press.
b) Why preconditioning of the web in the case of plastic reels is needed?

- Q3)** a) What is the role of the dancer roller? How does it help in tension control. [8]
b) State factors affecting tension in web presses. [8]

OR

- Q4)** State the factors controlling tension in the printing zone & in the rewind tension zone. Write short notes on following: Tensioning devices such as Brakes & Clutches. [16]

- Q5)** What is Static and Dynamic balancing. How is it measured and calculated? Why does balance of rollers change in printing machine. [16]

OR

- Q6)** a) What is a wrap angle? Why is it important to maintain a specific wrap angle for the web? [8]
b) How is the deflection in the transport rollers measured? What problems occur due to deflection in rollers. [8]



Total No. of Questions : 6]

SEAT No. :

PD4917

[6405]-20

[Total No. of Pages : 1

First Year M.E. (Printing Technology) (Graphic Communication)

SUBSTRATE AND INK

(2017 Pattern) (Semester - II) (508109)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Assume Suitable Data, if necessary.*
- 3) *Neat Diagram must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

Q1) Draw a chemical structure of Biodegradable substrates and states its characteristics and brief the drawbacks. **[18]**

OR

Q2) Explain the principal of drying mechanisms including UV curing EB curing process. **[18]**

Q3) a) Find out the weight of one ream of paper of 80GSM in double medium size. **[8]**

b) How much paper in $61 \times 88\text{cm}$ will be required for the printing of 20000 booklets in $210 \times 297\text{mm}$ size assuming they each booklet contains 24 pages. **[8]**

OR

Q4) a) A ream of paper in $61 \times 88\text{cm}$ size weight 21.5kg. Find the weight of the same paper in quad crown size. **[8]**

b) Calculate papers for endpapers in RA1 size for 2000 books in A5 size having 240 pages with 2% allowances. **[8]**

Q5) Explain the Quality control parameters for inks. **[16]**

OR

Q6) Explain the VOC & its significance in printing inks. **[16]**



Total No. of Questions : 6]

SEAT No. :

PD4918

[Total No. of Pages : 2

[6405]-21

Second Year M.E. (Printing Engineering & Graphic Communication)

PRINTED ELECTRONICS AND RFID

(2017 Pattern) (Semester - III) (608101)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Explain the concepts of stretchable, foldable, and rollable electronics.[9]

b) Compare traditional electronics manufacturing methods with printing methods used in printed electronics. [9]

OR

Q2) a) What are the key factors to consider when selecting a printing method and substrate for a printed electronics application? [9]

b) Discuss the role of paper and polymer substrates in printed electronics [9]

Q3) a) Describe the construction of an RFID tag [8]

b) Compare active and passive RFID tags. [8]

OR

Q4) a) Discuss why is RFID considered a potential replacement for UPC barcodes? [8]

b) What is RFID infrastructure, and how does it support RFID applications? [8]

P.T.O.

- Q5)** a) Discuss the application of printed electronics in signage and displays **[8]**
b) Discuss the role of printed electronics in healthcare management. **[8]**

OR

- Q6)** a) Describe How are printed electronics used in photovoltaic cells for power generation? **[8]**
b) Explain the role of printed batteries in portable and wearable devices **[8]**



Total No. of Questions : 6]

SEAT No. :

PD-4919

[Total No. of Pages : 1

[6405]-22

M.E. (Printing Engineering & Graphic Communication)
ADVANCES IN CONVERTING AND PACKAGING
(2017 Pattern) (Semester - III) (608102)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer Q.1 or Q.2, Q. 3 or Q.4, Q.5 or Q.6.*
- 2) *Figures to the right side indicates full marks.*
- 3) *Draw neat diagrams wherever necessary.*

- Q1)** a) What is integration in a flexo press? [9]
b) Explain the integration of bindery in the commercial press. [9]

OR

- Q2)** a) Explain the following operations in packaging die-cutting, punching and holograms. [9]
b) Explain in detail its importance in packaging. [9]

- Q3)** a) Explain wet lamination with a neat diagram. State advantages and limitations with regards to dry lamination. [8]
b) What is corona treatment? How does poor surface treatment affect quality? [8]

OR

- Q4)** Explain in detail carton packaging. Explain working and function of folder gluer. [16]

- Q5)** Explain in detail the FFS techniques used for food packaging. [16]

OR

- Q6)** Explain different barrier technologies used and how it is useful in packaging. [16]



Total No. of Questions : 5]

SEAT No. :

PD4920

[Total No. of Pages : 2

[6405]-23

M.E. - I (Information Technology)

MATHEMATICAL FOUNDATION OF INFORMATION
TECHNOLOGY

(2017 Pattern) (Semester - I) (514401)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

Q1) Solve any two

- a) Assume the following relationship for revenue and cost functions. Find out at what level of output x , where x is measured in tons per week, profit is maximum. $R(x) = 1000x - 2x^2$ and $C(x) = x^3 - 59x^2 + 1315x + 5000$. [5]
- b) Using your own intuition and definitions of the universe of discourse, plot fuzzy membership functions for “weight of people”. [5]
- c) Explain with example Karmarkar’s algorithm. [5]

Q2) Solve any two

- a) The probability of error in the transmission of a bit over a communication channel is $P = 10^{-5}$. What is the probability of more than three errors in transmitting a block of 1000 bits? [5]
- b) A graph containing m edges $\{e_1, e_2, \dots, e_m\}$ can be decomposed into $2^{m-1} - 1$ different ways into pairs of sub graphs g_1 and g_2 . [5]
- c) The geometric mean of 10 observations was calculated as 28.6. It was later discovered that one of the observations was recorded as 23.4 instead of 32.4. Apply appropriate correlation and calculate the correct geometric mean. [5]

Q3) Solve any two

- a) Define the terms [5]
 - i) Local Maxima
 - ii) Local Minima
 - iii) Global Minima
 - iv) Global Maxima
- b) Explain with example karmarkar’s algorithm. [5]
- c) List the applications of probability in computer. [5]

P.T.O.

Q4) Solve any two

- a) The first two sub-groups has 100 items with mean 15 and standard deviation 3. If the whole group has 250 items with mean 15.6 and standard deviation $\sqrt{13.44}$, find the standard deviation of the second sub-group. [5]
- b) Explain single point cross over and two point crossover with example. [5]
- c) Determine the maximum of function $\exp(-3x) + \sin(6\pi x)$ using genetic algorithm. Given range = [0.004 0.7]; bits=6; population=12; generations=36; mutation=0.005; matenum=0.3. [5]

Q5) Solve any two

- a) Describe the concepts involved in real-coded genetic algorithm. [5]
- b) Prove that the value of any flow in a given transport network is less than or equal to the capacity of any cut in the network? [5]
- c) As voters exit the polls, you ask a representative random sample of 6 voters if they voted for proposition 100. If the true percentage of voters who vote for the proposition is 55.1%, what is the probability that, in your sample, exactly 2 voted for the proposition and 4 did not? [5]



Total No. of Questions : 7]

SEAT No. :

PD-4921

[Total No. of Pages : 2

[6405]-24

M.E. (Information Technology)

**ADVANCE SOFTWARE ENGINEERING & PROJECT
MANAGEMENT**

(514402) (2017 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidate:

- 1) *Answer any five questions from seven questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary and use of calculator is allowed.*

Q1) a) Explain the key differences between Prescriptive and Specialized software process models. **[5]**

b) Describe the Descriptive Specification techniques using Logic and Algebraic specifications. **[5]**

Q2) a) Explain the Design Concepts that are essential in software design. **[5]**

b) Discuss the role of User Interface Design principles in software development. **[5]**

Q3) a) What are the key principles of Extreme Programming (XP)? How does it enhance software development? **[5]**

b) Compare SCRUM and Feature-Driven Development (FDD) Agile methodologies. **[5]**

P.T.O.

Q4) a) What is the importance of PERT and CPM in software project scheduling? **[5]**

b) Describe the role of Earned Value Management (EVM) in project monitoring and control. **[5]**

Q5) Write a brief overview of any two topics. **[10]**

a) Pair Programming

b) Distributed Software Engineering.

c) User Interface Design

Q6) a) Explain Ishikawa's Seven Tools of quality management with suitable examples. **[5]**

b) What are Process Assessment Models? How do they improve software quality? **[5]**

Q7) a) How do Software Agents and Mobile Agents enhance software engineering? Provide real-world applications. **[5]**

b) Explain the concept of Aspect-Oriented Programming (AOP) and its advantages. **[5]**



Total No. of Questions : 8]

SEAT No. :

PD-4922

[Total No. of Pages : 2

[6405]-25

F.Y. M.E. (Information Technology)
APPLIED ALGORITHMS
(2017 Pattern) (Semester - I) (514403)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) What is complexity of an algorithm? How it is measured? [4]
- b) Write and explain an algorithm to determine whether any pair of line-segments intersects. [3]
- c) Compare Prim's and Kruskal's algorithm. [3]
- Q2)** a) Analyze best average and worst case of Quick Sort in detail. [3]
- b) Write, explain and analyses Rabin-Karp algorithm. [4]
- c) What is recurrence relation? Explain master theorem to solve recurrences. [3]
- Q3)** a) What is Bipartite graphs? Explain its application. [3]
- b) Write and explain Floyd Warshall algorithm with example. [3]
- c) Write and explain an algorithm to find a solution of 2D-Closest pair problem. Also analyze the same. [4]

P.T.O.

- Q4)** a) Explain following terms: [3]
i) Flow Network
ii) Residual Capacity
iii) Augmentation of Flow .
b) State and prove Max-flow Min-cut theorem. [3]
c) Write and explain Johnson's algorithm for sparse graph. [4]
- Q5)** a) Write a parallel algorithm for expression evaluation. [5]
b) Write a general framework to design an approximation algorithm for a particular problem using linear programming. Explain it with the example of vertex cover problem. [5]
- Q6)** a) What is online algorithm? Write and explain obstacle traversal algorithms. [5]
b) What is non deterministic algorithms? Explain different classes of non-deterministic Algorithms. [5]
- Q7)** a) Explain the following terms with suitable examples: [5]
i) NP-Hard Problem
ii) NP-Complete Problem
iii) Splaying
iv) Self-adjustment in Trees
v) Vertex Cover Problem
b) Discuss various parallel computational modules and explain how they achieve the parallelism in algorithmic design. [5]
- Q8)** a) What are the properties of the red-black tree? Explain delete operation with example. [5]
b) Write short notes on: [5]
i) PRAM model of computation
ii) Approximation Algorithms



Total No. of Questions : 6]

SEAT No. :

PD4923

[Total No. of Pages : 2

[6405]-26

First Year M.E. (Information Technology)

RESEARCH METHODOLOGY

(2017 Pattern) (Semester - I) (514404)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

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

Q1) a) Differentiate between various research approaches, such as qualitative, quantitative, and mixed-methods and elucidate when and how each approach is most suitable for a research study. **[5]**

b) Explore the different types of research and provide examples to illustrate each type, highlighting their distinctive characteristics. **[5]**

Q2) a) How can various online resources such as Google, CiteSeer, ACM Digital Library, and IEEE be effectively utilized in the literature review process for research formulation? **[5]**

b) Define the concept of a hypothesis in research. Explain the types of hypotheses and discuss the steps involved in the development and testing of a hypothesis. **[5]**

Q3) a) Discuss the importance of uncertainty analysis and probable errors in research. How do researchers address and mitigate uncertainties in their studies? **[5]**

b) Describe the importance of graphical representation and mapping of data in research. Provide examples of how these techniques can aid in data analysis. **[5]**

P.T.O.

- Q4)** a) When reading a scientific paper, the “Three Pass Approach” is a commonly recommended strategy. Describe this approach in detail and compare it with other methods for comprehending scientific papers. Additionally, discuss how the Three Pass Approach aids in identifying potential research issues. [5]
- b) To ensure a well-written technical paper in English, it’s essential to focus on grammar, punctuation, and linguistic correctness. Provide general advice on addressing these language aspects, along with valuable tips for writing correct English in scientific papers. [5]
- Q5)** a) Discuss how effective report writing skills contribute to clear communication, decision-making, and knowledge dissemination in various fields. [5]
- b) Explore the art of scientific Writing, focusing on techniques to enhance clarity, coherence, and readability. [5]
- Q6)** a) How can one effectively write a research proposal, and what are the key elements that should be included in it? [5]
- b) Discuss the trade-related aspects of intellectual property rights (TRIPS) and their implications for researchers, especially in international collaborations. [5]

Total No. of Questions : 5]

SEAT No. :

PD-4924

[Total No. of Pages : 2

[6405]-27

M.E. (Information Technology)
CYBER SECURITY AND FORENSICS
(2017 Pattern) (Semester - II) (514407)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicates full marks.*
- 3) *Draw neat diagrams where necessary.*

Q1) Solve any Two :

- a) Define the term “Computer Forensics”. [5]
- b) What are the roles of a Computer in a Crime? [5]
- c) Explain the Fundamental Dilemma of Computer Security. [5]

Q2) Solve any Two :

- a) State the objectives of Computer Forensics. [5]
- b) Explain Network defense tools: Firewalls, VPNs, Intrusion Detection, and filters. [5]
- c) Explain The Clark–Wilson Model. [5]

Q3) Solve any Two :

- a) Explain Uses of Digital Forensic Analysis. [5]
- b) What is Cyber stalking, Violent crime and Digital Evidence. [5]
- c) Explain Domain Name System (DNS) and DNS cache poisoning. [5]

Q4) Solve any Two :

- a) Explain Electronic Discovery and Identification of Electronic Data. [5]
- b) Explain Windows Forensic Analysis – NTFS Overview. [5]
- c) Explain Forensic Analysis Fundamentals. [5]

P.T.O.

Q5) Solve any Two :

- a) Explain BitLocker and Encrypting File System (EFS). [5]
- b) Explain Interception of Digital Evidence on Mobile Networks. [5]
- c) Explain Mobile Network Investigations. [5]



Total No. of Questions : 8]

SEAT No. :

PD4925

[Total No. of Pages : 2

[6405]-28

**First Year M.E. (Information Technology)
CLOUD AND DATA TECHNOLOGIES
(2017 Pattern) (Semester - II) (514408)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

- Q1)** a) Discuss following Cloud-Enabling Technology : **[6]**
i) Data Center Technology
ii) Virtualization Technology
b) Write a note on Cloud Security Threats. **[4]**
- Q2)** a) Demonstrate Hypervisor Clustering architecture in Cloud Computing. **[6]**
b) Explain key issues related Cloud Delivery Model Considerations. **[4]**
- Q3)** a) Explain Non-Disruptive Service Relocation Architecture. **[6]**
b) Explain the functionality of the Kaggle Model. **[4]**
- Q4)** a) Discuss various parameters to improve Quality of Service(QoS) in Cloud Computing. **[6]**
b) Explain concept of Zero Downtime Architecture. **[4]**
- Q5)** a) Write a brief note on : **[6]**
i) Rapid Provisioning Architecture
ii) Hubris
b) Explain the concept Data Visualization and Fraud Detection. **[4]**

P.T.O.

- Q6)** a) Discuss various issues and challenges in Big data. [4]
b) Demonstrate with suitable examples : [6]
i) Data Science and Risk
ii) Data Leakage and Model.
- Q7)** a) Write a short note on SLA Management System. [5]
b) Explain Specialized Cloud Architectures of cloud. [5]
- Q8)** a) Demonstrate relationships of Big Data and Cloud Computing. [5]
b) Discuss Models and Techniques for Cloud-Based Data Analysis. [5]



Total No. of Questions : 6]

SEAT No. :

PD4926

[6405]-29

[Total No. of Pages : 3

First Year M.E. (Information Technology)

ITOOR

(2017 Pattern) (Semester - II) (514409)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Attempt any one of Q1 or Q2, rest all questions compulsory.
- 2) Assume Suitable Data, if necessary.
- 3) Neat Diagram must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.

Q1) Consider the following LP problem :

[10]

Maximize $Z = 5x_1 + 8x_2$

Subject to : $x_1 + 5x_2 \leq 14$

$x_1 + 3x_2 \leq 10$ and $x_1, x_2 \geq 0$

- i) Convert this problem to a minimization problem.
- ii) Solve the problem of (i) by the graphical method.

OR

Q2) a) Define Operations Research and explain the methodology of Operations Research. [5]

b) Identify principal phases for implementing Operations Research in practice. [5]

Q3) Attempt any two.

- a) Describe mathematical formulation of Transportation problem. [5]
- b) Consider the following profit and requirement table of a transportation problem, find an optimal solution. [5]

12	6	4	11	18	40
5	8	11	15	16	55
9	10	6	13	8	30
32	20	30	23	20	

P.T.O.

- c) Consider the problem of assignment 5 jobs to 5 machines. The assignment costs are given below, find an optimal way of assignment.

[5]

12	-	19	20	12	18
15	17	-	16	13	22
20	16	18	17	-	22
-	16	14	19	18	15
13	15	15	-	21	14

Q4) Attempt any two :

- a) Write any four limitations of Game Theory. [5]
- b) Solve the following game using graphical Method: [5]

3	1
5	-1
6	-7
1	3

What are the best strategies for players A and B in this game? What is the value of the game for A and B?

- c) Define following terms with respect to game theory : [5]
- Pure strategy
 - Mixed Strategy
 - Payoff matrix

Q5) Attempt any two :

- a) Write short notes on dynamic programming and its application. [5]
- b) Describe the recursive equation approach to solve dynamic programming problems. [5]
- c) What are the stages and states for the dynamic programming formulation. [5]

Q6) Attempt any two.

- a) Explain the rules devised by Fulkerson for network construction. [5]
- b) The utility data for a network are given below. Determine the total float and identify the critical path. [5]

Activity :	1-2	1-4	1-7	2-3	3-6	4-5	4-8	5-6	6-9	7-8	8-9	9-10
Duration:	8	5	4	4	6	3	3	2	2	5	2	6

- c) Explain the algorithm of finding critical path. [5]



Total No. of Questions : 5]

SEAT No. :

PD4927

[Total No. of Pages : 2

[6405]-30

Second Year M.E. (Information Technology)

MOBILE AD-HOC NETWORKS

(2017 Pattern) (Semester-III) (5144013)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answers any two Sub-Questions from Q.1, Q.2, Q.3, Q.4, Q.5.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume Suitable data if necessary.*

Q1) Answer any two of three Sub-Questions.

- a) What are the primary challenges faced by Ad Hoc wireless Internet? [5]
- b) Explain the technical challenges involved in the architecture of PRNETs. [5]
- c) Explain the fundamental characteristics of the wireless channel. [5]

Q2) Answer any two of three Sub-Questions.

- a) Explain the functioning of the Ad Hoc On-Demand Distance Vector (AODV) protocol. [5]
- b) List and explain the advantages of Power Aware Routing (PAR) in Ad Hoc networks. [5]
- c) Explain the issues in designing a routing protocol for Ad Hoc wireless networks. [5]

Q3) Answer any two of three Sub-Questions.

- a) Describe the architecture reference model for multicast routing protocols. [5]
- b) Describe the operations of a mesh-based multicast routing protocol. [5]
- c) Explain the role of energy-efficient multicasting in Ad Hoc networks. [5]

P.T.O.

Q4) Answer any two of three Sub-Questions.

- a) Explain the design goals of transport layer protocols specific to ad hoc wireless networks. [5]
- b) Explain the challenges in achieving reliability in transport protocols over highly dynamic ad hoc networks. [5]
- c) Explain the role of feedback mechanisms in enhancing the performance of transport layer protocols in MANETs. [5]

Q5) Answer any two of three Sub-Questions.

- a) Explain the taxonomy of network security attacks and their mitigation strategies in MANETs. [5]
- b) Compare reactive and proactive security solutions for ad hoc networks. [5]
- c) Explain the trade-offs between performance and security in MANETs under high mobility scenarios. [5]



Total No. of Questions : 7]

SEAT No. :

PD-4928

[Total No. of Pages : 2

[6405]-31

**M.E. (Information Technology)
ADVANCED OPERATING SYSTEMS
(5144014) (2017 Pattern) (Semester - III)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidate:

- 1) *Answer any five questions from seven questions.*
- 2) *Figures to right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) What are the fundamental differences between centralized operating systems and distributed operating systems in terms of structure and management? [5]
- b) Discuss how context switching works in distributed operating systems and the role of system calls and interrupts. [5]
- Q2)** a) Explain the importance of process addressing in distributed systems. How does message- passing solve issues related to process communication? [5]
- b) Describe the key elements of a Remote Procedure Call (RPC) model and its implementation challenges. [5]
- Q3)** a) Explain the concept of consistency models in DSM. How do these models ensure the correct behavior of distributed memory systems? [5]
- b) Discuss the challenges of memory access in DSM systems and how granularity affects performance. [5]

P.T.O.

- Q4)** a) What are the different techniques for achieving mutual exclusion in distributed systems? Compare the advantages and disadvantages of centralized and distributed approaches. [5]
- b) Discuss the concept of deadlock detection and handling in distributed systems. [5]
- Q5)** a) Explain how file replication and consistency contribute to fault tolerance in a distributed file system. [5]
- b) What are the key design principles for ensuring high availability in distributed file systems? [5]
- Q6)** a) How do mobile operating systems optimize I/O performance for mobile devices? Discuss the role of device drivers and I/O scheduling. [5]
- b) Explain the importance of security in mobile operating systems. How does Android OS handle security features like app sandboxing and permission models? [5]
- Q7)** Write short notes on the following (Any two) [10]
- a) Resource management in distributed operating systems
- b) Thrashing in Distributed Shared Memory systems
- c) Election algorithms in distributed systems



Total No. of Questions : 7]

SEAT No. :

PD4929

[Total No. of Pages : 2

[6405]-32

First Year M.E. (Instrumentation & Control)/(Process Instrumentation)

MATHEMATICAL METHODS IN INSTRUMENTATION

(2017 Pattern) (Semester - I) (506101)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any five questions.*
- 2) *Assume suitable data if necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*

Q1) a) Define linear combination of vector with suitable examples. **[2]**

b) Determine basis and dimension of vectors $(3, 8, -3, -5)$, $(1, -2, 5, -3)$, $(2, 3, 1, -4)$ in a vector space $V = R^4$. **[4]**

c) Show that the vectors $(1, 1, 1)$, $(1, 1, 0)$, $(1, 0, 0)$ is linearly independent in R^3 . **[4]**

Q2) a) Let R^4 have a Euclidean inner product, Find the cosine of angle between the vectors $\bar{u} = (-1, 2, 3, 4)$ and $\bar{v} = (4, 1, 2, 1)$ **[5]**

b) Obtain orthonormal vectors from the following vectors (Use Gram-Schmidt method) $\bar{u}_1 = (1, -3)$ $\bar{u}_2 = (2, 2)$. **[5]**

Q3) a) Solve by Gauss-Seidal iteration method. **[4]**

$$27x_1 + 6x_2 - x_3 = 85,$$

$$6x_1 + 15x_2 + 2x_3 = 72,$$

$$x_1 + x_2 + 54x_3 = 110$$

b) Explain Gauss Elimination method with suitable example. **[6]**

Q4) a) The first four central moments of a distribution are 0, 2.5, 0.7 and 18.75. Comment on the skewness and kurtosis of the distribution. **[6]**

b) Determine the value of y when $x = 0.2$, by Euler modified method, given

that $\frac{dy}{dx} = x^2 + y$, $y(0) = 1$ and $h = 0.1$. **[4]**

P.T.O.

- Q5) a)** A continuous random variable X has a probability density function given by $f(x) = 2e^{-x}$, $x > 0$. and $f(x) = 0$, $x \leq 0$. [5]
Find
- $E(X)$,
 - $E(X^2)$
- b)** Explain the terms Skewness and Kurtosis with suitable examples. [5]
- Q6) a)** A joint PDF of two continuous random variable X and Y is [6]
 $f(x, y) = cxy$, $0 < x < 4$, $1 < y < 5$. And $f(x, y) = 0$, otherwise.
- Find the value of constant C
 - Find $p[1 < x < 2, 2 < y < 3]$
 - Find $p[x \geq 3, y \leq 2]$.
- b)** Explain the terms axioms of Probability. [4]
- Q7) a)** Let R^4 have a Euclidean inner product, Find the cosine of angle between the vectors $\vec{u} = (-1, 2, 3, 4)$ and $\vec{v} = (4, 1, 2, 1)$. [5]
- b)** If on an average one ship in every ten is wrecked, find the probability that out of five ship expected to arrive, 4 at least will arrive safely. [5]



Total No. of Questions : 7]

SEAT No. :

PD-4930

[Total No. of Pages : 2

[6405]-33

M.E. (Process Instrumentation & Control)

TRANSDUCER DESIGN

(2017 Pattern) (Semester - I) (506102)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) State the classification and selection criteria of transducers and illustrate performance characteristics of transducer. [5]
- b) Suggest the suitable non contact type transducer used to measure the speed and elaborate the concept with neat sketch. [5]
- Q2)** a) Design Signal Conditioning Circuit for RTD pt100 for following specification, Input range: 0 to 1000C Output range: 0 to 50mv. [5]
- b) State the difference between angular velocity and power. [5]
- Q3)** a) Suggest suitable scheme to measure torque of a rotating shaft using strain gauge. [5]
- b) Illustrate computation of differential pressure using capacitive transducer and elaborate use of vacuum gauge in calibration. [5]
- Q4)** a) Explain with a neat sketch Carbon dioxide sensor in detail and state its applications. [5]
- b) Write a short notes on Microelectromechanical systems (MEMS). [5]

P.T.O.

- Q5)** a) Explain nano sensors in brief and state its applications. [5]
b) Explain: Static Characteristics of instruments. [5]
- Q6)** a) Explain the role of ADC in interfacing of sensor with suitable example.[5]
b) Discuss the SMART sensor used to detect leakage of gas in plant and explain with neat sketch. [5]
- Q7)** a) Describe linearization, conversation, filtering and impedance matching in detail. [5]
b) Explain the use of piezo electric transducer for force measurement with neat sketch. [5]



Total No. of Questions : 6]

SEAT No. :

PD-4931

[Total No. of Page : 1

[6405]-34

M.E. (Instrumentation & Control) (Process Instrumentation)

INDUSTRIAL AUTOMATION

(506103) (2017 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidate:

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Use of Calculator is allowed.*
- 5) Assume Suitable data if necessary*

Q1) Devise ladder programs for systems that will carry out the following tasks: Determine the number of items on a conveyor belt at any particular time by counting those moving onto the belt and those leaving and give an output signal when the number on the belt reaches 100. **[10]**

Q2) Draw a famous automation hierarchy for an industrial application. Analyze the function of each level of automation hierarchy. **[10]**

Q3) Develop point to point and multi-drop network configuration using HART protocol. **[10]**

Q4) What do you mean by OPC? How does it work? **[10]**

Q5) Develop sequential function chart for motor speed control using VFD. **[10]**

Q6) Compare MODBUS, Fieldbus and Profibus. **[10]**



Total No. of Questions : 6]

SEAT No. :

PD4932

[Total No. of Pages : 1

[6405]-35

First Year M.E. (Instrumentation & Control)/(Process Instrumentation)

RESEARCH METHODOLOGY

(2017 Pattern) (Semester - I) (506104)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of calculator is allowed.*
- 5) Assume suitable data if necessary.*

Q1) “Research is much concerned with proper fact-finding analysis and evaluation”. Do you agree with this statement-Justify? **[10]**

Q2) What are the various means of conducting literature survey in modern times?**[10]**

Q3) What is a Questionnaire? Explain the process of construction of a questionnaire. **[10]**

Q4) Write a detailed note on sampling and its design. **[10]**

Q5) What is Hypothesis? What is the significance of formulating the hypothesis in research work? **[10]**

Q6) Discuss the steps in preparation of Report. **[10]**

Total No. of Questions : 6]

SEAT No. :

PD-4933

[Total No. of Pages : 1

[6405]-36

M.E. Instrumentation & Control (Process Instrumentation)
PROCESS DYNAMICS AND CONTROL
(2017 Pattern) (Semester - II) (506107)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Use of Calculator is allowed.*
- 5) Assume Suitable data if Necessary.*

Q1) Design feedback control strategy with suitable example. **[10]**

Q2) Explain a feed-forward control strategy with suitable example. **[10]**

Q3) Design IMC controller for given SOPDT process $\frac{2e^{-3s}}{(3s+1)(5s+1)}$. **[10]**

Q4) Discuss with suitable example Gain Scheduling Adaptive Control. **[10]**

Q5) Develop ratio controller configurations to maintain ratio between two reactants in a reactor. **[10]**

Q6) Derive mathematical model of stirred tank heater using first principle. **[10]**



Total No. of Questions : 5]

SEAT No. :

PD4934

[Total No. of Pages : 2

[6405]-37

**First Year M.E. (Instrumentation and Control)/(Process
Instrumentation)**

**EMBEDDED SYSTEM DESIGN
(2017 Pattern) (Semester - II) (506108)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator.*
- 5) *Assume suitable data, if necessary.*

Q1) Attempt any two of the following :

- a) Elaborate with neat diagram, AVR general purpose registers in CPU of AVR μ C. [5]
- b) Draw neat block diagram and elaborate ADC pre-scaler of AVR microcontroller. [5]
- c) Analyze with suitable block diagram timer/counter prescalers of AVR μ C. [5]

Q2) Attempt any two of the following :

- a) Write short note on Timer-Counters of ARM-7 microcontroller. [5]
- b) Draw and explain Barrel shifter in ARM7. [5]
- c) Draw a neat block diagram and describe ARM bus technology. [5]

Q3) Attempt any two of the following :

- a) Compare RS-232 and RS-485 communication protocol. [5]
- b) Write short note on RS-485 bus. [5]
- c) Describe the four primary benefits of CAN protocol provides. [5]

Q4) Attempt any one of the following :

- a) Design embedded system using 8051 μ C for washing machine control. Draw and explain the system with suitable block diagram and circuit diagram. [10]
- b) Design embedded system using AVR μ C for temperature ON/OFF control. Draw and explain the system with suitable block diagram and circuit diagram. [10]

P.T.O.

Q5) Attempt any one of the following :

- a) It is decided to design greenhouse automation system. Develop the system using LPC2148 ARM-7 microcontroller to display the parameters on LCD display. Provide the facility to communicate the information through SMS to the farmer. For this system,
 - i) Identify different parameters for greenhouse automation system. [2]
 - ii) Enlist selected sensors. [2]
 - iii) Develop block diagram. [2]
 - iv) Elaborate the operation of the system with respect to block diagram. [2]
 - v) Develop the algorithm for the system. [2]
- b) Develop the system using LPC2148 ARM-7 microcontroller for monitoring Vehicale parameters. For this system,
 - i) Identify different parameters for health monitoring system. [2]
 - ii) Enlist selected sensors. [2]
 - iii) Develop block diagram. [2]
 - iv) Elaborate the operation of the system with respect to block diagram. [2]
 - v) Develop the algorithm for the system. [2]



Total No. of Questions : 5]

SEAT No. :

PD4935

[6405]-38

[Total No. of Pages : 2

First Year M.E. (Instrumentation & Control) (Process Instrumentation)

CONTROL SYSTEM

(2017 Pattern) (Semester - II) (506109)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Figure to the right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) Attempt any two Questions :

- a) Discuss various types of incidental Nonlinearities. [5]
- b) Discuss the term Jump Resonance in brief. [5]
- c) List different characteristics of nonlinear systems. Also brief about behavior of nonlinear systems. [5]

Q2) Attempt any two Questions :

- a) Elaborate the concept of Describing Function. [5]
- b) Describe the procedure to construct phase trajectory by delta method. [5]
- c) Determine the type and stability or the critical point at (0,0) of system below. [5]

$$\dot{x} = \begin{bmatrix} -4 & 0 \\ 0 & -4 \end{bmatrix} x$$

P.T.O.

Q3) Attempt any two Questions :

- a) Illustrate the Frequency-Dependent Describing Functions with example. [5]
- b) Consider the Nonlinear system [5]

$$\begin{aligned}\dot{x}_1 &= -x_1 - x_2^2 \\ \dot{x}_2 &= -x_2\end{aligned}$$

Investigate the stability of equilibrium points.

- c) Determine the stability of the system describe by the following equation. [5]

$$\dot{x} = \begin{bmatrix} -1 & -2 \\ -1 & -4 \end{bmatrix} x \text{ Assume } (Q = I).$$

Q4) Attempt any two Questions :

- a) Elaborate the describing function for ideal relay, saturation and dead band. [5]
- b) Illustrate the concept Diffeomorphisms and State Transformations. [5]
- c) Write short note on feedback linearization of SISO System. [5]

Q5) Attempt any one Question :

- a) Discuss the concept of sliding mode control with variable structure, model inaccuracies and Chattering effect. [10]
- b) Discuss the Design of the Sliding Manifold and Types of Variable Structure Control Laws. [10]



Total No. of Questions : 5]

SEAT No. :

PD4936

[Total No. of Pages : 2

[6405]-39

S.Y. M.E. (Instrumentation & Control) (Process Instrumentation)

ADVANCED SIGNAL PROCESSING

(2017 Pattern) (Semester-III) (606101)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator.*
- 5) *Assume Suitable data if necessary.*

Q1) Attempt any two Questions.

- a) Determine output response of an LTI system whose impulse response $h(n) = 1; 0 \leq n \leq 2$ and $x(n) = (0.5)^n u(n)$; is input applied. **[5]**
- b) What are different methods of FIR filter design, elaborate the windowing method for FIR filter design? **[5]**
- c) Explain different methods of IIR filter design. **[5]**

Q2) Attempt any two Questions.

- a) A signal with a sampling frequency of 2.048 KHz is to be decimated by a factor of 32 to get the new sampling frequency of 64Hz. The signal band of interest extends from 0 to 30 Hz. The pass band deviation is 0.01dB and stop band attenuation is 80dB. Calculate the normalized transition band width, Stop band and pass band ripples. **[5]**
- b) The transfer function of an FIR filter is given by $H(z) = 0.2 + 0.7z^{-1} + 0.8z^{-2} + 0.15z^{-3} + 0.6z^{-4} + 0.32z^{-5} + 0.5z^{-6} + 0.4z^{-7} + 0.9z^{-8}$ Obtain the poly phase decomposition of $H(z)$ to decompose into 2 and sections. **[5]**
- c) What are QMFs? How will you design these filters? What is ideal shape of these filters? **[5]**

P.T.O.

Q3) Attempt any two Questions

- a) Explain noble identities used in multirate signal Processings. [5]
- b) Consider the discrete time signal $x(n) = \{5 \ 6 \ 7 \ 8\}$. [5]
Determine the up scaled version of the signal for sampling rate conversion $I = 2, I = 3, I = 4$
- c) Compare LMS and RLS filters. [5]

Q4) Attempt any two Questions.

- a) Given Autocorrelation values $\gamma_{yy}(0) = 3, \gamma_{yy}(1) = 1$ and $\gamma_{yy}(2) = 3$, for a process of single sinusoid with additive noise. Find frequency, its power and variance of white noise. [5]
- b) Sketch Block schematic for finding periodogram using the Welch method, Blackman -Tukey method Bartlett method. Elaborate the each step. [5]
- c) Discuss use of parametric methods of power spectrum estimation. Write the algorithm for estimation of power spectrum using Yule Walker method. [5]

Q5) Attempt any one Question.

- a) List various approaches for Linear Predictor Coefficient. Discuss one method in detail. [10]
- b) What are different applications of Linear Prediction? Illustrate one application in detail. [10]
- c) Discuss various steps of the Burg algorithm for forward and backward prediction. [10]



Total No. of Questions : 7]

SEAT No. :

PD-4937

[Total No. of Pages : 2

[6405]-40

M.E. (Instrumentation & Control) (Process Instrumentation)
BUILDING AUTOMATION
(2017 Pattern) (Semester - III) (606102)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam table is allowed.*
- 5) Assume suitable data, if necessary.*

Q1) a) Draw the basic block diagram of building life safety system, explain each block in details. **[6]**

b) Write a short notes on "Addressable Fire Alarm System". **[4]**

Q2) a) Explain how template are generated in biometrics system with neat sketch. **[6]**

b) Write a short notes on NIDS. **[4]**

Q3) a) Explain Two pipe all water air conditioning system with neat sketch. **[6]**

b) Write a short notes on Cooling Towers. **[4]**

Q4) a) Explain any one application of vapour compression cycle with neat sketch. **[6]**

b) Write a short notes on MCC. **[4]**

P.T.O.

- Q5) a)** List and Explain benefits of DDC. **[6]**
- b)** Write a Short notes on Lon Works. **[4]**
-
- Q6) a)** Explain Integrated building management system in data centre with neat sketch. **[6]**
- b)** Write a short notes on Normal & Emergency operation in BMS. **[4]**
-
- Q7) a)** What is the difference between project life cycle & project management life cycle? **[6]**
- b)** Write a short notes on Skills, Required By PE & PM. **[4]**



[6405]-41

**First Year M.E. (Mechanical/Design Engineering) (Computer Aided
Design Manufacture & Engg.) (Automotive Engg.)
ADVANCED MATHEMATICS
(Design/CAD-CAM/Auto-Mobile)
(2017 Pattern) (Semester - I) (507201)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

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

- Q1)** a) Find the orthonormal basis for the following vectors in $\mathbb{R}^4$ applying Gram-Schmidt's method: $(1, 0, 1, 0)$, $(1, 1, 1, 1)$, $(-1, 2, 0, 1)$ [5]
- b) If the potential function ϕ is $\log(x^2 + y^2)$, find the flux function ψ and the complex function $f(z) = \phi + i\psi$. [5]

OR

- Q2)** a) Evaluate $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-2)(z-3)} dz$ where C is the circle $|z| = 4$. [5]
- b) Find the mechanical system which is governed by the differential equation with the given initial condition, using Laplace transform. [5]

$$\frac{d^2 y}{dt^2} + 9y = 18t, \quad y(0) = 0, \quad y'(0) = 1.$$

- Q3)** a) Express the following functions in terms of unit-step function and hence find its Laplace transform. [5]

$$f(t) = \begin{cases} 0, & t < 1 \\ t^2 - 2t + 2, & t \geq 1 \end{cases}$$

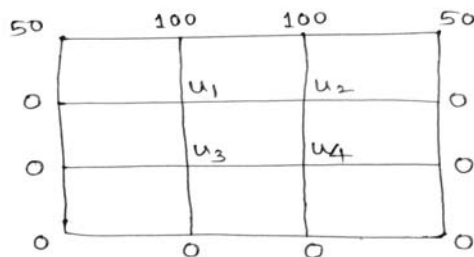
- b) Solve the following differential equation by series method. [5]
- $$Y'' - Y = 0.$$

P.T.O.

- Q4) a)** Calculate by power method the largest eigen value and the corresponding eigen vector of the matrix. [5]

$$A = \begin{bmatrix} 4 & 0 & 1 \\ 0 & 4 & 0 \\ 1 & 0 & 4 \end{bmatrix} \text{ with } X_0 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

- b) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ for the square mesh with boundary values as given below. [5]



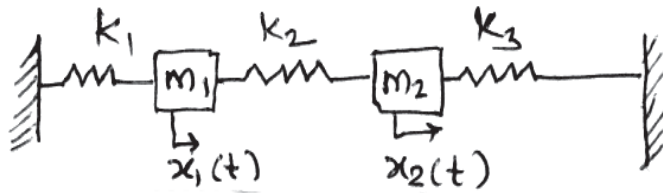
- Q5) a)** Solve the equation $\frac{\partial u}{\partial t} = 2 \frac{\partial^2 u}{\partial x^2}$ subject to the condition $u(0, t) = u(1, t) = 0$ and $u(x, 0) = x(1-x)$ with $h = 0.2$ using Bendre Schmidt Method. [5]
- b) Solve the boundary value problem $y'' + 3y = x^3$ with conditions $y(0) = 0$ and $y(2) = 0$ using Galerkin's method. [5]

- Q6) a)** Minimize the functional $\int_0^\pi [3y'^2 - 2y^2 + 4(\sin x)y] dx$ using condition $y(0) = 0$ $y(\pi) = 0$. [5]
- b) Solve the following overdetermined system of linear equations using least square method $5x - 3y = 7$, $2x + y = 4$, $3x + 2y = 5$. [5]

- Q7) a)** Under the transformation $w = \frac{i-z}{i+z}$, Show that the X-axis in Z-plane is mapped on to the circle $|w| = 1$. [5]

- b) Find the fourier transform of $f(x) = \begin{cases} 1; & |x| < 3 \\ 0; & |x| > 3 \end{cases}$ [5]

- Q8) a)** For the following mass spring system $m_1 = 9$, $m_2 = 1$, $k_1 = 24$, $k_2 = 3$, $k_3 = 3$, assuming there is no friction. Find the natural frequencies. [5]



- b) Solve $16 \frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}$ by taking $h = 1$ up to $t = \frac{5}{4}$ [5]

Given that

- i) $u(0, t) = u(5, t) = 0$
- ii) $u(x, 0) = x^2(5-x)$
- iii) $u_t(x, 0) = 0$

* * *

Total No. of Questions : 8]

SEAT No. :

PD4939

[Total No. of Pages : 2

[6405]-44

First Year M.E. (All Mechanical branches)

RESEARCH METHODOLOGY

(2017 Credit Pattern) (Semester - I) (502104)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of Logarithmic tables slide rule is electronic pocket calculator is allowed.*

- Q1) a)** What are the criteria of good Research? **[4]**
- b) What are the important parameters should be considered while finalizing the research problem? **[5]**

OR

- Q2) a)** Discuss the difference between fundamental research and applied research. **[4]**
- b) Discuss the role of literature review during various stages of research. **[5]**

- Q3) a)** Explain the steps in setting up a computer model to predict performance of experimental system. **[4]**
- b) What is Hypothesis? Explain characteristics of Hypothesis. **[5]**

OR

- Q4) a)** Discuss the errors in Selecting Research Problem. Also elaborate the benefit of conducting Pilot Study of Research Problem. **[4]**
- b) Explain the Meaning of variable and Selection of variables. **[5]**

P.T.O.

- Q5) a)** Explain the role of DSP in data collection in noisy environment. **[8]**
b) Explain Regression Analysis and Curve Fitting. **[8]**

OR

- Q6) a)** Explain the Static and dynamic characteristics of instruments used in experimental set up (any 4). **[8]**
b) Explain different steps and precautions while writing research report. **[8]**

- Q7) a)** Explain outline and structure of research report. **[8]**
b) Explain error analysis and methods to reduce errors in research process. **[8]**

OR

- Q8) a)** Explain the term Plagiarism. How can we avoid plagiarism in paper writing and thesis writing? **[8]**
b) What is Uncertainty analysis? How uncertainty in the measurement is estimated? **[8]**

Total No. of Questions : 7]

SEAT No. :

PD4940

[Total No. of Pages : 2

[6405]-48

S.Y.M.E. (Mechanical) (Automotive Engineering)

VEHICLE DYNAMICS

(2017 Pattern) (Semester-III) (602313)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any FIVE questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *All questions carry equal marks.*
- 4) *Assume suitable data, if necessary.*

Q1) a) Explain variation of tractive effort with longitudinal slip. **[5]**

b) Draw the tire axis system as recommended by the SAE and explain various angles and forces associated with the tire. **[5]**

Q2) The mass of a passenger car including four tires is 1500 kg. Each of the tires weighs 225 N, has an effective diameter of 67 cm and a radius of gyration of 28 cm. The engine develops a power of 45 kW at 4000 rpm. The equivalent weight of the rotating parts of the driveline is 450 N with a radius of gyration of 10 cm. The transmission efficiency is 88% and the total reduction ratio of the driveline in the second gear is 7.7 to 1. The vehicle has a frontal area of 1.67 m² and the aerodynamic drag coefficient is 0.45. Assume standard atmospheric temperature and pressure condition as 15 °C and 1.013 bar and gas constant for air $R = 287 \text{ J/kg-K}$. The average coefficient of rolling resistance is 0.015. Under these conditions determine- **[10]**

- a) Speed of the car,
- b) Aerodynamic resistance to the car and
- c) Acceleration of the car on a level road

Q3) a) Describe anti-dive and squat suspension geometry. **[5]**

b) Define reference frame, toe-in, toe-out, wheel camber, caster and kingpin angle with respect to the suspension kinematics **[5]**

P.T.O.

Q4) A passenger car weighs 20 kN and has a wheelbase of 2.8 m. The center of gravity is 1.27 m behind the front axle. If a pair of radial-ply tires, each of which has a cornering stiffness of 46 kN/rad are installed in the front, and a pair of bias-ply tires, each of which has a cornering stiffness of 33 kN/rad are installed in the rear. The average steering gear ratio is 22. [10]

Determine-

- i) Whether the vehicle is understeer or oversteer
- ii) the required angle in degrees at steering wheel during a constant radius test with turn radius of 12 m at a constant forward speed of 40 kmph

Q5) a) Discuss in detail the effect of natural frequency of sprung mass and damping factor on the performance of vehicle suspension. [4]

- b) The sprung mass of a passenger car weigh 14 kN and the un-sprung parts weigh 8% of sprung mass. When car is stationary the suspension spring and tire deforms by 175 mm and 20mm respectively. Determine [6]

- i) Vertical stiffness of suspension spring and tire.
- ii) The two natural frequencies of the bounce motion of the sprung and un sprung mass.

Q6) a) Explain the method of calculating RMS value of the vehicle response when it is excited by the random road profile with known power spectral density. [5]

- b) Write short note on the model of ISO road profile. [5]

Q7) a) Explain the effect of wheelbase filtering on the vibration response of vehicle suspension to the road roughness [5]

- b) Explain various tests that can be used to evaluate handling characteristics of vehicles. [5]



Total No. of Questions : 5]

SEAT No. :

PD4941

[Total No. of Pages : 2

[6405]-50

**First Year M.E. (Mechanical)/(Computer Aided Design,
Manufacture & Engineering)**

**ADVANCED MACHINE DESIGN
(2017 Pattern) (Semester - I) (502402)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Solve any two from each question.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of electronic pocket calculator is allowed.*

Q1) Attempt any two

- a) Investigate what problem of plane stress is represented by the function.[5]

$$\phi = \frac{3F}{4h} \left(xy - \frac{2Ry^3}{3h^2} \right) + \frac{P}{2} y^2$$

Where 'h' is half depth of beam, and 'F' as the concentrated load.

- b) Explain fundamental assumptions made in the theory of elasticity and explain strain energy theory. [5]
- c) Derive the expression for Airy's stress function in Cartesian coordinate.[5]

Q2) Attempt any two

- a) Explain Von misses and Tresca criteria. [5]
- b) Explain Mohr's theory of failure in detail. [5]
- c) Write stress-strain relation for brittle and ductile material. [5]

Q3) Attempt any two

- a) Explain Castiglione's theorem with its applications. [5]
- b) Explain Raleigh-Ritz method and its important characteristics. [5]
- c) What is true stress and true strain? Assuming exponential relation for stress and true strain derive the expression to estimate time of rupture.[5]

P.T.O.

Q4) Attempt any two

- a) What is the cumulative fatigue damage? How the life of component subjected to different values of fluctuating stresses in cycle, is estimated by using Miner's equation. [5]
- b) Describe the influence of super imposed static stress in fatigue. [5]
- c) Explain the concept of energy balance during crack growth. [5]

Q5) Attempt any two

- a) Consider a graphite epoxy laminate whose elastic constant along the perpendicular direction to fibres are as follows, [5]
 $E_{xx} = 181 \text{ Gpa}, \quad E_{yy} = 10.3 \text{ Gpa}, \quad G_{xy} = 7.17 \text{ Gpa},$
 $V_{yx} = 0.28, \quad V_{xy} = 0.01594.$
Obtain the compliance coefficient approx $x'y'$ axes which are at,
 - i) $+ 30^\circ$ counter clockwise to XY axes and
 - ii) $+ 90^\circ$ to XY axes
- b) Write short note on Transverse shear effect in composite laminates. [5]
- c) Write short note on Maxwell model and Rheological model. [5]



Total No. of Questions : 7]

SEAT No. :

PD-4942

[Total No. of Pages : 2

[6405]-51

M.E. (Mechanical) (CADME)
COMPUTER AIDED DESIGN
(2017 Pattern) (Semester - I) (502403)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicates to the full marks.*
- 4) *Assume suitable data whenever necessary.*
- 5) *Use of non-programmable calculator is allowed.*

- Q1)** a) Explain the parametric representation of Analytical curves. [5]
b) Explain different types of IGES standard used in CAD. [5]
- Q2)** a) Explain the parametric representation of Plane surface and Revolved surface. [5]
b) Explain the 3D Modelling features and Feature entities. [5]
- Q3)** a) Explain the parametric representation of spline surface. [5]
b) Explain in brief surface manipulation techniques. [5]
- Q4)** a) Explain 3D modelling operation Strategies. [5]
b) Explain top down approaches used for assembly modeling. [5]
- Q5)** a) Explain the algorithms used for manipulating images. [5]
b) Explain the Circular and Perpendicular feature representation used in CAD. [5]

P.T.O.

- Q6)** a) Write notes on evaluation of data exchange formats. [5]
b) Explain the Collaborative Design Approaches. [5]
- Q7)** Write short note on :
a) Spline [5]
b) B Rep [5]



Total No. of Questions : 7]

SEAT No. :

PD4943

[Total No. of Pages : 1

[6405]-52

**First Year M.E. (Mechanical)(CADM & E)
COMPUTER INTEGRATED MANUFACTURING
(2017 Pattern) (Semester - II) (502407)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions from the following.*
- 2) Neat diagram must be drawn wherever is necessary.*
- 3) Figure to be right side indicates full marks.*
- 4) Use of calculator is allowed.*
- 5) Assume suitable data if necessary.*

Q1) Explain CIM hardware and software elements and list their functions? [10]

Q2) Discuss the requirements of data base management in CIM? Explain PDM and its Advantages. [10]

Q3) Explain and discuss Flexible Manufacturing System and its various components with neat sketches. [10]

Q4) Explain the role of integrative manufacturing in CAD/CAM for planning and control. [10]

Q5) Write short note on MRP - I and JIT manufacturing philosophy. [10]

Q6) Explain the web base manufacturing for forging and forming process with example. [10]

Q7) Explain the principle of lean manufacturing and its characteristics also explain four functions of lean production. [10]



Total No. of Questions : 7]

SEAT No. :

PD4944

[Total No. of Pages : 1

[6405]-53

First Year M.E. (Mechanical Engineering) (CADM&E)

INDUSTRIAL PRODUCT DESIGN & PRODUCT LIFE

CYCLE MANAGEMENT

(2017 Pattern) (Semester - II) (502408)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions from the following.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

Q1) Explain the concept of Quality Function Deployment (QFD) and evaluate its strategic application in product planning. **[10]**

Q2) Critically examine contemporary methodologies in product design and assess the significance of rapid prototyping in the design process. **[10]**

Q3) Evaluate the process of benchmarking and its role in establishing precise engineering specifications. **[10]**

Q4) Assess the impact of Design for Manufacturability (DFM) on development costs and product quality, considering strategic implications. **[10]**

Q5) Compare and contrast the key characteristics of various Product Data Management (PDM) systems, emphasizing their functional advantages. **[10]**

Q6) Interpret Product Lifecycle Management (PLM) and. analyze the underlying architectures of PLM systems, highlighting their technological sophistication. **[10]**

Q7) Explain the intricacies of product workflow, considering its role in enhancing operational efficiency and quality control. **[10]**



Total No. of Questions : 7]

SEAT No. :

PD-4945

[Total No. of Pages : 2

[6405]-54

M.E. (Mechanical Engineering) (CADME)
AUTOMATED MANUFACTURING SYSTEM
MODELLING
(2017 Pattern) (Semester - II) (502409)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

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

Q1) Describe the fundamental elements of an automated system and their functions. Provide examples to illustrate each element. **[10]**

Q2) Explain the concept of flow lines and transfer mechanisms in automated manufacturing. How do these systems optimize production efficiency and reduce cycle times? **[10]**

Q3) Discuss the role of pneumatic sensors, amplifiers, and logic devices in automated systems. How do these components contribute to system efficiency and reliability? **[10]**

Q4) Evaluate the role of artificial neural networks (ANNs) and fuzzy logic in enhancing manufacturing automation. Provide examples of their applications in optimizing production processes. **[10]**

Q5) Describe the principles of manufacturing support systems and their role in optimizing production operations. Provide examples of commonly used support systems. **[10]**

P.T.O.

Q6) Explain the notation and examples of queuing networks in manufacturing. How are queuing networks used to optimize production flow and resource utilization?

[10]

Q7) Discuss the benefits of implementing integrated automation systems in terms of production efficiency, quality improvement, & cost reduction. Provide examples of successful integration strategies.

[10]



Total No. of Questions : 7]

SEAT No. :

PD4946

[Total No. of Pages : 1

[6405]-55

S.Y.M.E.(Mechanical)(Computer Aided Design Manufacture & Engineering)

SIMULATION MODELING

(2017 Pattern) (Semester-III) (602413)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any five questions.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Assume suitable data, if necessary.*

Q1) Classify the distribution system. Explain Exponential distribution system with suitable example. **[10]**

Q2) Explain the following terms. **[10]**

- a) Explain the simulation procedure of continuous system.
- b) Explain the Triangular Distribution.

Q3) List the areas of application related to simulation modeling. And list the limitations of simulation. **[10]**

Q4) Explain Poisson Distribution. **[10]**

Q5) Explain different performance measures in manufacturing system modeling. **[10]**

Q6) Explain Linear congruential method with example. **[10]**

Q7) What is necessity of verification & validation of model? **[10]**



Total No. of Questions : 7]

SEAT No. :

PD-4947

[Total No. of Pages : 2

[6405]-56

M.E. (Mechanical (CADM & E))

OPTIMIZATION TECHNIQUES

(2017 Pattern) (Semester - III) (602414)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Answer any five questions from the following.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

Q1) Solve by liner programming :

[10]

$$\text{Minimize } f(X) = -67x_1 - 127x_2$$

$$\text{Subject to } 37x_1 + 32x_2 \leq 4000$$

Where x_2 & x_1 is greater than or Equal to Zero

Q2) How optimization problem can be formed & Discuss classification of optimization problem. [10]

Q3) Explain different Optimality criteria for single objective, Multi objective & constrained optimization problem. [10]

Q4) How to solve secant method & Write an algorithm for interval halving method, [10]

P.T.O.

Q5) Minimize $F(X_1, X_2) = [X_1^2 + X_2 - 11]^2 + [X_1 + X_2^2 - 7]^2$ **[10]**

Subjected to $g_1(x) = 26 - (X_1 - 5)^2 - X_2^2 \geq 0$.

$g_2(x) = 20 - 4X_1 - X_2 \geq 0$,

$5 \geq X_1, X_2 \geq 0$

using complex search Method.

Q6) Explain the concept of Particle Swarm Optimization. **[10]**

Q7) Explain the working variable elimination method & cubic search method particle Swarm Optimization. **[10]**



[6405]-57

M.E. - I (Mechanical) (Design Engineering)
MATERIAL SCIENCE AND MECHANICAL BEHAVIOUR OF
MATERIALS
(2017 Pattern) (Semester - I) (502202)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Attempt any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of programmable calculator is not allowed.
- 5) Assume suitable data wherever necessary.

- Q1)** a) For single-phase metals, explain strengthening by grain size reduction, solid-solution alloying, and strain hardening. [5]
 b) Write a note on nanomaterials, their types, applications, and properties. [5]
- Q2)** a) Explain Von Misses' Criteria of Yielding and draw its Yield Locus. [5]
 b) A thin-walled steel cylindrical vessel with a diameter $D=50.8$ cm and a wall thickness $t=6.35$ mm is subjected to an interior pressure p as shown in Figure 1; the ends of the tubes are closed. The yield stress of the steel is 225 MPa. According to- [5]
 i) The Tresca criterion and
 ii) The Von Misses criterion, find the pressure p , under which the vessel begins to yield

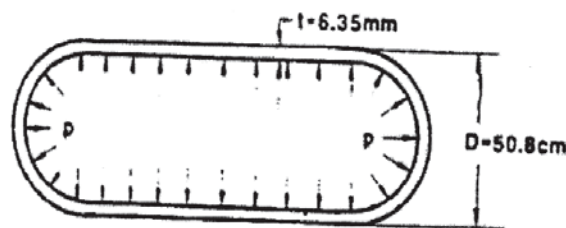


Figure 1

- Q3)** a) The state of stress at a point in a body is given by
$$\begin{bmatrix} 10 & 0 & 3 \\ 0 & 3 & 0 \\ 3 & 0 & 2 \end{bmatrix}$$
. [5]

Determine the following:

- i) Octahedral normal stress
 - ii) Octahedral shear stress
 - iii) Maximum shear stress
- b) Explain with a neat sketch the Bridgeman correction for metals. [5]

P.T.O.

- Q4)** a) A tensile specimen with a 12 mm initial diameter and 50 mm gauge length reaches maximum load at 90 kN and fractures at 70 kN. The minimum diameter at fracture is 10mm. Determine the engineering stress at maximum load and true fracture stress. [5]
- b) Explain the Three Point Bend Test with neat sketch. [5]
- Q5)** a) Two points on a true stress-strain curve for aluminum alloy are $\sigma = 222$ MPa at $\epsilon = 0.05$ and $\sigma = 303$ MPa at $\epsilon = 0.15$. Find the values of K and n using the Power Law Approximation that best fit the data. [5]
- Then using these values of K and n, predict the true stress at a strain of $\epsilon = 0.30$.
- b) Write a short note on: [5]
- i) Isotropic Hardening Model
- ii) Kinematic Hardening Model
- Q6)** a) Explain the Deformation Theory of Plasticity. [5]
- b) Explain Elastic-plastic torsion of a solid circular shaft. [5]
- Q7)** a) What is viscoelasticity? Explain Maxwell's model and the Voigt Model for viscoelastic material with a neat sketch. [5]
- b) The amplitude of a vibrating member decreases so that the amplitude on the 100th cycle is 13% of the amplitude on the 1st cycle. Determine natural Decay. [5]



[6405]-58

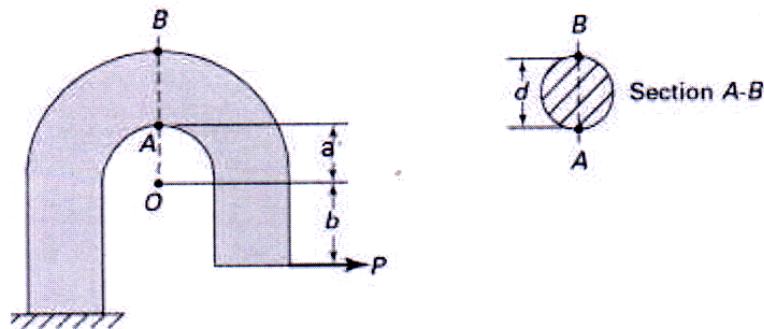
M.E. (Mechanical) (Design Engineering)**ADVANCED STRESS ANALYSIS****(2017 Pattern) (Semester - I) (502203)****Time : 3 Hours]****[Max. Marks : 50****Instructions to the candidates :**

- 1) Solve Any five questions.
- 2) Draw suitable neat diagrams, whenever necessary.
- 3) Use of scientific calculator is allowed.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data if required.

- Q1) a)** Verify whether the Airy stress function $\Phi = Ar^2 \ln(r)$ satisfies the biharmonic equation in polar coordinates. Also find corresponding stresses. [5]
- b)** A curved beam of a circular cross section of diameter d is fixed at one end and subjected to a concentrated load P at the free end as shown in figure below. [5]

Calculate :

- i) resultant stress at point A and
- ii) resultant stress at point B.

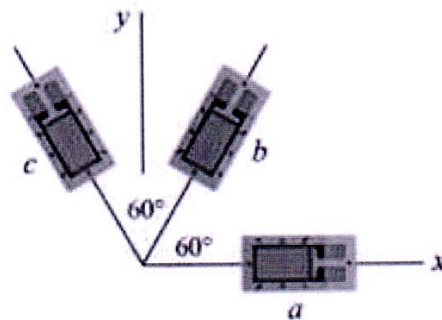
Given: $P = 800 \text{ N}$, $d = 20 \text{ mm}$, $a = 25 \text{ mm}$, and $b = 15 \text{ mm}$.**P.T.O.**

Q2) A strain gauge rosette as shown in figure was mounted over a free surface of a thin-walled pressure vessel that is subjected to pressure P and torque T and the following strains were sensed **[10]**

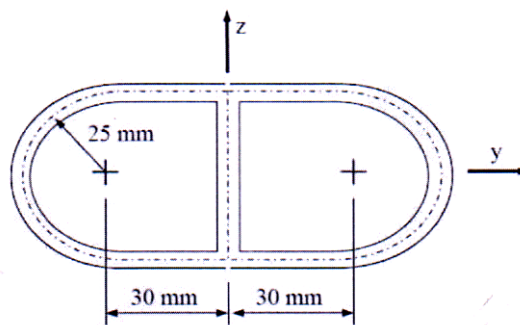
$$\epsilon_a = 200 \mu\text{m/m}, \epsilon_b = 212 \mu\text{m/m} \text{ and } \epsilon_c = 1163 \mu\text{m/m}.$$

If modulus of Elasticity = 200 GPa and Poisson ratio = 0.3, determine

- the state of stress and strain at the location of the strain gauge
- the principal strains
- the principal stresses
- direction of maximum stress/strain
- the maximum shear stress.

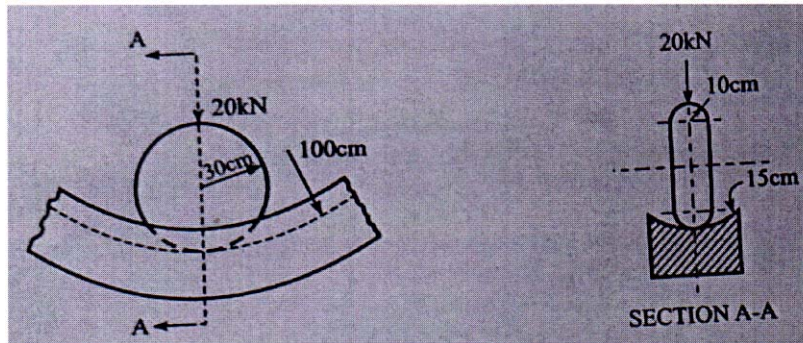


Q3) A thin-walled, two-cell aluminum tube, symmetric with the y and z axes, is transmitting a torsional moment of 2.5 kN.m. The thickness of each wall is 5 mm. For Aluminum modulus of rigidity = 70 GPa and Poisson ratio = 0.33. Determine the average shear stress in each wall and the angle of twist per unit length. **[10]**



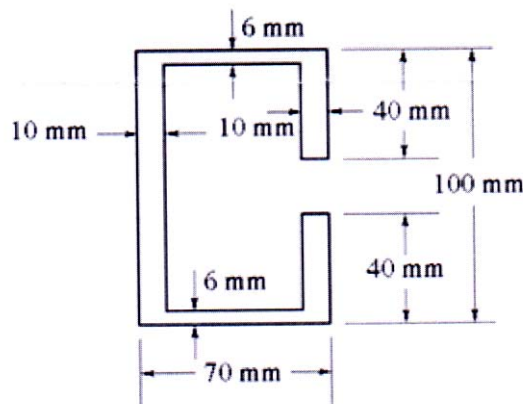
Q4) Obtain a deflection of circular plate subjected due to symmetrical loading with respect to centre. **[10]**

- Q5)** A hardened steel roller ($E = 210 \text{ GPa}$ and $\nu = 0.29$) runs in an annular groove of cast iron member ($E = 110 \text{ GPa}$ and $\nu = 0.26$) with a total load of 20 kN . Determine the maximum principal stress, maximum shear stress and locate the point where these stresses occur. **[10]**



- Q6)** A thin-walled cross section of a beam is shown in Fig. The dimension is given based on the centerline of each member of the cross. **[10]**

- Determine the moment of inertia about x-axis passing through CG.
- Calculate forces in the legs of the cross section due to shear flow.
- And hence find the shear center for the beam cross section.



- Q7)** a) Explain the working of plain Polariscope and explain how Iso-clinics and Iso- chromatics are obtained when a stressed model is viewed through polariscope. **[5]**
- b) Explain the importance of analogies used in torsion. Derive expression for membrane analogy with suitable sketch. **[5]**

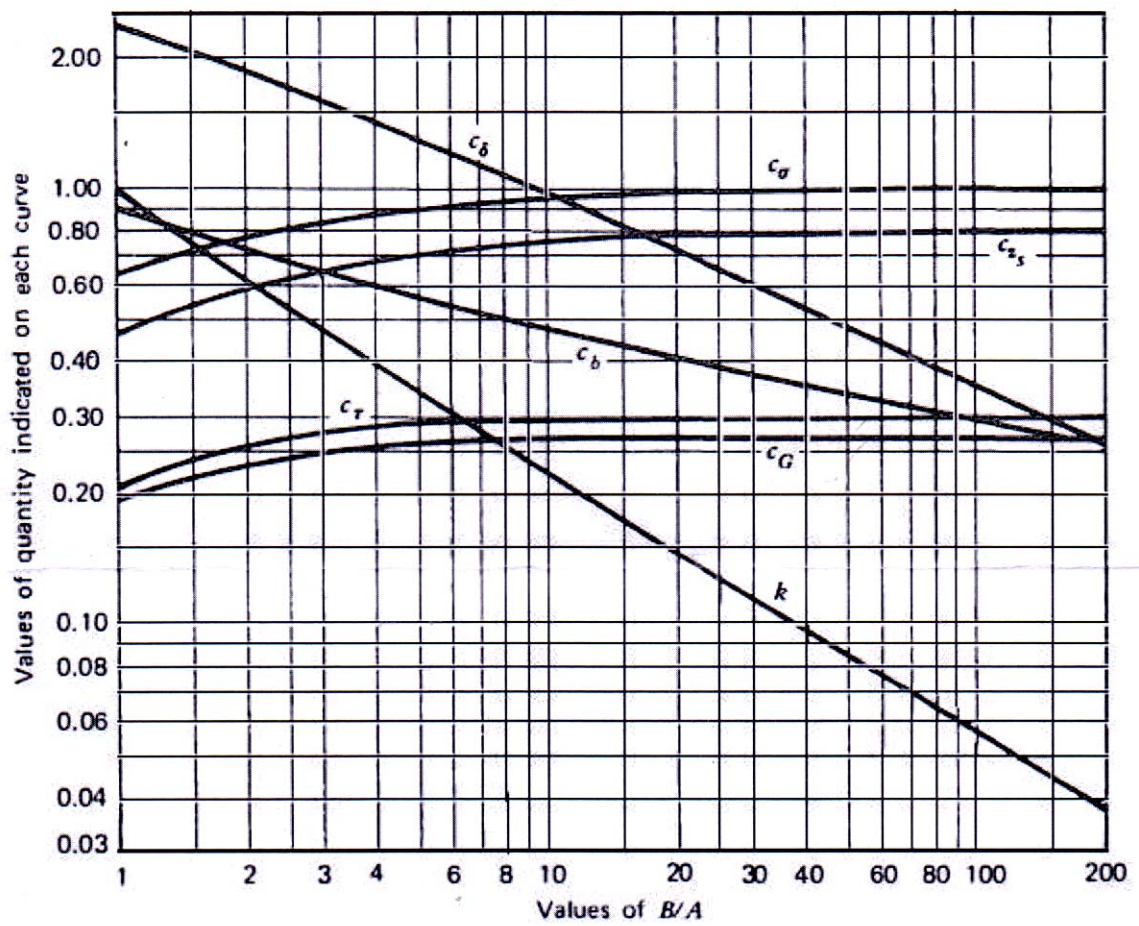


Figure Stress and deflection coefficients for two bodies in contact at a point.

[6405]-59

First Year M.E. (Mechanical)/(Design Engineering)

ANALYSIS & SYNTHESIS OF MECHANISMS

(2017 Pattern) (Semester - II) (502207)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.
- 2) A neat diagram must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of a programmable calculator is not allowed.
- 5) Assume suitable data wherever necessary.

Q1) a) Discuss the importance of the following terms with reference to the 4-bar mechanism. [5]

- i) Transmission Angle
- ii) Mechanical Advantage
- iii) Toggle Position

b) Find out the degree of freedom for the mechanism shown in Figure 1 using Grubler's criterion without drawing the sketch. [5]

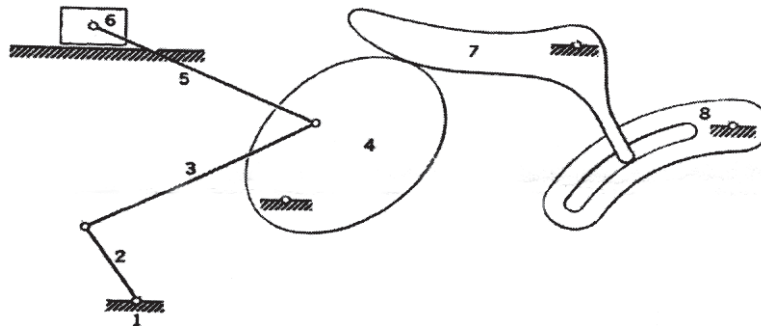


Figure 1

Q2) a) Explain the term 'Kinematically complex mechanism'. Discuss the terms with suitable examples. [5]

- i) Low degree of complexity &
- ii) High degree of complexity

b) Explain Goodman's Method for acceleration analysis of complex mechanisms. [5]

P.T.O.

- Q3) a)** Figure 2 shows a 4-Bar Mechanism. Find out the center of curvature of the coupler curve traced by point C in the position shown by using the 'Euler Savary equation'. [5]

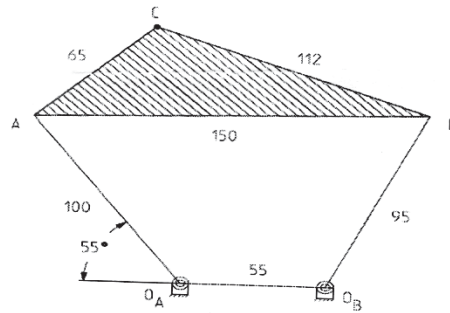


Figure 2

- b) With neat sketches, explain Bobillier's constructions. [5]

- Q4) a)** Figure 3 shows a 4-bar Mechanism. Redraw the mechanism on a drawing sheet to the scale and draw its cognate linkages in the same figure. [5]
Given: AB=50mm, AD=135mm, and BC is horizontal.

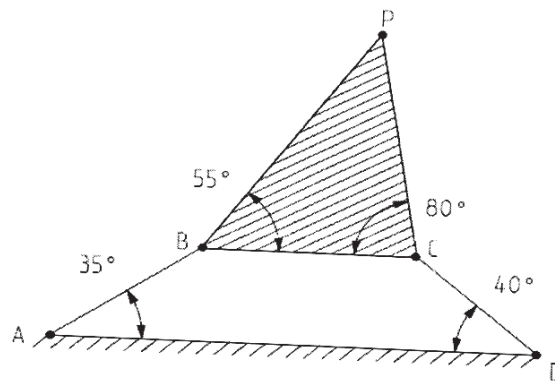


Figure 3

- b) Discuss the 3-position graphical synthesis of a 4-bar mechanism for body guidance. Synthesize a 4-bar mechanism to guide a rod AB through the three consecutive positions A_1B_1 , A_2B_2 & A_3B_3 as shown in Figure 4. Draw the mechanism in its first position. [5]

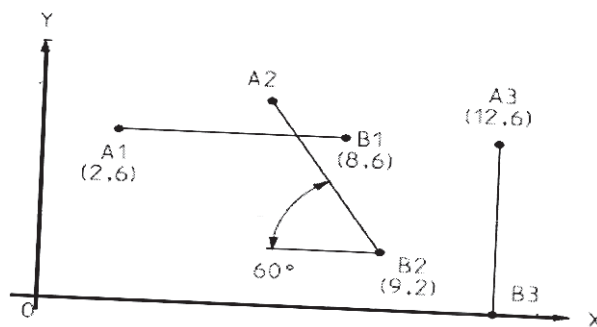


Figure 4

- Q5)** Explain the complex number method of synthesis for a 4-bar mechanism. Using this method, determine the link lengths of a 4-bar linkage that will in one of its positions satisfy the following specifications of angular velocity & angular acceleration. The length of the input link is to be unity. The subscripts 1, 2, & 3 represent the input link, the coupler & the output link respectively. Draw the mechanism & comment on the resulting mechanism. **[10]**

Angular Velocity	Angular Acceleration
$\omega_1 = 8 \text{ rad/sec}$	$\alpha_1 = 0 \text{ rad/sec}^2$
$\omega_2 = 1 \text{ rad/sec}$	$\alpha_2 = 20 \text{ rad/sec}^2$
$\omega_3 = -3 \text{ rad/sec}$	$\alpha_3 = 0 \text{ rad/sec}^2$

- Q6)** What is the relative pole? Design a slider crank mechanism to coordinate three positions of the crank and slider for the following data by the relative pole method. $\theta_{12} = 40^\circ$, $S_{12} = 180 \text{ mm}$, $\theta_{13} = 120^\circ$, $S_{13} = 300 \text{ mm}$. Take the eccentricity of the slider as 20 mm. **[10]**

- Q7)** Write short notes on the following: **[10]**

- Matrix method of analysis of spatial mechanisms.
- D-H parameters.



[6405]-60

First Year M.E. (Mechanical - Design Engineering)

ADVANCED MECHANICAL VIBRATIONS

(2017 Pattern) (Semester - II) (502208)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Solve any five Questions.
- 2) Draw Neat diagrams wherever necessary.
- 3) Use of scientific calculator is allowed.
- 4) Assume suitable data wherever necessary.
- 5) Figures to the right indicate full marks.

- Q1)** Three rail bogies are connected by two springs of stiffness $40 \times 10^5 \text{ N/m}$ each as shown in figure 1. The mass of each bogie is $20 \times 10^3 \text{ Kg}$. Determine the frequencies of vibration by any method. Neglect friction between the wheels and rails. [10]

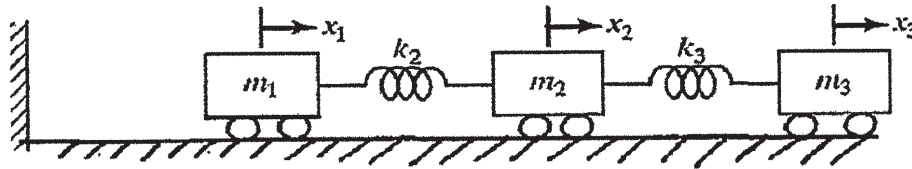


Fig.1

- Q2)** Find the lower natural frequency of vibration for the system shown in fig.2 by Rayleigh's method. $E = 1.96 \times 10^{11} \text{ N/m}^2$, $I = 4 \times 10^{-7} \text{ m}^4$. [10]

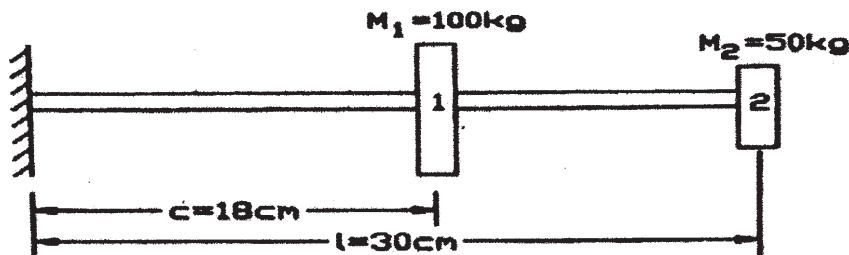


Fig.2

- Q3)** The differential equations governing the motion of a 2 DOF system are as given below. Determine the system's natural frequencies. [10]

$$\begin{bmatrix} m & 0 \\ 0 & m \end{bmatrix} \begin{bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \end{bmatrix} + \begin{bmatrix} 2k & -k \\ -k & 3k \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

P.T.O.

Q4) What is the required tension in a transmission line of length 15m and linear density of 5kg/m such that the transmission lines lowest natural frequency for transverse vibrations is 100 rad/sec? Assume the line is simply supported. **[10]**

Q5) A random signal has a spectral density that is a constant $s(f) = 0.004 \text{ cm}^2/\text{cps}$ between 20 and 1200 cps and that is zero outside this frequency range. Its mean value is 2.0 cm. Determine its rms value and its standard deviation. **[10]**

Q6) a) Explain how time domain and frequency domain techniques are used for condition monitoring and fault diagnosis. **[5]**

b) Explain Duhamel's Integral. **[5]**

Q7) Write Short note on any three. **[10]**

a) Auto correlation function.

b) Experimental modal analysis.

c) Rayleigh-Ritz Method.

d) In-situ balancing of rotors.



PD-4952

[6405]-61

M.E. Mechanical (Design Engineering)

FINITE ELEMENT METHOD

(2017 Pattern) (Semester-II) (502209)

Time : 3 Hours]

[Max. Marks : 50

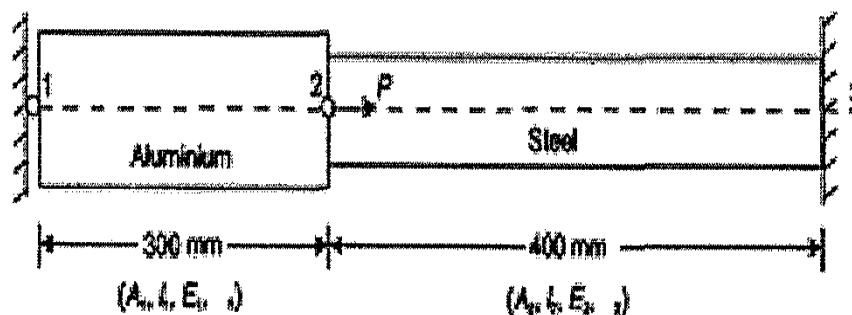
Instructions to the candidates :

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right candidates indicate full marks.
- 4) Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam table is allowed.
- 5) Assume suitable data, if necessary.

Q1) a) Discuss steps in FEA of Cantilever 1D Rod element? Also list down any 2D- three finite elements used in FEA? [4]

- b) Compare and explain the [6]
- i) principle of virtual work
 - ii) the principle of minimum potential energy?

Q2) a) Figure Shows 2-Stepped rod element with P-20KN of different materials. Calculate Nodal Displacements and stresses in each elements with following data? Let $D = 40\text{mm}$ $d = 20\text{mm}$ and $L_1 = 300\text{mm}$ $L_2 = 400\text{mm}$ $E_1 = E_2 = 2 \times 10^5 \text{ N/mm}^2$ [6]



- b) What does discretization mean in the finite element method? Explain Penalty approach used for solving FEA problems. [4]

P.T.O.

- Q3) a)** A 3-noded triangle has following details. Calculate the displacements in x and y directions? Assume $\alpha_1 = 0.2$ and $\alpha_2 = 0.3$ [6]

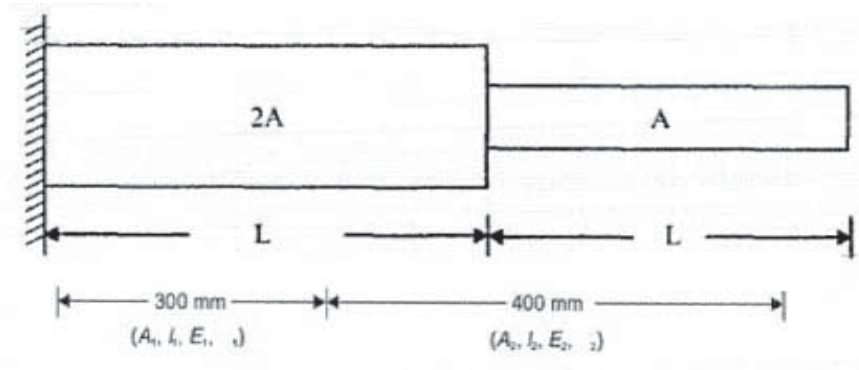
Nodes	1	2	3
x-coordi.	0	10	5
y-coordi.	0	0	5
u-vector	0.1	0.15	0.5
v-vector	0.2	-0.1	0.6

- b) Discuss Steps to solve Unknowns by following used in FEA. [4]
- Newton cotes Formula
 - Simpson 1/3rd Rule
- Q4) a)** Explain Hexahedral and Tetrahedral Elements used in 3D Problems for stress analysis. [5]
- b) Explain FEA procedure used in solving 3-D Rectangular element problems to calculate Unknown Deflections and elemental stresses? [5]
- Q5) a)** Explain the following terms: [5]
- Mindlin's Co-continuity element
 - Shear Locking
- b) Discuss Kirchhoff's Law in Plate Theory and Enlist the Kirchhoff assumptions in plate bending. [5]

OR

- Q6) a)** Explain with example Material Non-Linearity problems and Geometric Non-Linearity problems [5]
- b) A **1D nonlinear spring** has the force-displacement relationship [5]
- $$F_{int} = (u) = k_1 u + k_2 u^3$$
- Where $k_1 = 100 \text{ N/m}$ (linear stiffness), $k_2 = 50 \text{ N/m}^3$ (nonlinear stiffness) and $F_{ext} = 10 \text{ N}$ (applied force). Find the displacement u using Newton Raphson Method assume Initial Guess of $u = 0$ and solve for 3-Iterations.

- Q7) a)** Explain types of Vibration problems with examples? And also list out 2-numerical methods to solve eigen values? [4]
- b)** Find the natural frequencies of vibrations of stepped shaft fixed at one end and free at other end. The shaft has Let $D = 40\text{mm}$ $d = 20\text{mm}$ and $L_1 = 300\text{mm}$ $L_2 = 400\text{mm}$ $E_1 = E_2 = 2 \times 10^5 \text{ N/mm}^2$ as shown. [6]



- Q8) a)** Discuss Types of meshing with sketch? And define isoparametric, subparametric and super parametric elements? [5]
- b)** List and discuss errors in FEA? Also Compare h and p Method? [5]



Total No. of Questions : 7]

SEAT No. :

PD4953

[Total No. of Pages : 2

[6405]-62

S.Y. M.E. (Mechanical) (Design Engineering)

OPTIMIZATION TECHNIQUES

(2017 Pattern) (Semester - III) (602213)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

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

Q1) a) What do you mean by optimization? Discuss in brief classification of optimization problems? **[5]**

b) Discuss in Brief **[5]**

- i) Design Vector
- ii) Design Constraints
- iii) Constraint Surface
- iv) Objective Function
- v) Statement of Optimization Problem

Q2) Maximize the following function with simple simplex method. **[10]**

$$\text{Maximize } Z = 60X_1 + 50X_2$$

$$\text{Subject to, } X_1 + 2X_2 \leq 40$$

$$3X_1 + 2X_2 \leq 60$$

$$X_1, X_2 \geq 0$$

Q3) Write a short note on (Any Two) **[10]**

- a) Genetic Algorithm
- b) Neural-Network
- c) Simulated Annealing
- d) Fuzzy Optimization

P.T.O.

Q4) Minimize the function using the golden section method with $n=6$
 $f(x) = 0.65 - [0.75 / (1 + x^2)] - 0.65x \tan^{-1}(1/x)$ within the range $[0.3]$. **[10]**

Q5) Explain following **[10]**

- a) ESO for stress level optimization
- b) ESO for stiffness optimization

Q6) Explain with suitable example Neural-Network-based optimization technique **[10]**

Q7) a) What is topology optimization? Explain with suitable example. **[5]**

b) Write a short note on Bi-Directional evolutionary optimization. **[5]**



Total No. of Questions : 10]

SEAT No. :

PD-4954

[Total No. of Pages : 3

[6405]-63

M.E. (Mechanical (Design Engineering))
MECHANICAL MEASUREMENTS AND CONTROLS
(2017 Pattern) (Semester - III) (602214)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer Q.1 or Q.2, Q. 3 or Q.4, Q.5 or Q.6, Q.7or Q.8, Q.9. or Q.10.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicates full marks.*
- 4) *Use of electronic scientific pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Explain working of Strain gauge with neat Sketch. [5]
b) Compare Resistance Thermometer Detectors (RTD) and THERMISTOR. [5]

OR

- Q2)** a) Explain how FFT analyzer can be used for vibration measurement [6]
b) Define : [4]
i) State space
ii) State variable

- Q3)** a) List various types of DAC. Explain R-2R type DAC. [6]
b) Compare Time Domain and Frequency Domain modeling approach. [4]

OR

- Q4)** a) Explain Laser Doppler Vibrometer in details. [5]
b) Using a suitable block diagram, explain the application of a closed loop control system in temperature control in Air Conditioner [5]

P.T.O.

- Q5) a)** For system shown in figure Assume mass = 2 kg, stiffness = 4N/m and damping = 0.3Ns/m, also $f(t)$ = force input in N and $y(t)$ is displacement output in m [6]

For this system :

- Derive transfer function
- Identify the location of the poles and zeros.

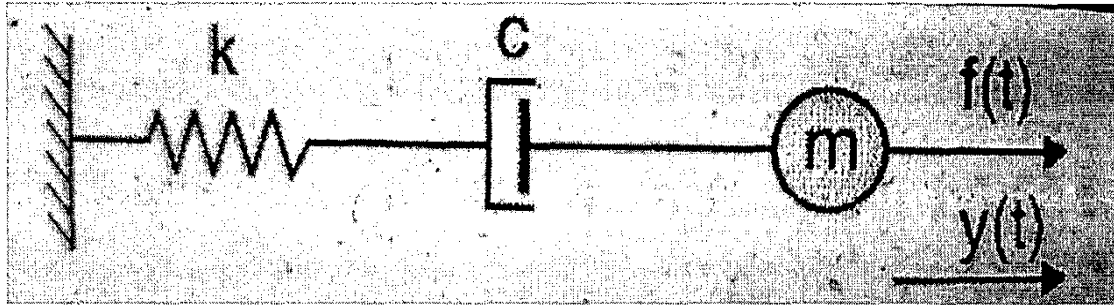
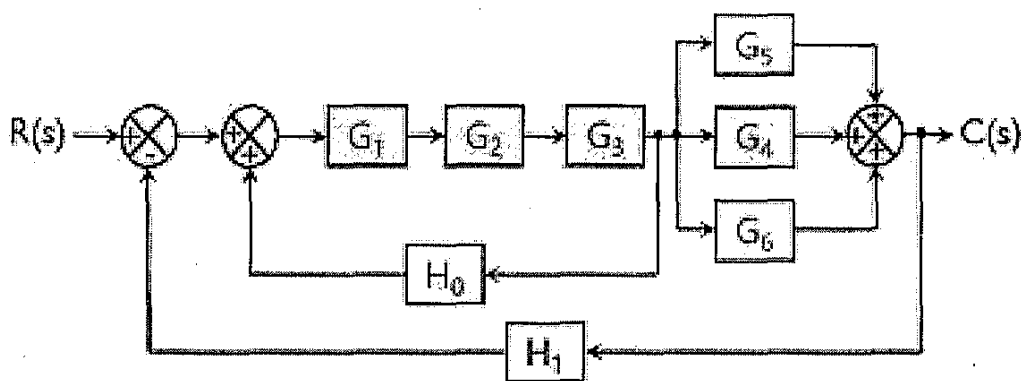


Fig. Q5a

- b)** A torque T Nm is applied to a shaft having a moment of inertia J and coefficient of viscous friction of ' f ' produces an angular shift of θ radians. Obtain the transfer function relating θ and T . [4]

OR

- Q6) a)** Determine overall transfer function $C(s)/R(s)$: [6]



- b)** How control system can be represented mathematically. [4]

- Q7) a)** Explain the importance of Transient response specifications w.r.t. performance of control system. [5]
- b)** Write short note on band filter. [5]

OR

- Q8) a)** for graph shown in figure, Sketch the PI controller (Serial form) output with respect to time. Assume $K_p=10$, $K_i=2$, $K_d=0.5$ and $P_0=0$ [6]

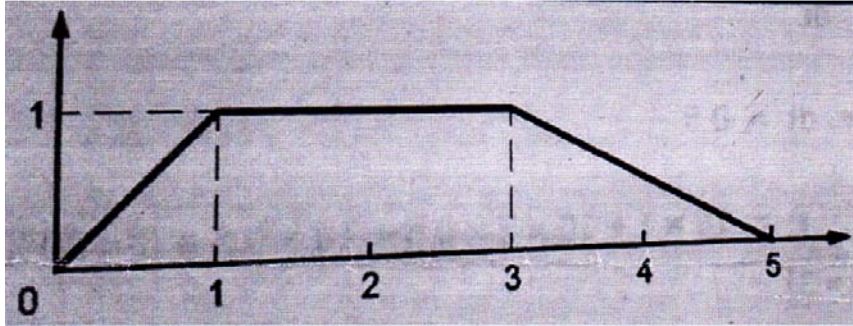


Fig. Q8 a (x - axis Time, y - axis Error)

- b)** Explain in detail PID tuning based on transient response. [4]
- Q9) a)** Differentiate between PI and PD Controller. [4]
- b)** Draw the Bode log-magnitude and phase plots for the system. [6]

$$G(s) = \frac{(S + 20)}{(S+1)(S + 7)(S + 50)}$$

OR

- Q10)a)** Discuss the importance of controllability in a control system. [4]
- b)** Using Routh Horwitz criterion, find the stability of closed loop system given below : [6]

$$\frac{C}{R} = \frac{2S+1}{(S^3+3S^2+3S+1)}$$

~~~~~

Total No. of Questions : 8]

SEAT No. :

**PD4955**

[Total No. of Pages : 3

**[6405]-64**

**First Year M.E. (Mechanical Heat Power & Energy)**  
**ADVANCED MATHEMATICS & NUMERICAL METHODS**  
**(2017 Pattern) (Semester - I) (507101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Find a solution of  $3x + \sin x - e^x = 0$  correct upto four decimal places by Newton's method. **[5]**

**b)** Fit a parabola of the form  $y = ax^2 + bx + c$  to the following data. **[5]**

|     |   |     |     |     |     |
|-----|---|-----|-----|-----|-----|
| $x$ | 0 | 1   | 2   | 3   | 4   |
| $y$ | 1 | 1.8 | 1.3 | 2.5 | 6.3 |

**Q2) a)** The following are data from the steam table. **[5]**

|                            |       |       |       |       |        |
|----------------------------|-------|-------|-------|-------|--------|
| Temperature °C             | 140   | 150   | 160   | 170   | 180    |
| Pressure kg/m <sup>2</sup> | 3.685 | 4.854 | 6.302 | 8.076 | 10.225 |

Find the pressure at temperature 142°C.

**b)** Apply Gauss-Seidal method to solve the system of equations (upto 3<sup>rd</sup> iterations) **[5]**

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

**Q3) a)** Use Romberg's method to evaluate  $\int_0^1 \frac{dx}{1+x^3}$  correct to 3-decimal places. **[5]**

**b)** Using cubic spline method, find  $y(1.5)$  for the following data : **[5]**

|     |   |   |   |    |
|-----|---|---|---|----|
| $x$ | 1 | 2 | 3 | 4  |
| $y$ | 1 | 2 | 5 | 11 |

**P.T.O.**

- Q4) a)** Determine the largest eigen value and corresponding eigen vector of the matrix  $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$ . [5]

- b) Using Gaussian quadrature 3-point formula, evaluate  $\int_{-1}^1 \frac{dx}{1+x^2}$ . [5]

- Q5) a)** Using House-Holders method reduce the following matrix A to its tridiagonal form : [5]

$$A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 2 & -1 \\ 4 & -1 & 1 \end{bmatrix}$$

- b) Apply Runge-Kutta method of fourth order to solve  $\frac{dy}{dx} = \frac{1}{x+y}$ ,  $x_0 = 0, y_0 = 1$  find  $y$  at  $x = 0.4$  taking  $h = 0.2$ . [5]

- Q6) a)** Using Adam's-Bashforth predictor method find  $y(0.4)$ , given that  $\frac{dy}{dx} = \frac{xy}{2}$ ,  $y(0) = 1, y(0.1) = 1.01, y(0.2) = 1.022, y(0.3) = 1.023$ . [5]

- b) Use Gauss siedel's method to solve the partial differential equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ , represented by a mechanical system carry out five iterations. Given that [5]

|   |   |       |   |
|---|---|-------|---|
|   | 1 | 1     |   |
| 0 |   | $u_3$ | 0 |
| 0 |   | $u_1$ | 0 |
|   | 0 | 0     |   |

**Q7)** a) Solve  $\frac{\partial^2 u}{\partial x^2} = 16 \frac{\partial u}{\partial t}$  if  $u(x, 0) = 0$ ,  $u(1, t) = 0$  and  $u(1, t) = 200t$ . Compute  $u$  for one step  $t$  division by using Crank-Nicolson method. [5]

b) Solve the equations by Gauss Jacobi method upto third iterations. [5]

$$27x_1 + 6x_2 - x_3 = 85$$

$$6x_1 + 15x_2 + 2x_3 = 72$$

$$x_1 + x_2 + 54x_3 = 110$$

**Q8)** a) Use Euler's method to solve the equation  $\frac{dy}{dx} = 1 + xy$  subject to the conditions at  $x = 0, y = 1$  and find  $y$  at  $x = 0.5$  taking  $h = 0.1$ . [5]

b) Solve  $u_{tt} = u_{xx}$ ,  $0 \leq x \leq 1$  subject to  $u(x, 0) = \sin \pi x$ ,  $\frac{\partial u}{\partial t} \Big|_{t=0} = 0$ ,  $0 \leq x \leq 1$  and  $u(0, t) = 0$ ,  $u(1, t) = 0$ ,  $t > 0$  by using in the implicit method. [5]



Total No. of Questions : 7]

SEAT No. :

**PD4956**

[Total No. of Pages : 2

**[6405]-65**

**First Year M.E. Mechanical (Energy Engineering)**

**ADVANCED THERMODYNAMICS**

**(2017 Pattern) (Semester - I) (502502)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right of each question indicate full marks.*
- 4) *Assume suitable data wherever necessary and mention the same clearly.*
- 5) *Use of steam tables, Mollier chart and calculator is allowed.*

**Q1) a)** Write the Van der Waals equation of state. What is the force of cohesion?  
What is co volume? **[6]**

b) Define compressibility factor Z. What is the physical significance of the compressibility factor Z? **[4]**

**Q2) a)** State and Explain Gibbs phase rule. **[6]**

b) Draw P-V-T surfaces of the substance. **[4]**

i) that contracts on freezing

ii) that expands on freezing

**Q3) a)** Explain Nernst heat theorem and third law of thermodynamics. **[4]**

b) 1 kg of ice at 0°C is mixed with 12 kg of water at 27°C. Assuming the surrounding temperature as 15°C, calculate the net increase in entropy and unavailable energy when the system reaches common temperature :  
Given : Specific heat of water = 4.18 kJ/kg K ; specific heat of ice = 2.1 kJ/kg K and enthalpy of fusion of ice (latent heat) = 333.5 kJ/kg. **[6]**

**Q4) a)** What is Exergy? Differentiate between physical and chemical exergy. **[6]**

b) Explain the following term **[4]**

i) Useful work

ii) Reversible work

**P.T.O.**

- Q5)** a) Explain Inversion curve and Joule Thomson coefficient. [5]  
 b) With usual notations derive the following thermodynamics relation. [5]

$$ds = C_p \frac{dT}{T} - \beta v dp$$

- Q6)** a) What is adiabatic flame temperature? How to determine it? [4]  
 b) Determine the enthalpy of combustion of liquid octane ( $C_8H_{18}$ ) at 25°C & 1 atm. Using enthalpy of formation data. Assume that water in the products is in the liquid form take. [6]

| Substance       | h <sup>o</sup> f kJ/Kmol |
|-----------------|--------------------------|
| $C_8H_{18} (l)$ | -249950                  |
| $CO_2$          | -393520                  |
| $H_2O (l)$      | -285830                  |

- Q7)** Write Notes on (any two) [10]  
 a) Amagat Law  
 b) Fugacity and Activity  
 c) The criteria for chemical equilibrium



Total No. of Questions : 7]

SEAT No. :

**PD4957**

[Total No. of Pages : 2

**[6405]-67**

**First Year M.E. (Mechanical-Energy Engineering)**

**ADVANCED HEAT TRANSFER**

**(2017 Pattern) (Semester - II) (502507)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data wherever necessary and mention the same clearly.*
- 5) *Use of steam tables, mollier chart and calculator is allowed.*

**Q1)** What do you mean by initial and boundary conditions. Explain with example. **[10]**

- a) Heat flux boundary condition
- b) Convection boundary condition
- c) Constant temperature condition
- d) Radiation Boundary condition

**Q2)** a) A steel pipe with 50 mm OD is covered with a 6.4 mm asbestos insulation ( $k=0.166 \text{ W/m}^\circ\text{C}$ ) followed by 25 mm layer of fiber glass insulation ( $k=0.0485 \text{ W/m}^\circ\text{C}$ ). The pipe wall temperature is 393 K and outside insulation temperature is 311 K. Calculate interface temperature between asbestos and fiber glass. **[5]**

- b) What do you mean by Thermal Contact Resistance? What are methods to reduce the same? **[5]**

**Q3)** Explain physical significance of following dimensionless numbers. **[10]**

- a) Richardson Number
- b) Prandtl Number
- c) Peclet Number
- d) Reynold Number
- e) Nusselt number

**P.T.O.**

**Q4) Write Short Notes on following. [10]**

- a) Local and average Heat Transfer Coefficient
- b) Hydraulic diameter
- c) Thermal entrance region and length

**Q5) a)** A plate type 200 mm × 300 mm heater is immersed in water bath at 40 °C. The larger side of heater is maintained vertical. The heater rating is 3.5 kW. Determine the steady state temperature attended by the heater using following thermo physical properties. Consider heat transfer from one side of the plate **[5]**

$k = 0.667 \text{ W/m } ^\circ\text{C}$ ,  $\nu = 0.415 \times 10^{-6} \text{ m}^2/\text{s}$ ,  $\rho = 977.8 \text{ Kg/m}^3$ ,  $C_p = 4187 \text{ KJ/kg } ^\circ\text{C}$ ,  $\beta = 4.15 \times 10^{-4} \text{ per degree Kelvin}$

For heat transfer by convection use following correlation  
 $Nu = 0.13 (Ra)^{(0.33)}$

- b)** Explain following terms of mixed convection with neat sketch. **[5]**
  - i) Combined Natural Convection and Radiation
  - ii) Combined Natural and Forced Convection

**Q6) a)** Explain with neat sketch different regimes of pool boiling curve. **[5]**

- b)** Write note on. **[5]**
  - i) Forced convection boiling
  - ii) Drop and film condensation

**Q7) Explain the following in brief. [10]**

- a) Shape factor,
- b) Intensity of radiation
- c) Solid Angle
- d) Radiation shield
- e) Emissive power





Total No. of Questions : 7]

SEAT No. :

**PD4958**

[Total No. of Pages : 2

**[6405]-72**

**First Year M.E. (Mechanical-Heat Power)**  
**ADVANCED THERMODYNAMICS AND COMBUSTION**  
**TECHNOLOGY**  
**(2017 Pattern) (Semester - I) (502102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right of each question indicate full marks.*
- 4) *Assume suitable data wherever necessary and mention the same clearly.*
- 5) *Use of steam tables, Mollier chart and calculator is allowed.*

- Q1) a)** Define the compressibility factor and describe the generalized compressibility chart. **[5]**
- b) Sketch the Mollier chart and explain why do the isobars diverge from one another on mollier diagram. **[5]**
- Q2) a)** State and Explain the third law of thermodynamics. **[4]**
- b) Ten grammes of water at 20°C is converted into ice at –10°C at constant atmospheric pressure. Assuming the specific heat of liquid water to remain constant at 4.2 J/gK and that of ice to be half of this value, and taking the latent heat of fusion of ice at 0°C to be 335 J/g, calculate the total entropy change of the system. **[6]**
- Q3) a)** What is the second law efficiency? How does it differ from the first-law efficiency? **[4]**
- b) An economizer, a gas-to-water finned tube heat exchanger, receives 67.5kg/s of gas,  $c_p = 1.0046$  kJ/kg K, and 51.1 kg/s of water,  $c_p = 4.186$  kJ/kg K. The water rises in temperature from 402 to 469 K, where the gas falls in temperature from 682 K to 470 K. There are no changes of kinetic energy and  $p_0 = 1.03$  bar and  $T_0 = 289$  K. Determine: **[6]**
- i) Rate of change of availability of the water
  - ii) The rate of change of availability of the gas
  - iii) The rate of entropy generation

**P.T.O.**

**Q4) a)** Set up a Tds relation in the following form  $Tds = C_p dT - B V T dp$ . [4]

**b)** With usual notations derive the following thermodynamics relation. [6]

$$C_p - C_v = \frac{T v B^2}{K}$$

**Q5) a)** Explain inversion curve and Joule-Thomson coefficient. [6]

**b)** Using Clausius-Claperyon's equation. estimate the enthalpy of vapourisation. The following data is given At 200°C:  $v_g = 0.1274 \text{ m}^3/\text{kg}$ ;

$$v_t = 0.001157 \text{ m}^3/\text{kg}; \quad \frac{dp}{dT} = 32 \text{ kPa/K.} \quad [4]$$

**Q6) a)** What is adiabatic flame temperature? How to determine it? [4]

**b)** Explain the term Enthalpy of formation and Enthalpy of combustion. [6]

**Q7) Write Notes on (any two)** [10]

**a)** Gibb's phase rule

**b)** Thermodynamics of Nutrition and exercise

**c)** Thermodynamics of Aging and Death



Total No. of Questions : 7]

SEAT No. :

PD-4959

[Total No. of Pages : 3

[6405]-73

**M.E. (Mechanical) (Heat Power)**  
**ADVANCED FLUID MECHANICS**  
**(2017 Pattern) (Semester - I) (502103)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any Five Questions*
- 2) *Neat diagrams must be drawn wherever necessary*
- 3) *Figures to the right of each question indicate full marks*
- 4) *Assume suitable data wherever necessary and mention the same clearly*
- 5) *Use of steam tables, Mollier chart and calculator is allowed*

**Q1) a)** Explain Velocity Potential, Stream Function. **[5]**

b) Consider the steady, incompressible, two-dimensional velocity field **[5]**

$$\vec{V} = (u, v) = (0.5 + 0.8x)\vec{i} + (1.5 - 0.8y)\vec{j}$$

Calculate the stagnation point, material acceleration at the point ( $x = 2$  m,  $y = 3$  m).

**Q2) a)** For each of the listed equations, write down the equation in vector form and decide if it is linear or nonlinear. If it is nonlinear, which term(s) make it so? **[6]**

- i) Incompressible continuity equation
- ii) Compressible continuity equation,
- iii) Incompressible Navier-Stokes equation.

b) Discuss concept of Stress tensor **[4]**

**P.T.O.**

- Q3)** Consider steady, incompressible, laminar flow of a Newtonian fluid in an infinitely long round pipe of diameter  $D$  or radius  $R = D/2$  (. You can ignore the effects of gravity. A constant pressure gradient  $\frac{\partial p}{\partial x}$  is applied in the  $x$ -direction, [10]

Applied pressure gradient :  $\frac{\partial P}{\partial x} = \frac{P_2 - P_1}{x_2 - x_1} = \text{constant}$

where  $x_1$  and  $x_2$  are two arbitrary locations along the  $x$ -axis, and  $P_1$  and  $P_2$  are the pressures at those two locations. Note that we adopt a modified cylindrical coordinate system here with  $x$  instead of  $z$  for the axial component, namely,  $(r, \theta, x)$  and  $(u_r, u_\theta, u)$ . Derive an expression for the velocity field inside the pipe and estimate the viscous shear force per unit surface area acting on the pipe wall.

- Q4)** a) What is Circulation or vortex strength? Discuss its applications with related theorem. [5]
- b) Discuss concept of Doublet, Uniform Stream and Line Sink. [5]
- Q5)** a) A small low-speed wind tunnel is being designed for calibration of hot wires. The air is at  $19^\circ\text{C}$ . The test section of the wind tunnel is 30 cm in diameter and 30 cm in length. The flow through the test section must be as uniform as possible. The wind tunnel speed ranges from 1 to 8 m/s, and the design is to be optimized for an air speed of  $V = 4.0$  m/s through the test section. For the case of nearly uniform flow at 4.0 m/s at the test section inlet, by how much will the centerline air speed accelerate by the end of the test section? [5]

Take Kinematic Viscosity as  $1.507 \times 10^{-5} \text{m}^2/\text{s}$

- b) Discuss the development of the velocity boundary layer in a pipe with diagram. [5]

- Q6) a)** A 2.2-cm-outer-diameter pipe is to span across a river at a 30-m-wide section while being completely immersed in water. The average flow velocity of water is 4 m/s and the water temperature is 15°C. Determine the drag force exerted on the pipe by the river. Take dynamic viscosity of water as  $1.138 \times 10^{-3}$  kg/m.s, drag coefficient = 1. Density of water = 1000 kg/m<sup>3</sup> [5]
- b)** Write short note on following with suitable diagram. [5]
- Wake
  - Large eddy simulation

- Q7) a)** Derive following with usual notations [5]

i) 
$$\frac{P_0}{P} = \left[ 1 + \left( \frac{k-1}{2} \right) Ma^2 \right]^{k/(k-1)}$$

ii) 
$$\frac{P^*}{P_0} = \left( \frac{2}{k+1} \right)^{k/(k-1)}$$

- b)** Air at 1 MPa and 600°C enters a converging nozzle with a velocity of 150 m/s. Determine the mass flow rate through the nozzle for a nozzle throat area of 50 cm<sup>2</sup> when the back pressure is 0.7 MPa. Take adiabatic index = 1.4, gas constant of air is 0.287 kJ/kg K, refer Table 1 [5]

**Table 1**

| One-dimensional isentropic compressible flow functions for an ideal gas with $k = 1.4$ |        |          |                  |               |                  |
|----------------------------------------------------------------------------------------|--------|----------|------------------|---------------|------------------|
| Ma                                                                                     | Ma*    | A/A*     | P/P <sub>0</sub> | $\rho/\rho_0$ | T/T <sub>0</sub> |
| 0                                                                                      | 0      | $\infty$ | 1.0000           | 1.0000        | 1.0000           |
| 0.1                                                                                    | 0.1094 | 5.8218   | 0.9930           | 0.9950        | 0.9980           |
| 0.2                                                                                    | 0.2182 | 2.9635   | 0.9725           | 0.9803        | 0.9921           |
| 0.3                                                                                    | 0.3257 | 2.0351   | 0.9395           | 0.9564        | 0.9823           |
| 0.4                                                                                    | 0.4313 | 1.5901   | 0.8956           | 0.9243        | 0.9690           |
| 0.5                                                                                    | 0.5345 | 1.3398   | 0.8430           | 0.8852        | 0.9524           |
| 0.6                                                                                    | 0.6348 | 1.1882   | 0.7840           | 0.8405        | 0.9328           |
| 0.7                                                                                    | 0.7318 | 1.0944   | 0.7209           | 0.7916        | 0.9107           |
| 0.8                                                                                    | 0.8251 | 1.0382   | 0.6560           | 0.7400        | 0.8865           |
| 0.9                                                                                    | 0.9146 | 1.0089   | 0.5913           | 0.6870        | 0.8606           |
| 1.0                                                                                    | 1.0000 | 1.0000   | 0.5283           | 0.6339        | 0.8333           |
| 1.2                                                                                    | 1.1583 | 1.0304   | 0.4124           | 0.5311        | 0.7764           |
| 1.4                                                                                    | 1.2999 | 1.1149   | 0.3142           | 0.4374        | 0.7184           |
| 1.6                                                                                    | 1.4254 | 1.2502   | 0.2353           | 0.3557        | 0.6614           |



Total No. of Questions : 7]

SEAT No. :

**PD4960**

[Total No. of Pages : 5

**[6405]-74**

**First Year M.E. (Mechanical-Heat Power)**

**ADVANCED HEAT TRANSFER**

**(2017 Pattern) (Semester - II) (502107)**

**Time : 3 Hours]**

**[Max. Marks : 50**

**Instructions to the candidates:**

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data wherever necessary and mention the same clearly.*
- 5) *Use of steam tables, mollier chart and calculator is allowed.*

**Q1)** Derive Three Dimensional Heat Conduction Equation in Cartesian Coordinates with Unsteady State and Heat Generation for Anisotropic material and deduce it to **[10]**

- a) 1-D Fourier Equation in x coordinate
- b) 2-D Laplace Equation in x and y coordinate
- c) 1-D Poisson's Equation in z coordinate

Write Derive Three Dimensional Heat Conduction Equation in Polar and Cylindrical Coordinates.

**Q2)** a) Discuss following in brief. **[5]**

- i) Thermal Contact resistance
- ii) Overall heat transfer coefficient

b) Consider large brass plates of 4 cm thickness that are initially at a uniform temperature of 20°C are heated by passing them through an oven that is maintained at 500°C. The plates remain in the oven for a period of 7 min. Taking the combined convection and radiation heat transfer coefficient to be  $h = 120 \text{ W/m}^2 \cdot ^\circ\text{C}$ , determine the surface temperature of the plates when they come out of the oven. **[5]**

The properties of brass at room temperature are Thermal Conductivity = 110 W/m °C, Density = 8530 kg/m<sup>3</sup>, Cp = 380 J/kg °C, and Thermal diffusivity  $33.9 \times 10^{-6} \text{ m}^2/\text{s}$ .

**Q3)** a) Explain in brief **[5]**

- i) Reynolds analogy
- ii) Chilton-Colburn analogy

b) Experimental results for the local heat transfer heat transfer coefficient  $h_x$  for flow over a flat plate with an extremely rough surface were found to fit the relation **[5]**

$$h_x(x) = x^{-0.1}$$

where  $x$  (m) is the distance from the leading edge of the plate. Develop an expression for the ratio of the average heat transfer coefficient for a plate of length  $x$  to the local heat transfer coefficient  $h_x$  at  $x$ .

**P.T.O.**

- Q4) a)** Explain physical significance of following dimensionless numbers. [5]
- i) Stanton Number
  - ii) Peclet Number
  - iii) Richardson Number
- b) Water enters a tube with fully developed velocity and uniform temperature of 20°C. The inside diameter of the tube is 4 cm and its length is 9 m. It is desired to heat the water to 60°C by maintaining the surface at 90°C uniform temperature. Determine the mass flow rate to satisfy the above condition. Take [5]
- $k = 0.64 \text{ W/m } ^\circ\text{C}$ ,  $\nu = 0.62 \times 10^{-6} \text{ m}^2/\text{s}$ ,  $\rho = 995 \text{ Kg/m}^3$ ,  $C_p = 4187 \text{ KJ/kg } ^\circ\text{C}$ ,  $\beta = 4.25 \times 10^{-4} \text{ per degree Kelvin}$
- Use following correlations
- $$\text{Nu} = 0.023 \text{ Re}_d^{0.8} \text{Pr}^{0.4}$$
- Q5) a)** Discuss with diagram significance of Velocity Boundary layer. How thickness of VBL and thickness TBL are correlated with Prandtl number? [5]
- b) Discuss following. [5]
- i) Combined natural and forced convection
  - ii) Thermal entrance region
- Q6) a)** What do you mean by force convection boiling explain with diagram.[5]
- b) The steam at 165°C condenses in the shell side of a heat exchanger over the tubes through which water flows. Water enters the 4-cm-diameter, 14-m-long tubes at 20°C at a rate of 0.8 kg/s. Determine the exit temperature of water and the rate of condensation of steam. Take fluid properties at 85°C and latent heat of steam as 2066.5 kJ/kg [5]
- Use following correlations
- |                                                            |                                                     |
|------------------------------------------------------------|-----------------------------------------------------|
| $\text{Nu} = 4.6$                                          | for laminar flow, Constant heat flux                |
| $\text{Nu} = 3.66$                                         | for laminar flow, Constant wall temperature         |
| $\text{Nu} = 0.023 \text{ Re}_d^{(0.8)} \text{Pr}^{(0.4)}$ | for turbulent flow, Constant heat flux or wall temp |
- Q7) a)** What do you mean by radiation shield? Derive expression for the same.[5]
- b) Discuss concept of Radiosity and irradiation. How it can be used in network analysis? [5]

**Table 1: Physical Properties of Air (1 atm)**

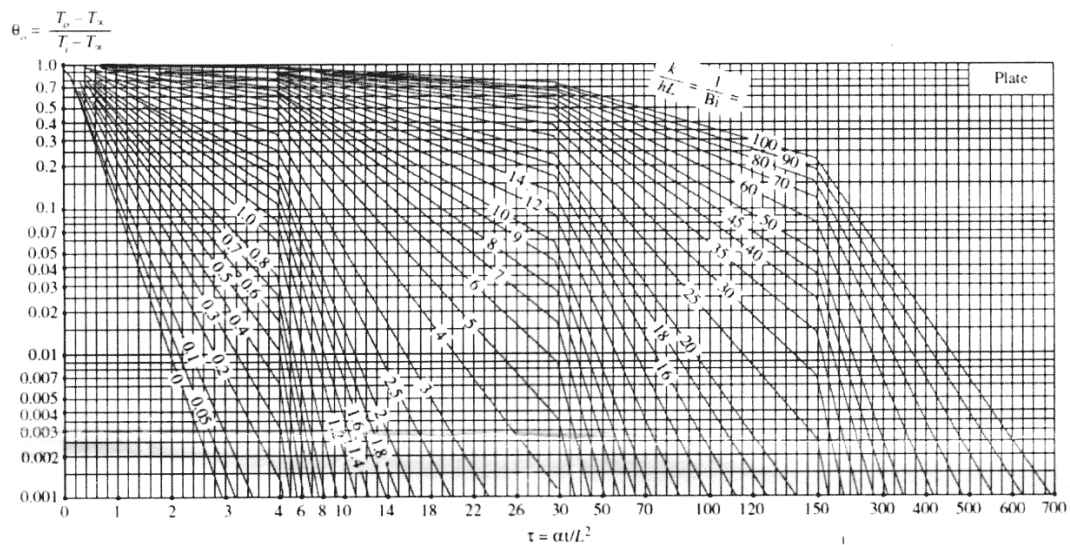
| $t$<br>°C | $\rho$<br>kg/m <sup>3</sup> | $c_p$<br>kJ/kgK | $k \times 10^2$<br>W/mK | $\alpha \times 10^4$<br>m <sup>2</sup> /hr | $\mu \times 10^2$<br>kg/hr-m | $\nu \times 10^6$<br>m <sup>2</sup> /s | $Pr$<br>– |
|-----------|-----------------------------|-----------------|-------------------------|--------------------------------------------|------------------------------|----------------------------------------|-----------|
| 10        | 1.247                       | 1.005           | 2.511                   | 7.22                                       | 6.346                        | 14.16                                  | 0.705     |
| 20        | 1.205                       | 1.005           | 2.592                   | 7.71                                       | 6.533                        | 15.06                                  | 0.703     |
| 30        | 1.165                       | 1.005           | 2.673                   | 8.23                                       | 6.717                        | 16.00                                  | 0.701     |
| 40        | 1.128                       | 1.005           | 2.755                   | 8.75                                       | 6.904                        | 16.96                                  | 0.699     |
| 50        | 1.093                       | 1.005           | 2.824                   | 9.29                                       | 7.067                        | 17.95                                  | 0.698     |
| 60        | 1.060                       | 1.005           | 2.894                   | 9.79                                       | 7.221                        | 18.97                                  | 0.696     |
| 70        | 1.029                       | 1.009           | 3.045                   | 10.28                                      | 7.523                        | 21.09                                  | 0.692     |
| 80        | 1.000                       | 1.009           | 3.045                   | 10.87                                      | 7.523                        | 21.09                                  | 0.692     |
| 90        | 0.972                       | 1.009           | 3.127                   | 11.48                                      | 7.701                        | 22.10                                  | 0.690     |
| 100       | 0.946                       | 1.009           | 3.208                   | 12.11                                      | 7.880                        | 23.13                                  | 0.688     |
| 120       | 0.898                       | 1.009           | 3.336                   | 13.26                                      | 8.170                        | 25.45                                  | 0.686     |
| 140       | 0.854                       | 1.013           | 3.487                   | 14.52                                      | 8.479                        | 27.80                                  | 0.684     |
| 160       | 0.815                       | 1.017           | 3.638                   | 15.80                                      | 8.786                        | 30.08                                  | 0.682     |
| 180       | 0.779                       | 1.022           | 3.778                   | 17.10                                      | 9.070                        | 32.49                                  | 0.681     |
| 200       | 0.746                       | 1.026           | 3.929                   | 18.49                                      | 9.380                        | 34.85                                  | 0.680     |



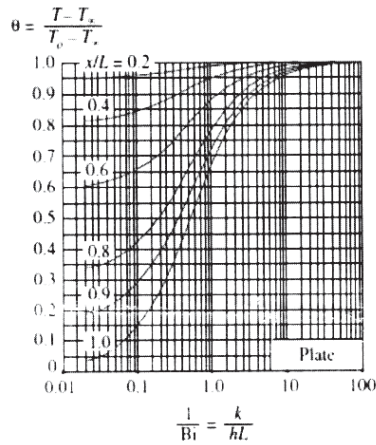
Table 2 Physical Properties of Water (Liquid state)

| $t$<br>°C | $\rho$<br>kg/m <sup>3</sup> | $c_p$<br>kJ/kgK | $k \times 10^2$<br>W/mK | $\alpha \times 10^4$<br>m <sup>2</sup> /hr | $\mu \times 10^2$<br>kg/hr-m | $\nu \times 10^6$<br>m <sup>2</sup> /s | $Pr$<br>— |
|-----------|-----------------------------|-----------------|-------------------------|--------------------------------------------|------------------------------|----------------------------------------|-----------|
| 0         | 999.9                       | 4.212           | 55.093                  | 4.71                                       | 644.093                      | 1.789                                  | 13.67     |
| 10        | 999.7                       | 4.191           | 57.418                  | 4.94                                       | 469.818                      | 1.306                                  | 9.54      |
| 20        | 998.2                       | 4.183           | 59.859                  | 5.16                                       | 361.892                      | 1.006                                  | 7.02      |
| 30        | 995.7                       | 4.174           | 61.718                  | 5.35                                       | 288.668                      | 0.805                                  | 5.42      |
| 40        | 992.2                       | 4.174           | 63.345                  | 5.51                                       | 235.602                      | 0.659                                  | 4.31      |
| 50        | 988.1                       | 4.178           | 64.740                  | 5.65                                       | 197.771                      | 0.556                                  | 3.54      |
| 60        | 983.2                       | 4.178           | 65.902                  | 5.78                                       | 169.305                      | 0.478                                  | 2.98      |
| 70        | 977.8                       | 4.187           | 66.716                  | 5.87                                       | 146.370                      | 0.415                                  | 2.55      |
| 80        | 971.8                       | 4.195           | 67.413                  | 5.96                                       | 127.924                      | 0.365                                  | 2.21      |
| 90        | 965.3                       | 4.208           | 67.995                  | 6.03                                       | 113.507                      | 0.326                                  | 1.95      |
| 100       | 958.4                       | 4.220           | 68.227                  | 6.09                                       | 101.910                      | 0.295                                  | 1.75      |

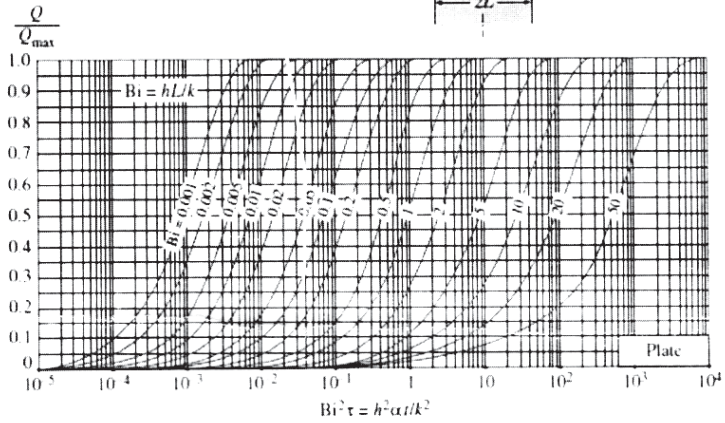
### Charts



(a) Midplane temperature (from M. P. Heisler)



(b) Temperature distribution (from M. P. Heisler)



(c) Heat transfer (from H. Gröber et al.)

Transient temperature and heat transfer charts for a plane wall of thickness  $2L$  initially at a uniform temperature  $T_i$  subjected to convection from both sides to an environment at temperature  $T_\infty$  with a convection coefficient of  $h$ .

where  $m$  is the mass,  $V$  is the volume,  $\rho$  is the density, and  $C_p$  is the specific heat of the body. Thus,  $Q_{\max}$  represents the amount of heat transfer for  $t \rightarrow \infty$ . The amount of heat transfer  $Q$  at a finite time  $t$  will obviously be less than this



Total No. of Questions : 7]

SEAT No. :

PD-5269

[Total No. of Pages : 2

[6405]-75

**M.E. (Mechanical) Heat Power Engg.  
AIR CONDITIONING TECHNOLOGY  
(2017 Pattern) (Semester - II) (502108)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any-05 questions out of-07*
- 2) *Draw neat labeled diagrams whenever necessary.*
- 3) *Assume suitable data, if necessary*
- 4) *Use of thermodynamics charts and psychometric table is permitted.*

**Q1)** Define and Discuss the following terms

- a) Dew point temperature
- b) Specific Humidity
- c) Degree of saturation
- d) Relative humidity
- e) Thermodynamic wet bulb temperature

**[10]**

**Q2)** a) Explain with neat sketch ADP.

**[4]**

- b) Atmospheric air at 38°C and 25% relative humidity passes through an evaporator cooler. If the final temperature of air is 18°C, how much water is added per kg of dry air and what is the final relative humidity?[6]

**Q3)** 108 m<sup>3</sup> of air per minute at 5°C DBT and 2.5°C WBT is passed through a heating coil which gives 48.85 k W energy to the air. Saturated steam at 110°C and with a rate of 48 kg/h is mixed with the air leaving the heater. Determine the DBT and WBT of the air after mixing the steam. Enthalpy of saturated steam at 110°C ( $h_g$ ) = 2691 kJ/kg

**[10]**

**Q4)** 250 m<sup>3</sup>/min of air at atmospheric conditions 12°CDBT and 50% RH is supplied to an air-conditioned hall. The required conditions are 18°C DBT and 60% RH Determine:

**[10]**

- i) Sensible heat and latent heat removed from the air per minute, and
- ii) Sensible heat factor for the system.

**P.T.O.**

**Q5)** A duct of rectangular cross-section  $600 \text{ mm} \times 400 \text{ mm}$  carries  $90 \text{ m}^3/\text{min}$  of air having density of  $1.2 \text{ kg/m}^3$ . Determine the equivalent diameter of a circular duct : **[10]**

- i) When the quantity of air carried in both the cases is same; and
- ii) When the velocity of air in both the cases is the same. If friction factor  $(f) = 0.011$  find the pressure loss per 100 m length of duct.

**Q6) a)** Write short note on Air washer. **[4]**

- b) Obtain an expression for pressure loss due to sudden enlargement in a duct passage. **[6]**

**Q7) a)** Write short note on "All water system". **[5]**

- b) What do you understand by effective temperature? In what way it is connected with comfort air conditioning? Explain factors affecting the effective temperature? **[5]**



Total No. of Questions : 7]

SEAT No. :

**PD4961**

**[6405]-76**

[Total No. of Pages : 2

**First Year M.E. (Mechanical-Heat Power)**  
**MEASUREMENTS AND CONTROLS**  
**(2017 Pattern) (Semester - II) (502109)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Any Five Questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data wherever necessary and mention the same clearly.*
- 5) *Use of steam tables, Mollier chart and calculator is allowed.*

**Q1) a)** Elaborate Static characteristics of instruments. **[5]**

b) Discuss the classification of measuring instruments. **[5]**

**Q2) a)** What do you mean by Systematic Errors and Random Errors? Discuss the main sources of the same. **[5]**

b) What are the properties of correlation coefficients and regression coefficients? **[5]**

**Q3) a)** What do you mean by RTD? Discuss working principle of RTD with diagram. **[5]**

b) Determine Karl Pearson's Correlation Coefficient : **[5]**

|   |    |    |    |    |    |
|---|----|----|----|----|----|
| X | 20 | 16 | 12 | 08 | 04 |
| Y | 22 | 14 | 04 | 12 | 08 |

**P.T.O.**

**Q4)** a) Explain the construction and working of turbine flow meter. [5]

b) Discuss technique measurement of heat flux. [5]

**Q5)** a) Explain construction and working of any one force measurement method. [5]

b) How McLeod gauge works? [5]

**Q6)** a) Explain any one instrument used for liquid level measurement. [5]

b) Write note on PI and PID controllers. [5]

**Q7)** Explain in brief: [10]

a) Stroboscope

b) U tube manometers



Total No. of Questions : 7]

SEAT No. :

**PD4962**

[Total No. of Pages : 2

**[6405]-77**

**S.Y.M.E. (Mechanical)/(Heat power)  
COMPUTATIONAL FLUID DYNAMICS  
(2017 Pattern) (Semester-III) (602113)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn, wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of electronic pocket calculator is allowed.*
- 5) Assume Suitable data if necessary.*

**Q1) a)** Explain the mathematical nature of hyperbolic equation and their physical boundary conditions. **[4]**

b) Explain the Transport equation in differential form and explain the significance of each term. **[6]**

**Q2) a)** Explain the significance of Substantial and Local Derivative in fluid mechanics. **[5]**

b) Explain the difference between explicit and implicit methods with its significant. **[5]**

**Q3) a)** Write a short note on Neumann and Robbin boundary conditions. **[4]**

b) Explain Solution of two dimensional steady heat conduction equation using explicit approach. **[6]**

**Q4) a)** Discuss the accuracy of the forward, backward and central difference method and explain which is most accurate and why? **[6]**

b) Explain QUICK Convection Scheme. **[4]**

**P.T.O.**

- Q5) a)** Derive a solution of Navier-Stoke's equation for incompressible flow using SIMPLE algorithm for lid driven cavity flow problem. **[6]**
- b) Explain the significance of 1-D transient convection -diffusion system. **[4]**

**Q6)** What are the difficulties in solving Navier-stokes Equations numerically? Discuss the remedy over the difficulties. Draw and discuss required control volumes. **[10]**

- Q7) a)** Explain the **[6]**
- i)  $k-\epsilon$  turbulence model and
  - ii)  $k-\omega$  turbulence model
- b) What are the limitations of RANS models, and how can these limitations be addressed? **[4]**





Total No. of Questions : 7]

SEAT No. :

PD-4963

[Total No. of Pages : 2

[6405]-78

**M.E. (Mechanical(Heat Power))**  
**Design of Heat Transfer Equipments**  
**(602114) (2017 Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) Attempt Any Five Questions*
- 2) Neat diagrams must be drawn wherever necessary*
- 3) Figures to the right indicate full marks*
- 4) Assume suitable data wherever necessary and mention the same clearly*
- 5) Use of steam tables, Mollier chart and calculator is allowed*

**Q1) a)** Steam in the condenser of a power plant is to be condensed at a temperature of 30 degrees Celsius with cooling water from a nearby lake, which enters the tubes of the condenser at 14 degrees Celsius and leaves at 22 degrees Celsius. The surface area of the tubes is 45 m<sup>2</sup>, and the overall heat transfer coefficient is 2100 w/m<sup>2</sup> °C. Determine the mass flow rate of the cooling water needed and the rate of condensation of the steam in the condenser. **[5]**

b) Discuss the Kern Method for assessment of shell-side heat transfer coefficient **[5]**

**Q2) a)** Cold water enters a counter-flow heat exchanger at 10 degrees Celsius at a rate of 8 kg/s. where it is heated by a hot water stream that enters the heat exchanger at 70 degrees Celsius at a rate of 2 kg/s. Assuming the specific heat of water to remain constant at  $C_p = 4.18 \text{ kJ/kg } ^\circ\text{C}$ , determine the maximum heat transfer rate and the outlet **[5]**

b) Draw Temperature profile in case of following **[5]**

- i) Evaporator
- ii) Condenser
- iii) Counter flow
- iv) 1-2 Split flow (TEMA G) exchanger.

**P.T.O.**

- Q3)** a) What is a need to analyze Pressure Drop in thermal device? [5]  
b) Discuss Assumptions for Pressure Drop Analysis [5]
- Q4)** a) What do you mean by Thermally Developing Flows? Discuss with diagram [5]  
b) Elaborate Steady-State Kays and London Technique [5]
- Q5)** a) Discuss working of forced draft cooling tower with diagram [5]  
b) Elaborate the various materials used for the construction of cooling towers. [5]
- Q6)** a) Explain following points related with Furnace [5]  
i) Components  
ii) Applications  
b) What are different passive heat transfer enhancement techniques for heat exchanger? [5]
- Q7)** Write Note on [10]  
a) Heat Pipe  
b) Bell Delaware method



Total No. of Questions : 8]

SEAT No. :

**PD4964**

[Total No. of Pages : 2

**[6405]-79**

**M.E. - I (Mechanical/Mechatronics)**

**SYSTEM MODELLING, IDENTIFICATION AND SIMULATION**

**(2017 Pattern) (Semester - I) (502801)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Discuss the concept of EOM of Mechanical System using Lagrangian Mechanics. [5]  
b) Explain Transfer Function Modeling with an example. [5]
- Q2)** a) Explain the process of Linearization of non-linear System using Graphical Approach. [5]  
b) Discuss the concept of Modeling of Distributed Parameter System with an example. [5]
- Q3)** a) What are the guidelines for creating a Bond Graph? [5]  
b) Create a Bond Graph Model of a Motorbike Suspension. [5]
- Q4)** a) Discuss the concept of Signal selection for identification. [5]  
b) Explain the process of ARX model and their identification using least squares. [5]
- Q5)** a) What is the difference between Time domain and frequency domain identification? [5]  
b) Discuss the concept of Experimental determination of frequency response. [5]
- Q6)** a) Discuss the concept of Extended Kalman Filter and its application. [5]  
b) Provide an example of Parameter Estimation using Kalman Filter. [5]

**P.T.O.**

- Q7)** a) Explain the concept of Supervised and Un-Supervised Learning. [5]  
b) Discuss the Basic Learning Laws in Neural Networks. [5]
- Q8)** a) What is Fuzzy Logic? Discuss the concept of Fuzzy If-Then Rules. [5]  
b) Explain the process of De-Fuzzification Techniques with an example.[5]



Total No. of Questions : 8]

SEAT No. :

**PD4965**

[Total No. of Pages : 2

**[6405]-80**

**First Year M.E. (Mechanical-Mechatronics)**

**CONTROL SYSTEMS - I**

**(2017 Pattern) (Semester - I) (502802)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Define Open Loop Control and Closed Loop Control. Explain the differences between them. [5]  
b) Explain the concept of State Space modelling with an example. [5]
- Q2)** a) What is the Lyapunov Criterion? Explain with an example. [5]  
b) Explain the concept of Controllability & Observability. How can they be determined from the Block Diagram of a system? [5]
- Q3)** a) Explain the concept of Full State Feedback (FSF) Control. How is FSF implemented using Pole Placement? [5]  
b) What is the Linear Quadratic Regulator type Optimal Control? Explain with an example. [5]
- Q4)** a) Define Linear Observer (Estimator). Draw and explain the Open Loop & Closed Loop block diagram of an Observer. [5]  
b) How is the design of an Observer done using Pole Placement? Explain with an example. [5]
- Q5)** a) Explain the design of a Reduced Order Observer using Pole Placement. [5]  
b) What is a Compensator? Draw the block diagram of a controlled system (System + Compensator) and explain. [5]

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

- Q6)** a) Explain the design of a Regulated system. What are the governing equations for a Regulated system? [5]  
b) Explain the design of a Command Tracking system (Integral Control with FSF and Observer). [5]
- Q7)** a) Explain the concept of State Transition Matrix. [5]  
b) Discuss the relation between Pole location and system response. [5]
- Q8)** a) What is the Routh Hurwitz Criterion? Explain with an example. [5]  
b) Discuss the effect of Condition Number on Controllability & Observability of a system. [5]



Total No. of Questions : 7]

SEAT No. :

**PD4966**

**[6405]-81**

[Total No. of Pages : 2

**First Year M.E. (Mechanical) (Mechatronics)**  
**SENSORS, TRANSDUCERS & INTERFACING TECHNIQUES**  
**(2017 Pattern) (Semester - I) (502803)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any Five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Use of scientific calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** a) Discuss the different types of experimental errors and how these errors can be minimized? [5]

b) Explain the concept of uncertainty analysis with suitable example. [5]

**Q2)** a) With the help of block diagram explain the operation of Cathod Ray Oscilloscope (CRO). State its applications. [5]

b) Discuss the different types of variable resistance transducers. [5]

**Q3)** a) Explain ionization gauge in detail. [5]

b) With neat diagram explain U-tube monometer & Well-type monometer.[5]

**Q4)** a) Discuss any one flow measurement technique with suitable diagram/sketches. [5]

b) Discuss the pressure probes in detail. [5]

**P.T.O.**

- Q5)** a) Discuss the transient response of thermal systems. [5]
- b) Explain the operation of following meters using neat diagram : [5]
- i) Flux meter
- ii) pH meter

OR

- Q6)** a) With the help of neat diagram explain the construction of Rosette strain gauge. State its advantages & drawbacks. [5]
- b) Discuss the various schemes of o/p measurement strain gauge. [5]
- Q7)** a) What are the different types of Analog-to-Digital converters? Explain Flash type ADC in detail. [5]
- b) What is need of signal conditioning in data acquisition system? Mention the circuits which can be used as signal conditioner. [5]





Total No. of Questions : 8]

SEAT No. :

**PD4967**

[Total No. of Pages : 2

**[6405]-82**

**First Year M.E. (Mechanical-Mechatronics)**

**PLC PROGRAMMING**

**(2017 Pattern) (Semester - II) (502807)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Write a PLC program to control a water tank level. The system should start filling the tank when the water level (I:1/0) falls below a certain point and stop filling when the water level reaches a certain point. The tank filling status should be indicated by an output coil (O:2/0). **[5]**
- b) Write a PLC program to control a traffic light system. The system should follow the sequence: Green (O:2/0) -> Yellow (O:2/1) -> Red (O:2/2). Each light should be on for 5 seconds. **[5]**
- Q2)** a) Explain the principles of operation of a Programmable Logic Controller (PLC). **[5]**
- b) Write a PLC program to control a parking lot barrier. The barrier should open when a car is detected by a proximity sensor (I:1/0) and close after a certain delay (T4:0). The barrier status should be indicated by an output coil (O:2/0). **[5]**
- Q3)** a) Describe the function of the I/O section in a PLC. **[5]**
- b) What is the difference between Discrete I/O Modules and Analog I/O Modules? **[5]**
- Q4)** a) How are Manually Operated Switches and Mechanically Operated Switches used in a PLC system? **[5]**
- b) Explain the role of Transducers and Sensors in a PLC system. **[5]**

**P.T.O.**

- Q5)** a) What is difference between relay schematics and ladder logic? [5]  
b) Write a PLC program to control a heating system. The system should start heating when the temperature (I:1/0) falls below a certain set point (N7:0) and stop heating when the temperature rises above a certain set point. The heating status should be indicated by an output coil(O:2/0). [5]
- Q6)** a) Explain the role of Electromagnetic Control Relays in a PLC system. [5]  
b) What is difference between Timer and Counter Instructions in a PLC program? [5]
- Q7)** a) What is the purpose of Immediate Input and Immediate Output Instructions in a PLC system? [5]  
b) How do you force an External I/O address in a PLC system? [5]
- Q8)** a) What is Addition, Subtraction, Multiplication and Division Instructions in a PLC? [5]  
b) What is a Shift Register in a PLC? [5]



Total No. of Questions : 8]

SEAT No. :

**PD4968**

[Total No. of Pages : 2

**[6405]-83**

**First Year M.E. (Mechanical - Mechatronics)**

**CONTROL SYSTEMS - II**

**(2017 Pattern) (Semester - II) (502808)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1) a)** Explain the Nyquist criterion and its application to determining stability. [6]

b) How would you tune a PID controller to control the level of a tank? [4]

**Q2) a)** What is the relay feedback method, and how is it used for PID tuning? [6]

b) Explain the significance of poles and zeros in the frequency response of a system. [4]

**Q3) a)** Explain the concept of bandwidth and its relationship to frequency response. [6]

b) How would you tune a PID controller to control the flow rate of a pump? [4]

**Q4) a)** What are the limitations of PID control? [4]

b) Explain the relationship between the open-loop and closed-loop transfer functions. [6]

*P.T.O.*

- Q5)** a) Discuss about Kappa-Tau (KT) tuning method in control system. [6]  
b) Explain complementary sensitivity function in control system. [4]
- Q6)** a) Compare the sensitivity characteristics of open-loop and closed-loop systems. [6]  
b) Explain the definition, purpose and advantage of ITAE Criterion. [4]
- Q7)** a) Explain loop shaping in control system. [6]  
b) Discuss the advantage & limitation of Internal Model Controller. [4]
- Q8)** a) Discuss about robust stability criterion in control system. [6]  
b) Explain the concept of controller tuning. [4]



Total No. of Questions : 8]

SEAT No. :

**PD4969**

**[6405]-84**

[Total No. of Pages : 2

**First Year M.E. (Mechanical-Mechatronics)**

**INDUSTRIAL DRIVES & ACTUATORS**

**(2017 Pattern) (Semester - II) (502809)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of Calculator is allowed.*
- 5) Assume Suitable data if necessary.*

**Q1) a)** Explain working principle of Synchronous Motor with neat sketch. [4]

b) Differentiate between pilot operated and direct operated pressure relief Valve. [6]

**Q2) a)** Explain working principle of Direction control valve. [4]

b) Explain selection of motor & its power rating. [6]

**Q3) a)** Explain the factor affecting speed of DC Motor. [6]

b) List the applications of pressure reducing valve. [4]

**Q4) a)** Discuss some considerations for correct mounting of the cylinder. [4]

b) A pressure relief valve has a pressure setting of 200 bar. Determine the power Loss across the valve if all the pump flow of 120 l/min flows back to the reservoir through this valve. [6]

**P.T.O.**

**Q5) a)** Explain the working principle of semi-rotary actuator with neat sketch. [6]

b) Discuss the function of bleed off circuits. [4]

**Q6) a)** Discuss about design consideration for cylinder. [4]

b) Define pump and state the purpose of the pump in hydraulic system. [6]

**Q7) a)** Explain the purpose of using fail safe circuit in any hydraulic system. [4]

b) Explain the working of gear type motor and vane type motor. [6]

**Q8) a)** Explain the Counter balance valve circuit used in the hydraulic System. [4]

b) A cylinder has a bore of 125 mm diameter and a rod of 70 mm diameter. It drives a Load of 2000 kg vertically up and down at a maximum velocity of 3 m/s. The load is slowed down to rest in the cushion length of 50 mm. If the relief valve is set at 140 Bar, determine the average pressure in the cushions While extending and retracting. [6]



Total No. of Questions : 8]

SEAT No. :

**PD4970**

[Total No. of Pages : 2

**[6405]-85**

**S.Y.M.E. (Mechanical(Mechatronics))**

**MICROCONTROLLER APPLICATIONS IN EMBEDDED  
SYSTEMS**

**(2017 Pattern) (Semester - III) (602813)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figure to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain with neat diagram block diagram of PIC18F microcontroller.

**[6]**

b) List and explain the instructions used for logic operations of PIC microcontroller.

**[4]**

**Q2) a)** What is Integrated Development Environment (IDE)? What are the different tools in IDE?

**[5]**

b) With neat diagram explain support devices of PIC18F microcontroller.

**[5]**

**Q3) a)** What are different types of conditional and unconditional branch instructions?

**[6]**

b) Explain the result after the execution of the following instructions. Identify the status of flags.

**[4]**

MOVLW 5AH

ADDLW 9FH

**Q4) a)** What is subroutine? Illustrate with example.

**[5]**

b) With neat circuit diagram, explain interfacing of seven segment display to PIC microcontroller.

**[5]**

**P.T.O.**

- Q5)** a) With neat circuit diagram, how push buttons are interfaced to PIC microcontroller? [5]  
b) What are Interrupts? Explain different types of interrupts. [5]
- Q6)** a) What is function of different timers used in PIC18F microcontroller. [5]  
b) Why Digital to Analog conversion is required? Explain any one method in detail. [5]
- Q7)** a) Explain basic concepts in serial communication. [5]  
b) Explain with block diagram Serial Peripheral Interface serial protocol. [5]
- Q8)** a) Discuss the software aspect of Embedded system design by considering Time and Temperature Monitoring System (TTMS) as a case study. [6]  
b) Explain the features of embedded systems. [4]





Total No. of Questions : 8]

SEAT No. :

PD-4971

[Total No. of Pages : 2

**[6405]-86**

**M.E. (Mechanical - Mechatronics)  
FLEXIBLE MANUFACTURING SYSTEMS  
(2017 Pattern) (Semester - III) (602814)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Attempt any 5 questions.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** List the major components of an FMS. Explain them in brief. **[10]**

**Q2) a)** Write short note on cellular manufacturing. **[6]**

b) What is single station automated cells. **[4]**

**Q3) a)** What is difference between Fixed Routing and Variable routing in Manufacturing system. **[6]**

b) What is automated production line? What is benefits of it? **[4]**

**Q4) a)** Write a note on: Automated guided vehicles associated with FMS. **[6]**

b) Explain the working of NC machine tool with the help of the diagram. **[4]**

**Q5) a)** Distinguish NC and CNC Machine. **[4]**

b) Explain the construction details of column type of CMM? Mention the advantages and disadvantages. **[6]**

**Q6) a)** Discuss Taguchi approach for design of experiments. **[6]**

b) What are the components on which success of Concurrent Engineering depend? **[4]**

**P.T.O.**

- Q7) a)** Explain how DFM helps in reducing the manufacturing cost of a product? **[6]**
- b) Write brief notes on inventory control system. **[4]**

- Q8) a)** As part of an overall quality improvement programme, a textile manufacturer decides to monitor the number of defects found in each inspected bolt (large bundle) of cloth. The data from 20 inspections are recorded in the table given below : **[6]**

|                          |    |    |    |    |    |    |    |    |    |    |
|--------------------------|----|----|----|----|----|----|----|----|----|----|
| <b>Bolt of Cloth</b>     | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
| <b>Number of Defects</b> | 10 | 19 | 5  | 9  | 2  | 8  | 7  | 13 | 3  | 2  |
| <b>Bolt of Cloth</b>     | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| <b>Number of Defects</b> | 22 | 4  | 6  | 9  | 7  | 2  | 5  | 12 | 4  | 2  |

- i) Which control chart should be used in this case? Calculate the control limits for this chart.
- ii) Do these data from a controlled process? If not, calculate the revised control limits.
- b) Explain the function of shop floor control. **[4]**



Total No. of Questions : 8]

SEAT No. :

**PD4972**

[Total No. of Pages : 2

**[6405]-87**

**First Year M.E. (E&TC)/(Communication Network)  
MODELING AND SIMULATION OF COMMUNICATION  
NETWORKS  
(2017 Pattern) (Semester - I) (504501)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicates marks.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of electronic pocket calculator is allowed.*

- Q1)** a) Explain Graphical Process for post processing. [4]  
b) Why PN sequence generators are needed in simulation? Discuss its components & properties of PN sequence. [4]  
c) What is the role of simulation in communication system? Discuss in brief. [2]
- Q2)** a) What are parameters of performance estimation in simulation? Discuss. [4]  
b) Explain multiplication algorithm with prime modules. [4]  
c) Elaborate Up & Down sampling in communication system. [2]
- Q3)** a) With example, explain the State Estimation Model for Band Pass Signal. [4]  
b) What are the aspects for selection of sampling frequency for a simulation. [4]  
c) List the steps in simulation & modeling. [2]
- Q4)** a) Explain Mixed Signal Congruence algorithm. [4]  
b) Explain various methodologies used in mapping a problem into a simulation model. [4]  
c) What are the categories of a communication channel? [2]
- Q5)** a) Enlist factors to be considered while simulating non-linearities. [4]  
b) Explain pure Monte-Carlo approach with respect to performance estimation of a communication system. [4]  
c) Explain simulation model of any simple communication system. [2]

**P.T.O.**

- Q6)** a) Explain Tapped time delay model. [4]  
b) Explain Random Process model with respect to time varying system.[4]  
c) Why semi analytic simulation technique is used in network analysis? [2]
- Q7)** a) Explain Multipath fading in wireless communication channel. [4]  
b) Explain Queue system related to network modeling. [4]  
c) Enlist any two parameters while simulating a radio channel. [2]
- Q8)** a) Write an algorithm to demonstrate two state Markov Model for discrete with memory. [4]  
b) Explain Poisson's modeling. [4]  
c) How to estimate the error probability in a digital transmission system?[2]



Total No. of Questions : 8]

SEAT No. :

**PD4973**

[Total No. of Pages : 2

**[6405]-88**

**First Year M.E. (E&TC)/(Communication Networks)**

**HIGH SPEED COMMUNICATION NETWORKS**

**(2017 Pattern) (Semester - I) (504502)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions out of eight.*
- 2) *All questions carry equal marks.*
- 3) *Neat labeled diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

- Q1)** a) Draw and explain ATM Protocol Architecture. [5]  
b) Write a note on [5]  
i) Fast Ethernet  
ii) Giga Ethernet
- Q2)** a) Explain dynamic routing Protocol? State advantages of dynamic routing over static routing? [5]  
b) Explain any 2 applications of wireless LANs for home environment. [5]
- Q3)** a) Explain the basic components of a queuing system and explain how queuing models help in measuring performance evaluation of network systems. [5]  
b) Explain any 2 types of –Single Server Queue models. [5]
- Q4)** a) Explain the significance of Congestion control? How does congestion affect network? [5]  
b) Write a note on TCP Congestion Control. [5]
- Q5)** a) Explain Karn's Algorithm in detail and how does Karn's Algorithm address the problems in TCP transmission. [5]  
b) Explain the need of traffic and congestion control critical in Asynchronous Transfer Mode (ATM) networks. [5]

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

- Q6)** a) Explain Guaranteed Frame Rate (GFR) in ATM, and how does it differ from ABR. [5]  
b) Describe the significance and need of Exponential RTO Back off. [5]
- Q7)** a) How does Motion Estimation and Video Filtering help in video compression. [5]  
b) Write a note on [5]  
i) Color Models  
ii) Video Coding standards
- Q8)** a) Explain the process of audio and video transmission in packet networks. [5]  
b) Write a note on Integrated Services Architecture. [5]



Total No. of Questions : 8]

SEAT No. :

**PD4974**

**[6405]-89**

[Total No. of Pages : 2

**First Year M.E. (E&TC) (Communication Networks)**

**NETWORK SECURITY**

**(2017 Pattern) (Semester - I) (504503)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Qu. No. 1 or 2, Qu. No. 3 or 4, Qu. No. 5 or 6 and Q. No. 7 or 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) Explain the Diffie - Hellman algorithm and calculate Keys (K1 & K2) with Following assumptions. Prime numbers  $n = 11$ ,  $g = 7$ . Assume  $x = 3$ ,  $y = 6$ . [6]

b) Write short note on Hash Function. [6]

OR

**Q2)** a) Calculate the following using RSA algorithm. Take Prime Numbers  $P=7$  &  $Q = 19$ , Public Key  $E=29$  & Private key  $D=41$  Convert Plain Text "G" into Cipher Text. [6]

b) Write a short note on AES algorithm. [6]

**Q3)** a) How OS Security System works? Explain with Neat Block Diagram.[7]

b) Draw and explain Security Architecture in detail. [6]

OR

**Q4)** a) Draw and DES algorithm. [7]

b) Draw and HMAC algorithm. [6]

**P.T.O.**

**Q5) a)** Explain S/MIME Email Security in detail. [6]

b) Write short note on Information Security. [6]

OR

**Q6) a)** Explain SSL Security in detail. [6]

b) Explain IPSec Transport mode Vs Tunnel Mode. [6]

**Q7) a)** Write short note on Secure Electronic Transaction. [7]

b) Explain the role of cyber security for VoIP Networks. [6]

OR

**Q8) a)** Compare ESP Vs AH protocol with respect to IPSEC. [7]

b) Write the short note on cyber security for Smart Grids. [6]





Total No. of Questions : 8]

SEAT No. :

**PD4975**

[Total No. of Pages : 2

**[6405]-90**

**First Year M.E. (Electronics & Telecommunication/Computer  
Networks/Communication Network/IoT and Sensor System (2020)/  
Microwave/VLSI & Embedded Systems)/(Signal Processing)/(Wireless  
Communication Technology)  
RESEARCH METHODOLOGY  
(2017 Pattern) (Semester - I) (504504)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt any five questions.*
- 2) Figures to the right indicate full marks.*
- 3) Neat diagrams must be drawn whenever necessary.*
- 4) Assume suitable data if necessary.*
- 5) Use of an electronic pocket calculator is allowed.*

- Q1)** a) What is the process involved in problem identification? Explain the steps involved in problem identification. [5]
- b) List the types of Research and explain the advantages of Qualitative and Quantitative Research in brief. [5]
- Q2)** a) What is the necessity of defining a research problem. [5]
- b) Distinguish between Research methods and Research methodology. [5]
- Q3)** a) Explain the Basic Instrumentation Scheme with example for experimental research. [5]
- b) Explain regression analysis with a suitable example. [5]
- Q4)** a) Explain the important characteristics of Multivariate techniques, and list multivariate techniques. [5]
- b) Explain the meaning of significance of concept of standard error in sampling analysis in research. [5]

**P.T.O.**

**Q5) a)** What do you mean by asymptotic analysis? Explain with suitable analysis. [5]

b) Justify the need of statistics for advance data analysis. [5]

**Q6)** Write short notes on- [10]

a) Process of evaluating the research

b) Data collection and interpretation of data

**Q7) a)** How to prepare Institutional research to setup Innovation Centre in your organization? Explain with Example. [5]

b) How to select appropriate tool for conducting research experiment. [5]

**Q8)** Write short note on- [10]

a) Conceptual Framework for Research.

b) Evaluation of Research Outcome.

\*\*\*

Total No. of Questions : 8]

SEAT No. :

PD-5324

[Total No. of Pages : 2

[6405]-91

**M.E. (E&TC) (Communiation Network)**

**TRAFFIC ANALYSIS AND QOS**

**(2017 Pattern) (Semester - II) (504507)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of electronic pocket calculator is allowed.*

**Q1) a)** Explain OSI network management model in detail. **[6]**

b) What is organization model? Explain 2 tier & 3 tier network management organization model in detail. **[6]**

OR

**Q2) a)** What are different message PDUs used in SNMP operation. Explain the encapsulation in detail. Write a note on Trap PDU with a suitable diagram showing different fields. **[6]**

b) What are the requirements of 3 tier NMS? **[6]**

**Q3) a)** Explain the conceptual Model of Telecommunication Management. **[7]**

b) Describe in detail Optical network & MAN feeder network. **[6]**

OR

**Q4) a)** Write a note on Broadband Network Management. **[7]**

b) Write a short note on Multi Protocol Label switching **[6]**

**P.T.O.**

- Q5)** a) Explain the utility & application area of high speed LANs. [6]  
b) Explain 802.5 token Ring Technology in High Speed LANs. [6]

OR

- Q6)** a) What are the two types of QoS solutions? Explain in brief, [6]  
b) What are the types of Network Traffic? Explain in brief. [6]

- Q7)** a) Write a short note on MPLS traffic Engineering. [7]  
b) What are function provided by ISA to manage congestion & QoS transport? [6]

OR

- Q8)** a) What is the difference between flow control and Error Control? [7]  
b) Describe Traffic Control and Congestion Control in ATM Networks.[6]



Total No. of Questions : 8]

SEAT No. :

**PD4976**

[Total No. of Pages : 2

**[6405]-92**

**First Year M.E. (E & TC)(Communication Network)**

**BROADBAND WIRELESS TECHNOLOGIES**

**(2017 Pattern) (Semester - II) (504508) (Theory)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume Suitable data if necessary.*

**Q1) a)** Explain MIMO Antenna system with respect to channel capacity, diversity & spatial multiplexing gain. Also state any one application in which MIMO Antenna systems are used. **[5]**

b) What is OFDM? Explain the various steps involved for designing the receiver in orthogonal frequency Division Multiplexing. **[5]**

**Q2) a)** Explain how to achieve transmitter diversity in MIMO systems. Explain Alamouti scheme in detail. **[5]**

b) What is cyclic prefix - based code-Division multiplexing Access system? What are their advantages over OFDM system? State any one application of CP based CDMA. **[5]**

**Q3) a)** Explain reservation MAC with reference to frame format for dynamic TDMA. Also explain silent state, contention state and reservation state. **[5]**

b) Compare and contrast between Time hopping ultra-wideband and Direct sequence ultra-wideband systems. **[5]**

**Q4) a)** Explain polling MAC protocol with the help of frame structure. **[5]**

b) Explain in detail the Multichannel Medium Access control system. **[5]**

**P.T.O.**

- Q5)** a) What is a Wi-MAX Mesh? Where it can be used? Discuss the general properties of Wi-MAX Mesh networks. [5]
- b) Write short note on Dynamic Bandwidth allocation algorithm (DBA). [5]
- Q6)** a) What is the importance of routing protocols in multihop networks? Compare Adaptive Routing Protocol and Scalable Routing Protocol. [5]
- b) What is QoS in wireless systems? Explain in detail how to achieve QoS in wireless systems. [5]
- Q7)** a) What is FTTx? What are various types of FTTx? Explain architecture of FTTx in detail. [5]
- b) Write a short note on Intra-ONU scheduling in EPON. [5]
- Q8)** a) Discuss different architectural consideration for the deployment of point to point FTTX. [5]
- b) Explain how Quality of service is implemented for upstream and downstream in Ethernet Passive Optical Networks. [5]



Total No. of Questions : 8]

SEAT No. :

**PD4977**

**[6405]-93**

[Total No. of Pages : 2

**First Year M.E. (E&TC) (Communication Network)**

**SDR AND COGNITIVE RADIO**

**(2017 Pattern) (Semester - II) (504509)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Neat diagrams to be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of calculator is allowed.*
- 5) Assume suitable data if necessary.*

**Q1) a)** Describe various low cost Cognitive Radio platforms available. **[7]**

b) Discuss on various future aspects of software defined radio. **[6]**

OR

**Q2) a)** Explain in brief the requirement and the architecture of cognitive radio. **[7]**

b) Write a note on Convergence between military and commercial systems. **[6]**

**Q3) a)** Draw and explain the layered architecture of Cognitive Radio. **[6]**

b) Explain How is end-to-end communication cognitive established in radio and What are the challenges faced? **[6]**

OR

**Q4) a)** Explain the major frequency bands allocated for cognitive radio worldwide with its significance. **[6]**

b) How is Quality of Service (QoS) and security maintained in end to end communication in cognitive radio. **[6]**

**P.T.O.**

**Q5) a)** Draw and explain the SCA architecture and state the key requirements of it. [6]

b) Write a note on Networking Overview of SCA. [6]

OR

**Q6) a)** Explain the Common Object Request Broker Architecture (CORBA). [6]

b) Write a note on SCA and JTRS compliance. [6]

**Q7) a)** Explain with neat diagram Smart antenna architectures. [7]

b) Explain the key considerations and challenges in Radio Frequency (RF) Design. [6]

OR

**Q8) a)** Write a note on Smart antennas and Phased array antennas. [7]

b) Explain how can cognitive radio principles enhance antenna performance and state its benefits with reference to smart antenna system. [6]





Total No. of Questions : 8]

SEAT No. :

**PD4978**

[Total No. of Pages : 2

**[6405]-94**

**S.Y.M.E. (E & TC) /(Communication Network)**

**4G LTE CELLULAR SYSTEMS**

**(2017 Pattern) (Semester - III) (604501)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or 2, Q.3 or 4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams to be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of a calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** What is LTE? Write on system architecture evolution of LTE **[7]**

b) Explain the characteristic features of LTE and LTE Advanced. **[6]**

OR

**Q2) a)** Describe in detail Packet Data Convergence Protocol in LTE. **[7]**

b) Explain in brief the role of Mobility Management Entity (MME),  
Serving Gateway (S-GW), Packet Data Network Gateway (PDN-GW) **[6]**

**Q3) a)** Detail the RF requirements for LTE. **[6]**

b) Explain the carrier aggregation in the LTE. **[6]**

OR

**Q4) a)** Describe in detail the trans-receiver design in spectrum sharing. **[6]**

b) Illustrate the methodology involved in resource management. **[6]**

**Q5) a)** What is the software defined networks? Explain in brief. **[6]**

b) Explain the key features of OFDMA. **[6]**

OR

**P.T.O.**

- Q6)** a) Explain downlink and uplink MIMO. [6]  
b) Explain the Advanced precoding concept. [6]

- Q7)** a) Discuss the backhaul design for in-band relaying. [7]  
b) Compare Centralized and Distributed architectures of CoMP. [6]

OR

- Q8)** a) Write short note on Wi-Max standards evolution. [7]  
b) Discuss the relay basic schemes in CoMP. [6]



Total No. of Questions : 8]

SEAT No. :

PD4979

[6405]-95

[Total No. of Pages : 2

**S.Y. M.E. (E & TC (Communication Network))**  
**MODERN COMMUNICATION RECEIVER DESIGN &**  
**TECHNOLOGY**  
**(2017 Pattern) (Semester - III) (604502)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams to be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1)** Enlist the various types of super-heterodyne receiver with block diagram and it's working. **[10]**

**Q2)** Explain Drift-Canceling Loops and the Barlow-Wadley Receiver with suitable diagram. **[10]**

**Q3)** a) Explain the design of Automatically Switched Half-Octave Filter Banks for HF transceiver. **[5]**

b) Explain the system composite noise figure with block diagram. **[5]**

**Q4)** Define the following terms in brief w.r.t. dynamic range : **[10]**

- a) Linear composite dynamic range (LCDR)
- b) Spurious-free second-order dynamic range (IP2SFDR)

**P.T.O.**

**Q5) a)** Give the Classification of frequency synthesizer forms. **[5]**

b) Explain the Gilbert Cell Mixers with suitable diagram. **[5]**

**Q6)** Explain the Double-Balanced Mixer with its performance characteristics. **[10]**

**Q7) a)** Enlist different Noise Blanker & state the importance of Noise Blanker in IF receiver. **[5]**

b) Explain with block diagram the front end designing of High frequency Rx/Tx. **[5]**

**Q8)** What are design considerations for Audio and Baseband Amplifier of receiver? **[10]**



Total No. of Questions : 8]

SEAT No. :

**PD4980**

[Total No. of Pages : 2

**[6405]-96**

**F.Y.M.E. (E&TC)/(Internet of Things & Sensor System)**

**SENSORS AND MEASUREMENTS**

**(2017/2024 Pattern) (Semester - I) (504801)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions out of 8.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculators is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Explain the types of sensors alongwith classification. **[5]**

b) Explain working principle of Avalanche photodiode with applications.**[5]**

**Q2) a)** Explain the following sensors. **[5]**

i) Piezoelectric force sensor

ii) Optoelectronic pressure sensor

b) What is an Inductive sensor and how does it work? **[5]**

**Q3) a)** What is intensity sensor? How it will be beneficial for real time applications. **[5]**

b) Justify the role of phase sensors in phase detection with practical application. **[5]**

**Q4) a)** Explain the working of piezoelectric accelerometer and List it major applications. **[5]**

b) Describe the working principle of Electromagnetic velocity sensor with its application. **[5]**

**Q5) a)** How does inductive and magnetic sensor work? **[5]**

b) Write short note on the following. **[5]**

i) Fabry perot sensor

ii) Capacitive liquid level sensor

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

- Q6)** a) Explain the working principle of LVDT. Also mention advantages and disadvantages. [5]  
b) How the signal condition circuits will work for reactive and self generating sensors. [5]
- Q7)** a) Explain the working principle of coriolis mass flow and drag flow sensor in detail. [5]  
b) Write short note on: [5]  
i) Acoustic sensor  
ii) Piezoelectric temperature sensor
- Q8)** a) Explain the working principle of ultrasonic sensor with real time application. [5]  
b) What are the different types of flow sensors. Illustrate any one with working principle and practical application. [5]



Total No. of Questions : 8]

SEAT No. :

**PD4981**

[Total No. of Pages : 2

**[6405]-97**

**F.Y. M.E. (Electronics & Telecommunication-Internet of Things and  
Sensor System (2020))**

**DATA COMMUNICATION & NETWORKING  
(2024 & 2017 Pattern) (Semester - I) (504602)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions out of 8.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain classical and modern data communication technologies and highlight its types? [5]  
b) Explain the ISO-OSI 7 layer network architecture model as it relates to data communications and networking. [5]
- Q2)** a) Explain about the motivation for cross layer protocol design with neat diagram. [5]  
b) Explain network traffic behaviour under the context of network layers and topology design. [5]
- Q3)** a) Explain the fundamentals of time synchronization and how it is fruitful to network management. [5]  
b) Explain the types of sensors which are used in sensor network of data communication and networking. [5]
- Q4)** a) What is a self-organizing network? And how does it work? [5]  
b) What do you understand by multimedia? What type of data is communicated in multimedia communication? [5]
- Q5)** a) Why Software defined Networking (SDN) is important in data communication. [5]  
b) Explain the term reliability and why it is important for data communications and networking. [5]

**P.T.O.**

- Q6)** a) What does scheduling mean? Write the names of two networks used in data communication and networking. [5]
- b) Explain wireless sensor networks. Why is wireless networking preferred overwired networks? [5]
- Q7)** a) What are the transport and application layers that are widely used in data communication and networking? [5]
- b) Explain the term quality of service (QoS) used extensively in data communications and networking. [5]
- Q8)** a) Explain network traffic behaviour. How routing algorithm solve the network traffic congestion. [5]
- b) Explain the term reliability and why it is important for data communications and networking. [5]





Total No. of Questions : 8]

SEAT No. :

**PD4982**

**[6405]-98**

[Total No. of Pages : 2

**F.Y. M.E. (Electronics & Telecommunications- IoT and  
Sensor System) (2020)**

**WIRELESS SENSOR NETWORK FOR IOT  
(2017/2024 Pattern) (Semester - I) (504803)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions out of eight.*
- 2) *All questions carry equal marks.*
- 3) *Neat labeled diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

**Q1)** a) Explain with wiring details RS232 & RS485 Protocol. **[5]**

b) Explain UWB technology with its application. **[5]**

**Q2)** a) With neat diagram describe the Sensor Node Architecture. **[5]**

b) Explain the major challenges in WSN in terms of Energy usage profile and Choice of modulation. **[5]**

**Q3)** a) Describe 2 types of Schedule-based protocols. **[5]**

b) What is data dissemination? Explain the challenges in ensuring reliable data dissemination in WSNs. **[5]**

**Q4)** a) What is Gateway in WSN? Explain the advantages of using gateways in WSN. **[5]**

b) Describe in detail WSN Tunneling. **[5]**

**P.T.O.**

- Q5)** a) Explain the process to access services of a WSN on Internet-based entity. [5]
- b) Explain the performance metrics/figure of metrics that are used for evaluating the performance of WSN. [5]
- Q6)** a) Define M2M communication. How does M2M communication contribute to IoT ecosystems? [5]
- b) Explain the primary components of a TinyOS? What makes TinyOS suitable for IoT devices. [5]
- Q7)** a) List the features of 6LoWPAN protocol. Explain architecture of 6LoWPAN. [5]
- b) Give the significance of IP in WSNs? State the challenges faced in implementing of IP in WSN devices? [5]
- Q8)** a) Explain the significance of 6LoWPAN in enabling IP-based WSNs. [5]
- b) What is the purpose of the AllJoyn framework? Give advantages of using AllJoyn for IoT development. [5]



Total No. of Questions : 8]

SEAT No. :

PD-4983

[Total No. of Pages : 2

**[6405]-99**

**M.E. (E & TC) (IoT & Sensor System)**

**EMBEDDED SYSTEM DESIGN**

**(2017 Pattern) (Semester - II) (504608)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Attempt any 5 questions out of 8.*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Figures to the right of questions indicate full marks.*
- 4) Assume suitable data, if necessary.*

**Q1) a)** What are the specification of embedded system. **[5]**  
**b)** What is main role or need of embedded system and design challenges. **[5]**

**Q2) a)** Explain in brief system overview of embedded system **[5]**  
**b)** What are the specification need for hardware and software. **[5]**

**Q3) a)** Explain design models and techniques, any one. **[5]**  
**b)** Difference between IC technology and design technology. **[5]**

**Q4) a)** Define & explain RTOS. **[5]**  
**b)** Explain re-engineering process. **[5]**

**Q5) a)** Explain integration of the hardware and software components. **[5]**  
**b)** What are different tools of testing and their selection criteria. **[5]**

**Q6) a)** Explain hardware reliability and failure analysis **[5]**  
**b)** Which communication protocol use for embedded system. **[5]**

**P.T.O.**

- Q7)** a) Explain any two real life embedded products. [5]  
b) Explain aspect of Mechanical packing and testing. [5]
- Q8)** a) Define embedded product area of technology. [5]  
b) Why EMI/RFI certification is important for embedded system. [5]



Total No. of Questions : 8]

SEAT No. :

**PD4984**

[Total No. of Pages : 2

**[6405]-100**

**F.Y.M.E. (E & TC) (IOT & Sensor System) (2020)**

**CLOUD ARCHITECTURE & PROTOCOLS**

**(2017 Pattern) (Semester - II) (504609)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt any 5 questions out of 8.*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

**Q1) a)** How do cloud storage, networking, and computing power contribute to cloud services? **[5]**

b) What are the five essential characteristics of cloud computing defined by NIST? **[5]**

**Q2) a)** How do infrastructure, platform, and software as a service (IaaS, PaaS, SaaS) function within cloud computing? **[5]**

b) In what scenarios would a company choose traditional IT services over cloud computing? **[5]**

**Q3) a)** How does cloud computing support high-performance computing applications? **[5]**

b) How does enterprise grid computing differ from cloud computing? **[5]**

**Q4) a)** What are the risks of application development in a cloud environment?**[5]**

b) What are the key regulatory challenges businesses face when using cloud services? **[5]**

**P.T.O.**

- Q5)** a) What steps can organizations take to ensure they meet legal and regulatory cloud computing standards? [5]
- b) Compare IaaS, SaaS and PaaS in terms of advantages, disadvantages and applications. [5]
- Q6)** a) What is a Public Cloud, and what are its advantages and disadvantages? [5]
- b) What are the key advantages of cloud computing for businesses and individuals? [5]
- Q7)** a) What are the main challenges businesses face when adopting cloud computing. [5]
- b) What is Infrastructure as a Service (IaaS), and how does it differ from SaaS and PaaS? [5]
- Q8)** a) How does CloudSim help in evaluating cloud performance and resource management? [5]
- b) What is VMware, and why is it widely used for virtualization? [5]



Total No. of Questions : 8]

SEAT No. :

**PD4985**

**[6405]-101**

[Total No. of Pages : 2

**F.Y. M.E. (Electronics & Telecommunications, IoT and  
Sensor System) (2020)**

**IoT ARCHITECTURE AND PROTOCOLS  
(2017 Pattern) (Semester - II) (504610) (Theory)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions out of 8.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain the Main Design Principles and needed capabilities of IoT. [5]

b) Explain the Everything as a Service (XaaS) related to the IoT architecture.[5]

**Q2) a)** Explain about the Real world design constraints of Reference architecture.[5]

b) Explain the Data representation and Visualization of IoT reference architecture. [5]

**Q3) a)** Explain the DASH7 and DHCP Protocol related to IoT and Sensor system. [5]

b) Explain the difference between RPL and CORPL in the context of IoT.[5]

**Q4) a)** What is a MPTCP? And how does it work? [5]

b) What do you understand by UDP? Why it is used? [5]

**P.T.O.**

- Q5)** a) What is XMPP and how does it work? [5]  
b) What is OMA? Compare this to BBF. [5]
- Q6)** a) What is 6 TiSCH? Why is it used in IoT? [5]  
b) What is ICMP? Why is it used in IoT? [5]
- Q7)** a) What are the different views related to reference architecture in IoT? [5]  
b) Why is security the most important parameter in IoT? [5]
- Q8)** a) What are the four main components of IoT architectural design? [5]  
b) Highlight the power consumption of IoT devices and architectures. [5]

**x x x**



Total No. of Questions : 8]

SEAT No. :

**PD4986**

[Total No. of Pages : 2

**[6405]-102**

**S.Y.M.E. (Electronics & Telecommunications-IoT and Sensor  
System) (2020)**

**MICRO SYSTEM FABRICATION  
(2017 Pattern) (Semester - III) (604601)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions out of 8.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain the device miniaturization? Why is it needed? **[5]**

b) Write a short notes on (i) Diffusion (ii) Ion-Implantation **[5]**

**Q2) a)** What is LIGA? Why is it needed? **[5]**

b) Explain the 5 steps involved in LIGA. **[5]**

**Q3) a)** What is MEMS actuator? Explain the basic principle of MEMS actuator. **[5]**

b) What is RF MEMS switch? Explain any one RF MEMS switch. **[5]**

**Q4) a)** What are the five important MEMS materials? **[5]**

b) What do you understand by puller? Mention the four sub-systems of puller. **[5]**

**Q5) a)** What is micro system? Why sputtering is used in VLSI? **[5]**

b) What is monolithic? Explain the beam mechanism. **[5]**

**P.T.O.**

- Q6)** a) Explain pattern transfer. Write subtractive and additive methods. [5]  
b) What is plasma? Explain the method of plasma production. [5]
- Q7)** a) What is the polishing? Why is it needed? [5]  
b) What is mean time to failure? Why is it needed? [5]
- Q8)** a) Explain the reliability. Draw failure rate versus time curve for typical ICs. [5]  
b) What is crystal? Explain the crystal growth with suitable diagram. [5]



Total No. of Questions : 8]

SEAT No. :

PD-4987

[Total No. of Pages : 2

**[6405]-103**

**M.E. (E&TC (IoT and Sensor System))  
IoT APPLICATIONS & WEB DEVELOPMENT**

**(2017 Pattern) (Semester - III) (604602)**

**Time : 3 Hours]**

**[Max. Marks : 50**

**Instructions to the candidates :**

- 1) Answer any 5 questions out of 8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) What is role of CSS in web development? [5]  
b) Explain J2ME & Application design using J2ME. [5]
- Q2)** a) Describe Event driven programming. [5]  
b) What are key stages in the mobile app development process? [5]
- Q3)** a) What is SQLITE and how does it differ from another SQL database.[5]  
b) Explain the SQLITE connection. [5]
- Q4)** a) Explain IOT fundamental and components. [5]  
b) What are notable case studies in MEMS in industrial application? [5]
- Q5)** a) Explain smart energy meters and how do they differ from traditional meter. [5]  
b) How can IOT devices are integrated with smart city infrastructure. [5]

**P.T.O.**

- Q6)** a) What role does the Hadoop ecosystem play in big data analysis? [5]  
b) Explain data lake services scenarios in IOT. [5]
- Q7)** a) What are the key features of JAVA script as a programming language? [5]  
b) Describe types of charts are most commonly used in IOT application. [5]
- Q8)** a) What are the fundamental principles of designing a simple UI layout? [5]  
b) How can you interface SQLITE with IOT application? [5]



Total No. of Questions : 8]

SEAT No. :

**PD4988**

[Total No. of Pages : 2

**[6405]-105**

**M.E. -I (E & TC) (Microwave)  
RF AND MICROWAVE CIRCUITS  
(2017 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Figures on the right indicate full marks.*
- 3) *Assume suitable data, wherever necessary.*

- Q1)** a) Derive the expressions for Propagation Constant, Impedance, and Power Flow for the lossless coaxial line [5]
- b) Consider a load resistance  $R_L = 100\Omega$  to be matched to a  $50\Omega$  line with a quarter-wave transformer. Find the characteristic impedance of the matching section and plot the magnitude of the reflection coefficient versus normalized frequency,  $f/f_0$ , where  $f_0$  is the frequency at which the line is  $\lambda/4$  long. [5]
- Q2)** a) Define the following terms w.r.t microwave components: [5]
- i) Sensitivity
- ii) Dynamic range
- b) For an arbitrary N port microwave device, derive the relationship between Transmission (ABCD) matrix and impedance matrix. [5]
- Q3)** a) Write a short note on Inter-symbol Interference (ISI). [5]
- b) Explain with help of proper diagram, working of two hole directional coupler and derive its scattering matrix. [5]
- Q4)** a) Explain with help of suitable diagram construction and working of Tunnel diode. [5]
- b) Explain with help of suitable diagram construction and working of Schottky diode. [5]

**P.T.O.**

- Q5) a)** An RF power BJT generates a total power  $P_w$  of 15W at case temperature of 25°C. The maximum junction temperature is 150°C and the maximum ambient operating temperature is specified to be  $T_a = 60^\circ\text{C}$ . What is the maximum dissipated power if the thermal resistance between case to sink and sink to air is 2°K/W and 10°K/W, respectively? **[5]**
- b) Explain in detail the construction, working of n-channel MESFET along with its electronic applications. **[5]**
- Q6)** Explain the unilateral design approach for amplifier design. Derive the unilateral figure of merit. **[10]**
- Q7)** Using signal flow graph of single stage amplifier, derive the following relationships: Incident power to the amplifier  $P_{inc}$ , available power  $P_A$ , Transducer gain  $G_T$  and Unilateral transducer gain  $G_{TU}$ . **[10]**
- Q8)** Describe in detail the construction, working of Gunn diode along with its two valley theory. **[10]**



**[6405]-112**

**M.E. (E & TC) (Signal Processing)**

**MATHEMATICS FOR SIGNAL PROCESSING**

**(2017 Pattern) (Semester - I) (504401)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *All questions are compulsory.*
- 2) *Assume suitable data, if necessary.*
- 3) *Use of non-programmable calculator is allowed.*

**Q1) a)** A coin is tossed up four times in succession, Determine the probability of obtaining three heads. **[6]**

b) Consider a random experiment consisting of drawing of two cards in succession from a deck of cards without replacing the first card drawn. Find the probability of obtaining two red aces in two draws. **[6]**

OR

**Q2) a)** The joint probability density of random variables X and Y is : **[6]**

$$F(x,y) = 1/4 \exp(-|x| - |y|)$$

for  $-\infty < x < \infty, -\infty < y < \infty$

Calculate the probability that :

$X < 1$  and  $Y < 0$

b) A binary symmetric channel has a conditional probability of error  $p = 10^{-5}$  and the messages  $m_0$  and  $m_1$  are generated at the source with equal probability. Determine : **[6]**

- i) The probability of receiving a response of  $r_0$
- ii) The probability of receiving a response of  $r_1$
- iii) The probability that  $m_0$  was sent and given that  $r_0$  is received
- iv) the probability that  $m_1$  was sent and given  $r_0$  is received.

**P.T.O.**

**Q3) a)** Determine the rank of the following matrices : **[7]**

$$\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix} \quad \begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$$

**b)** Use Guass - Jordan method to find the inverse of the matrix. **[6]**

$$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$$

OR

**Q4) a)** Reduce the matrix to its normal form and hence find its rank : **[7]**

$$\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$$

**b)** Verify given matrix is Orthogonal : **[6]**

$$A = \frac{1}{3} \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{bmatrix}$$

**Q5) a)** Prove That : **[6]**

$$[B \times C, C \times A, A \times B] = [ABC]^2$$

$$A \times \{B \times (C \times D)\} = B.D (A \times C) - B.C (A \times D)$$

**b)** Prove that formula : **[6]**

$$(B \times C). (A \times D) + (C \times A). (B \times D) + (A \times B). (C \times D) = 0$$

$$\text{And hence show that } \sin (C + \Phi) \sin (\theta - \Phi) = \sin 2 \theta - \sin 2 \Phi.$$

OR



**Q6) a)** Find the moment about a line through the origin having direction  $2\mathbf{i} + 2\mathbf{j} + \mathbf{k}$  due to a 30 kg force acting at a point  $(-4, 2, 5)$  in the direction of  $12\mathbf{i} - 4\mathbf{j} - 3\mathbf{k}$ . [6]

**b)** Prove that : [6]

$$\sin (A+B) = \sin A \cos B + \cos A \sin B$$

$$\cos (A+B) = \cos A \cos B - \sin A \sin B$$

**Q7) a)** Explain Power Spectral Density (PSD). Also explain its various properties. [7]

**b)** A sinusoidal signal generator of deterministic frequency  $f_0$  and amplitude  $A$  is switched on. The starting time is random such that  $x(t) = A \sin (2\pi f_0 t + \Phi)$ , Find the autocorrelation of the random process. Also sketch the same. [6]

OR

**Q8) a)** Consider a sinusoidal process  $X(t)$  denoted by : [7]

$X(t) = A \cos (2\pi f_e t + \Phi)$  : Where  $A$  and  $f_e$  are constants and  $\Phi$  is uniformly distributed random variable.

$$f_\phi(\theta) = 1/2\pi, 0 \leq \theta \leq 2\pi = 0, \text{ elsewhere}$$

Show that the random sinusoidal process is ergodic in both mean and autocorrelation function.

**b)** Discuss the transmission of random process through linear filters. [6]



Total No. of Questions : 8]

SEAT No. :

**PD4989**

[Total No. of Pages : 2

**[6405]-113**

**First Year M.E. (E&TC)/(Signal Processing)  
DIGITAL IMAGE & VIDEO PROCESSING  
(2017 Pattern) (Semester - I) (504402)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five question.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full Marks.*
- 4) *Assume the suitable data, if necessary.*

- Q1)** a) What is discrete cosine transform? Explain. [5]  
b) Explain Pseudo, color image processing in detail. Write its application. [5]
- Q2)** a) Explain separability of unitary transforms & basis images. [5]  
b) Write a short note on image sampling and quantization. [5]
- Q3)** a) Explain homo-morphic filtering approach for image enhancement. [5]  
b) Define Image Restoration and explain any one method of image restoration. [5]
- Q4)** a) Write a short note on maximum entropy-based method for image restoration. [5]  
b) Define Image enhancement and explain any one method of image enhancement. [5]
- Q5)** a) Describe the basic concept of Fourier descriptor for representation of boundary. List its properties and advantages. [5]  
b) What is the difference between lossy compression and lossless compression? Explain with their advantages, disadvantages and applications. [5]

**P.T.O.**

- Q6)** a) Explain the Morphological operators in edge detection. [5]  
b) What is difference between image restoration and image enhancement? Explain the image degradation model in detail. [5]
- Q7)** a) State the difference between analog and digital video? Explain basic video codes with suitable block diagram. [6]  
b) Explain the motion estimation and Prediction selection. [4]
- Q8)** a) Explain the following terms with respect to H.261. [6]  
i) Intra - frame compression.  
ii) Inter - frame compression.  
b) What is Pseudo coloring and False coloring? Give its application. [4]



Total No. of Questions : 8]

SEAT No. :

**PD4990**

**[6405]-114**

[Total No. of Pages : 2

**First Year M.E. (E & TC) (Signal Processing)**  
**ADVANCED DIGITAL SIGNAL PROCESSING**  
**(2017 Pattern) (Semester - I) (504403)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** a) Explain the design of linear phase FIR filter using frequency sampling method. [6]

b) State and prove Circular frequency shift property of DFT. [2]

OR

**Q2)** a) Compute the DFT of [4]

$$x(n) = \begin{cases} 1, & n \text{ even}, & 0 \leq n \leq N-1 \\ 0, & n \text{ odd} & 0 \leq n \leq N-1 \end{cases}$$

b) Differentiate IIR Filter and FIR Filter. [4]

**Q3)** a) Explain the polyphase structure for interpolator. [6]

b) What is need of Adaptive filters. [2]

OR

**Q4)** a) Design a two stage decimator for the following specifications [6]

Sampling rate of input signal: 20000 Hz,

M = 100, Passband: 0 to 40 Hz,

Transition band: 40 to 50 Hz

Pass band ripple: 0.01, Stop band ripple: 0.002

b) State & explain Wiener Hopf Equation. [2]

**P.T.O.**

**Q5) a)** Define the terms related to Random Process. [4]

i) Mean

ii) Variance

b) Define autocorrelation and list its properties. [7]

c) What is stationary process? Explain. [6]

OR

**Q6) a)** What is Ergodicity? Explain. [9]

Are the wide sense stationary process and Ergodic Process reasonable assumptions for a video signal?

b) Compare Time averages and Ensemble averages. [8]

**Q7) a)** Explain VLIW Architecture in detail. [9]

b) Write a brief note on Booth's Multiplication algorithm. [8]

OR

**Q8) a)** Explain Super Harvard Architecture in detail. [9]

b) Explain the process of implementation of FIR filter with the help of an example. [8]



Total No. of Questions : 8]

SEAT No. :

PD-4991

[Total No. of Pages : 2

[6405]-115

**M.E. (E & TC) (Signal Processing)**  
**BIOMEDICAL SIGNAL PROCESSING**  
**(2017 Pattern) (Semester - II) (504407)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain cell junction with the help of diagram. [5]  
b) Explain Heart Structure with diagram. [5]
- Q2)** a) How to use Eigen analysis for bio-signals processing. State its advantages and limitations. [5]  
b) Explain Electrical Activity of heart with diagram. [5]
- Q3)** a) Write a note on CT scan. [4]  
b) Explain with block diagram Biomedical Instrumentation System. [6]
- Q4)** a) What is the purpose of PET scanning? [4]  
b) Explain instrumentation amplifier. [6]
- Q5)** a) Write a note on MRI and Functional MRI(FMRI) [4]  
b) Write a note on Eigen Analysis Spectral Analysis. [4]  
c) List Time frequency Methods in processing of Bio-signals. [2]

*P.T.O.*

- Q6)** a) Discuss the Autoregressive (AR) analysis. [4]  
b) Explain in detail electromechanical models of signal generation. [4]  
c) What is PET Image. [2]
- Q7)** a) Define following: 1.Edge 2. Line 3. Points 4. Corners. [4]  
b) Explain Spectral Analysis of Heart rate. [4]  
c) Write a note on Lattice adaptive filter. [2]
- Q8)** a) Explain Noise reduction by Ensemble Averaging. [4]  
b) Write a short note on RLS and Lattice Filter. [4]  
c) What is role of Isolation amplifier. [2]



Total No. of Questions : 8]

SEAT No. :

**PD4992**

[Total No. of Pages : 2

**[6405]-116**

**First Year M.E. (E & TC) (Signal Processing)**

**SPEECH PROCESSING**

**(2017 Pattern) (Semester - II) (504408)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Make Suitable assumptions wherever necessary.*

**Q1)** a) Explain spectrographic analysis of speech signal & mention all parameters of it. [6]

b) Explain the role of vocal cord and vocal tract in speech production system [4]

**Q2)** a) Explain voiced, unvoiced and silence part of speech signal. How these parts of the speech signal are separated with the help of ZCR and energy. [6]

b) Define pitch. Explain auto correlation method for finding pitch period. [4]

**Q3)** a) Explain Levinson-Durbin recursive algorithm for the calculation of predication coefficients. [5]

b) Explain the transformation from LPC to LSP and LSP to LPC. [5]

**Q4)** a) Explain the homomorphic speech processing in detail. [5]

b) Explain the pitch detection using LPC parameters in detail. [5]

*P.T.O.*



- Q5)** a) Explain cepstrum analysis for speech signal. What is the importance of formants. [6]  
b) Explain the forward adaptive quantizer in detail. [4]
- Q6)** a) Explain the speech coding standard G. 726. [5]  
b) Explain Perceptual linear prediction in detail. [5]
- Q7)** a) Draw and explain speaker Identification System. Also explain different performance measurement parameters used for speaker recognition. [6]  
b) Compare speaker identification system with speaker verification system. [4]
- Q8)** a) Explain following speech enhancement methods along with its merits and demerits. [6]  
i) spectral subtraction.  
ii) Adaptive noise cancellation.  
b) What are three basic problems associated with HMMs? Give their solution. [4]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

PD-4993

[6405]-117

M.E. (E &TC) (Signal Processing)

COMPUTER VISION

(2017 Pattern) (Semester-II) (504409)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Attempt any 5 questions.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data if any.

**Q1)** a) Explain with sketch Pinhole camera. [5]

b) What is weak camera calibration. Explain any two techniques. [5]

OR

**Q2)** a) Describe what is texture analysis. Explain in detail with example. [5]

b) Explain in detail buyers pattern. [5]

**Q3)** a) Why are epipolar constraints useful for stereo matching? What happens to epipoles and epipolar line in rectified image? What are advantages of applying image rectification before we do stereo matching? [5]

b) What is basic idea behind stereo and triangulation? [5]

OR

**Q4)** a) Describe hough transform for lines and curves. [5]

b) Explain Epipolar geometry in detail with respect to stereo vision. [5]

**Q5)** a) Explain with neat diagram image stitching. [5]

b) Explain meaning of good feature and describe basic idea of Harris Corner detector with relevant mathematics. [5]

OR

**Q6)** Explain RANSAC algorithm for model fitting with applications to image analysis. [10]

P.T.O.

- Q7)** a) Write short note on applications of kalman filter in motion estimation.[5]  
b) List different methods of patch based motion estimation And explain Iterative Estimation w.r.t. Optical flow. [5]

OR

- Q8)** a) Define optical flow in images. What is brightness consisting in optical flow estimation? [5]  
b) Explain any one differential technique for motion estimation. [5]



Total No. of Questions : 8]

SEAT No. :

**PD4994**

[Total No. of Pages : 2

**[6405]-118**

**S.Y.M.E. (Electronics & Telecommunication) (Signal Processing)**

**STATISTICAL SIGNAL PROCESSING**

**(2017 Pattern) (Semester - III) (604401)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions out of eight.*
- 2) *All Questions carry equal marks.*
- 3) *Figures to the right indicate full marks.*
- 4) *Make suitable assumptions wherever necessary.*

- Q1)** a) Compare Autocorrelation and covariance methods. [5]  
b) With the help of suitable block diagram explain Wiener filter application for Noise Cancellation. [5]
- Q2)** a) Explain ARMA Process [5]  
b) Explain Least Square Method for signal modeling & its disadvantages. [5]
- Q3)** a) Explain filtering of Random Process. [5]  
b) What is Adaptive filtering? Explain with the help of block diagram and suitable set of Equations. [5]
- Q4)** a) Prove that Modified Periodogram is not a consistent estimate of power spectrum. [5]  
b) Discuss Properties and limitations of Pade's approximation technique. [5]
- Q5)** a) Explain FIR & IIR Wiener Filter. [4]  
b) Implement third order FIR filter  $H(z) = 1 + 0.5z^{-1} - 0.1z^{-2} - 0.5z^{-3}$  using Lattice structure and stepdown recursion having the vector coefficient,  $a_3 = [1, 0.5, -0.1, -0.5]^T$ . [3]  
c) Compare parametric and Nonparametric methods for power spectrum estimation. [3]

**P.T.O.**

- Q6)** a) What are the advantage of lattice filters? [3]
- b) Enlist advantages of NLMS over LMS. [3]
- c) A third order all pole Pade's approximation to a signal  $x(n)$  has been found to be  $H(Z) = \frac{1}{1 + 2Z^{-1} + Z^{-2} + 3Z^{-3}}$  [4]

What information about  $x(n)$  can be obtained from this model?

- Q7)** a) What is Recursive Least Squares? State condition of growing window RLS algorithm. [3]
- b) Write a short note on spectral factorization. [3]
- c) Explain need of adaptive filters. [4]
- Q8)** a) Explain the properties of estimates with unbiased & consistent estimators [6]
- b) Explain steepest descent algorithm in brief. [4]



Total No. of Questions : 8]

SEAT No. :

PD-4995

[Total No. of Pages : 2

**[6405]-120**

**M.E. (E&TC) (VLSI & Embedded Systems)**

**DIGITAL CMOS DESIGN**

**(504201) (2017 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) Answer any five questions.*
- 2) Assume suitable data if necessary.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Use of nonprogrammable calculator is allowed.*

- Q1)** a) With the help of diffusion capacitances, explain various parasitics of enhancement MOSFET. Which capacitances are dominant? [5]
- b) What is need of technology scaling? Explain the types & their characteristics in detail. [5]
- Q2)** a) What is significance of static & short circuit power dissipation? How to minimize them? [5]
- b) What are different fabrication techniques? With the help of suitable diagrams explain any one of them in detail. What are the limitations occur due to technology scaling? [5]
- Q3)** a) Explain various resistances & capacitances pertaining to MOSFET & wire interconnect that are involved in layout [4]
- b) What is SPICE? List SPICE model parameters of MOSFET. How are these useful in design? [4]
- c) Draw layout of CMOS inverter. List DRC rules. [2]

**P.T.O.**

- Q4)** a) With the help of mathematical analysis, explain the need of transistor sizing. [4]
- b) Draw layout cross section diagram of CMOS Inverter and mention the dimensions [2]
- c) Derive the expression for power delay product. What is its significance in design? What is its relation with fan out? [4]
- Q5)** a) Explore voltage transfer characteristics of CMOS inverter. Give the expression for propagation delay. [4]
- b) Design CMOS logic for  $Y = ABC + DE + FGHI$ . Compute active area on chip. [4]
- c) What are the merits and demerits of transmission gate? [2]
- Q6)** a) With help of suitable combinational logic, explore static & dynamic hazards in detail. What are the sources & mitigation techniques? [4]
- b) Draw FSM diagram & write HDL code for 4 bit ring counter. [4]
- c) Design 4:1 mux using transmission gates. Compare with conventional method. [2]
- Q7)** a) Compare at least three logic families in detail. [4]
- b) With the help of schematic, explain the concept of ratioed circuits. [4]
- c) What is need of BiCMOS? Explain in brief. [2]
- Q8)** a) List the low power design techniques. Explore any one in detail. [5]
- b) What is merit of dynamic circuit? Explain with schematic. [5]



Total No. of Questions : 8]

SEAT No. :

**PD4996**

[Total No. of Pages : 2

**[6405]-121**

**First Year M.E. (E&TC)/(VLSI & Embedded Systems)**

**RECONFIGURABLE COMPUTING**

**(2017 Pattern) (Semester - I) (504202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from questions (Q.1 to Q.8).*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data wherever necessary.*
- 5) *Use of calculator is allowed.*

**Q1) a)** Compare and contrast General-Purpose Processors and Domain-Specific Processors. **[5]**

b) Define the terms: Specialization, Reconfiguration, and Runtime. **[5]**

**Q2) a)** Explain the flow of program execution in Von Neumann Architecture. **[5]**

b) Describe the role of DSP Processors in domain-specific applications with examples. **[5]**

**Q3) a)** Draw and elaborate on Garp's Non-Symmetrical RPF as a fine-grained architecture. **[5]**

b) Explain the Design Flow of FPGA in Reconfigurable Computing. **[5]**

**Q4) a)** Discuss Non-Frequently Reconfigurable Systems and their applications. **[5]**

b) Explain the utility of Adaptive Controllers in complex systems. **[5]**

**Q5) a)** Describe the architecture of DPGA and its relevance in reconfigurable systems. **[5]**

b) Explain Instruction-Level Parallelism and its impact on computational efficiency. **[5]**

**P.T.O.**



- Q6)** a) Write a note on Run-Time Reconfiguration with examples. [5]  
b) Describe the J-Bit Reconfiguration Project Design Approach. [5]
- Q7)** a) Elaborate on Pattern Matching using automation for text searching. [5]  
b) Explain FPGA's Role in high-performance computing with examples.[5]
- Q8)** a) Discuss Software-Defined Radio in the context of Reconfigurable Computing. [5]  
b) Write short notes on Relocation and Defragmentation. [5]



Total No. of Questions : 8]

SEAT No. :

**PD4997**

**[6405]-122**

[Total No. of Pages : 2

**First Year M.E. (E & TC) (VLSI and Embedded Systems)**

**EMBEDDED SYSTEM DESIGN**

**(2017 Pattern) (Semester - I) (504203)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** a) Explain the system on chips in embedded systems. **[5]**

b) Discuss the key design metrics as performance, power consumption, size, cost, reliability, and safety for an embedded system. **[5]**

**Q2)** a) State and explain any five-design metrics used for the design of an embedded system. **[5]**

b) Compare the different types of development platforms trends in terms of IDE, board details and applications. **[5]**

**Q3)** a) Explain the Bluetooth protocol with suitable diagram with reference to ARM CORTEX M3 microcontroller. **[5]**

b) Which ARM Cortex core is right for your application: A, R or M? Explain with reason. **[5]**

**Q4)** a) Draw and explain architecture of LPC1768. **[5]**

b) Explain the USB protocol with suitable diagram with reference to CORTEX M3 controller. **[5]**

**P.T.O.**

- Q5)** a) Explain file structure and its use in Embedded Linux. [5]  
b) What are the steps to implement device driver for blinking of LED? [5]
- Q6)** a) Compare and contrast the role of BIOS and bootloaders in the context of embedded Linux systems. [5]  
b) Explain various storage consideration in Embedded Linux. [5]
- Q7)** a) Explain design of Wearable Health Monitoring Device. [5]  
b) Explain importance of EMI/RFI certification in embedded product. [5]
- Q8)** a) Explain automatic metering system in detail. [5]  
b) Explain testing and documentation for embedded system. [5]



Total No. of Questions : 8]

SEAT No. :

PD-4998

[Total No. of Pages : 2

[6405]-123

M.E. (E & TC VLSI & Embedded Systems)

ANALOG CMOS DESIGN

(2017 Pattern) (Semester - II) (504207)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Answer any five questions from questions (Q. 1. to Q. 8.)
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data wherever necessary

**Q1) a)** Differentiate between current references and voltage references. Explain the principle and design considerations of a bandgap voltage reference. [6]

b) Draw and label the small-signal equivalent circuit of a MOSFET. Briefly explain each component. [4]

**Q2) a)** Explain how a MOSFET can be used as a switch, a diode, and an active resistor. Illustrate each mode of operation with appropriate circuit diagrams. [6]

b) Differentiate between a current sink and a current source with simple circuit diagrams. [4]

**Q3) a)** Draw and explain the working of a basic inverting CMOS amplifier. What are its advantages and limitations? [6]

b) Explain the importance of micro power Op-Amps. What design techniques are used to reduce power consumption? [4]

**Q4) a)** Describe the structure and operation of a differential amplifier using CMOS. Why is it widely used in analog design? [6]

b) Compare low noise Op-Amps with standard Op-Amps in terms of design and performance. [4]

P.T.O.

- Q5) a)** Describe the concept of frequency compensation in two-stage operational amplifiers. Why is it necessary, and what impact does it have on amplifier performance? **[6]**
- b)** Explain the impact of multi-pole systems on the frequency response of an Op-Amp. How do poles influence the system's stability? **[4]**
- Q6) a)** What are the challenges in compensating a two-stage Op-Amp? Discuss the role of dominant pole compensation and its effect on transient response. **[6]**
- b)** What is the relationship between phase margin and system stability in the context of frequency compensation? **[4]**
- Q7) a)** Explain the impact of parasitic elements on the performance of high-frequency amplifiers. How can these parasitics be minimized or compensated for in RF amplifier designs? **[6]**
- b)** Describe the trade-off between noise and power in Low Noise Amplifier design. How do designers balance these two factors during the design process? **[4]**
- Q8) a)** In RF amplifiers, discuss the relationship between the noise figure (NF) and the gain of the amplifier. How does the overall gain affect the noise performance in multistage designs? **[6]**
- b)** Discuss the importance of gain and linearity in RF amplifiers. How does the gain affect signal fidelity and overall system performance in RF applications? **[4]**



Total No. of Questions : 8]

SEAT No. :

**PD4999**

[Total No. of Pages : 2

**[6405]-124**

**First Year M.E. (E & TC)/(VLSI and Embedded Systems)**

**SYSTEM ON CHIP**

**(2017 Pattern) (Semester - II) (504208)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of Calculator is allowed.*
- 5) Assume Suitable data if necessary.*

**Q1) a)** What do you mean by Control Flow Modeling and enlist the Limitations of Data Flow Models? **[4]**

b) Write a short note on driving factor of hardware and software co-design. **[6]**

**Q2) a)** Write a short note on data flow model and its advantages. **[4]**

b) Write a detailed note on RTL synthesis. **[6]**

**Q3) a)** Write a short note on RISC pipeline. **[4]**

b) Explain different Timing Parameters for Digital Logic. **[6]**

**Q4) a)** Explain the difference between the following terms : **[6]**

i) Control hazard and data hazard

ii) Delayed branch and conditional branch

b) Explain time multiplexing of two hardware-Module ports over a single control shell. **[4]**

**P.T.O.**

- Q5)** a) What are Causes of Power Dissipation? [4]  
b) Write a note on Bus Synchronization along with the Challenges in it and Enable Synchronization Method? [6]
- Q6)** a) Which are the Factors Affecting Delay and Slew? [4]  
b) What is the need of memory optimization and management in SoC? [6]
- Q7)** a) What is Hybrid Power Management Technique? [4]  
b) Write a note on “A SOC Controller for Digital Still Camera”. [6]
- Q8)** a) Explain energy management techniques for SoC design. [4]  
b) What are the Design Issues and Techniques for image codec? [6]



Total No. of Questions : 8]

SEAT No. :

PD-5001

[Total No. of Pages : 2

[6405]-125

**M.E. (E & TC) (VLSI & Embedded System)**

**EMBEDDED AUTOMOTIVE SYSTEMS**

**(2017 Pattern) (Semester - II) (504209)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Answer any five questions from questions (Q. 1. to Q. 8.).*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume Suitable data wherever necessary.*

**Q1) a)** Describe with the help of sketches the different ways in which a hybrid vehicle can be laid out. **[6]**

b) Discuss different Dashboard Instruments. **[4]**

**Q2) a)** Explain Automotive cabin comfort system. **[6]**

b) Briefly explain the working of spark plug with suitable diagram. **[4]**

**Q3) a)** What is Lambda sensor? Explain the construction and working of Lambda sensor. **[6]**

b) What is tyre pressure monitoring system? How does it work? **[4]**

**Q4) a)** What is Hall effect? Explain a position sensor using principle of Hall effect? Compare with magnetic reluctance position sensor. **[6]**

b) Explain working Principle of Proximity Distance Sensors. **[4]**

**P.T.O.**



- Q5)** a) Draw & explain electronic fuel control and electronic ignition system configuration. [6]  
b) Compare analog & digital cruise control system. [4]
- Q6)** a) Outline & Explain components of an electronically controlled engine with suitable diagram. [6]  
b) Draw & explain anti-lock braking system. [4]
- Q7)** a) Draw & explain architecture of AUTOSAR. Also state AUTOSAR libraries. [6]  
b) Explain Protocol wakeup & startup with respect to FlexRay protocol. [4]
- Q8)** a) State the meaning of terms 'fault' and 'symptom'. State the two main criteria necessary to diagnose the fault. [6]  
b) Compare LIN & CAN with respect to automotive applications. [4]



Total No. of Questions : 8]

SEAT No. :

PD-5325

[Total No. of Pages : 2

**[6405]-126**

**S.Y.M.E. (E&TC) (VLSI & Embedded System)  
TESTING AND VERIFICATION OF VLSI CIRCUITS  
(604201) (2017 Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) Answer any five questions. Each question carries 10 marks.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data If necessary.*

**Q1) a)** Enlist the prominent Analytical & Formal Test approaches. **[5]**

b) Differentiate between VLSI verification and VLSI testing. **[5]**

**Q2) a)** Explain statistical methods for fault simulation. **[5]**

b) What are Analog Test bus standards? **[5]**

**Q3) a)** Explain combinational circuit test generation using suitable example. **[5]**

b) Write a short note on : VLSI Test equipment. **[5]**

**Q4) a)** How do you model circuits for simulation? **[5]**

b) Explain any one algorithm used for Fault simulation. **[5]**

**P.T.O.**

- Q5)** a) Write a short note on: A.T.P.G. [5]
- b) Explain in brief: Equivalence checking and model checking. [5]
- Q6)** a) Explain in brief the types of Boundary Scan Architectures. [5]
- b) Define : Observability and Controllability. [5]
- Q7)** a) Write a short note on: Embedded Core Testing. [5]
- b) Write a short note on: Current based testing. [5]
- Q8)** a) What is Functional Verification? Explain with a suitable example. [5]
- b) Write a short note on : Hardware Emulation. [5]



Total No. of Questions : 8]

SEAT No. :

**PD5002**

**[6405]-127**

[Total No. of Pages : 2

**S.Y. M.E. (E &TC (VLSI & Embedded Systems))**

**ASIC DESIGN**

**(2017 Pattern) (Semester - III) (604202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculators is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Write a VHDL code for a sequence detector, which detects the sequence '1011' using Mealy machine. **[5]**

b) Design a basic testbench in Verilog for a 2-to-1 multiplexer and explain how simulation helps in validating ASIC functionality before fabrication. **[5]**

**Q2) a)** Write VHDL code and test-bench code for 4-bit shift register. **[5]**

b) Compare different ASIC technologies. **[5]**

**Q3) a)** Classify the placement algorithms. Explain the min-cut algorithm with the help of example. **[5]**

b) Explain different CAD tools used in ASIC Design. **[5]**

**Q4) a)** Differentiate floor planning and placement in ASIC design. **[5]**

b) Differentiate global routing and detailed routing. **[5]**

**P.T.O.**

- Q5)** a) What is role of different capacitances in ASIC library design? [4]  
b) Explain different SI issues in ASIC design. [4]  
c) Give example of Left-edge algorithm and comment on it. [2]
- Q6)** a) Compare pre layout simulation and post layout simulation techniques. [4]  
b) How false path detection is carried out in ASIC? [4]  
c) Which design tool is more preferable to solve the SI Problem? [2]
- Q7)** a) Explain Partial scan and Full scan. [4]  
b) Draw and explain linear feedback shift register (LFSR) in detail. [4]  
c) What are the goals and objectives of placement? [2]
- Q8)** a) Explain basic ATPG algorithm with an example. [4]  
b) Write short note on Joint Test Action Group. [4]  
c) How to estimate delays in ASIC Design? [2]



Total No. of Questions : 8]

SEAT No. :

**PD5003**

[Total No. of Pages : 2

**[6405]-136**

**First Year M.E. (Electronics)/(Digital Systems)**

**ANALOG & DIGITAL CMOS DESIGN**

**(2017 Pattern) (Semester - I) (504101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any Five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculators is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Explain the terms: [4]  
i) Threshold variations  
ii) Hot-Carrier Effects  
b) Explain ESD protection in detail. [4]  
c) Which components are used in photolithography? [2]
- Q2)** a) What is latchup and how to avoid latchup? [4]  
b) Explain in brief Micron design rules. [4]  
c) Draw MOSFET equivalent diagram. [2]
- Q3)** a) What is the lowest resistance metal for interconnect? Where it is used? [4]  
b) Derive the expression for static and dynamic power dissipation in CMOS logic circuit. [4]  
c) With the help of suitable schematic, explain RC delay model. [2]
- Q4)** a) What are the components considered for the power dissipation in a CMOS VLSI circuit. Calculate approximate dynamic power dissipation in a chip operating with  $V_{DD}=3.3\text{ V}$  at 300MHz with an internal switched capacitance of 50PF. [4]  
b) What is short circuit dissipation? How to minimize it? [4]  
c) Explain logical effort with an example. [2]
- Q5)** a) Explain current sink and current source in detail. Give expressions for output voltage range and output resistance. [4]  
b) What is band gap reference circuits, draw any one band gap voltage or current reference circuit and explain the same. [4]  
c) Draw and describe general two stage OPAMP. Describe frequency response curve. [2]

**P.T.O.**

- Q6)** a) Estimate the open-loop frequency response of the op-amp with a load and compensation capacitance  $C_L = C_C = 100 \text{ fF}$ ,  $R_1 = r_{on} = r_{op} = 111 \text{ k}\Omega$ ,  $R_2 = r_{op} = 333 \text{ k}\Omega$ ,  $G_{m1} = g_{mn} = 150 \text{ }\mu\text{A/V}$  (diff-amp),  $g_{m2} = g_{mp} = 150 \text{ }\mu\text{A/V}$  (common-source). [4]
- b) Suppose an op-amp is to be used to amplify 250 mV to 500 mV with an error less than 1 mV. Estimate the minimum required op-amp open loop gain. [4]
- c) What are the advantage of cascade amplifier over the inverting amplifier. [2]
- Q7)** a) How to compute slew-rate limitations in OP-AMP? [4]
- b) What do you mean by dynamic CMOS logic? Implement the following Boolean equation in dynamic CMOS logic and conventional static CMOS logic:  $Y = (A+B). C. (D+E)$ , Compare the two circuits with respect to speed and area. [4]
- c) What kind of load operational transconductance amplifier (OTA) can drive without buffer? [2]
- Q8)** a) How to reduce power in a sense amplifier? Explain with an example. [4]
- b) Explain different techniques for low power logic design. [4]
- c) Why NAND gates design is preferred over NOR gate designs? [2]



Total No. of Questions : 8]

SEAT No. :

**PD5004**

[Total No. of Pages : 2

**[6405]-137**

**First Year M.E. (Electronics)/(Digital Systems)**

**MULTIRATE SIGNAL PROCESSING**

**(2017 Pattern) (Semester - I) (504102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of scientific calculator is allowed.*
- 5) *Assume suitable data, if required.*

**Q1) a)** Explain decimation and interpolation process with suitable example. [5]

b) Explain design of phase shifter in multirate systems? [5]

**Q2) a)** Explain the design of DFT filter bank? [5]

b) Design a 2-stage interpolator which is used to increase sampling rate from 10 KHz to 200 KHz [5]

Passband ripple: 0.01

Stop band ripple : 70dB

Pass band: 0 to 90 Hz

**Q3) a)** Define a gradient in the steepest descent algorithm. What are the limitation of this algorithm. [5]

b) Explain multi resolution analysis.? [5]

**Q4) a)** Explain the term Haar wavelet and wavelet filter bank with suitable equations. [5]

b) Explain the use of adaptive filter for echo cancellation.? [5]

**Q5) a)** How wavelet transform can provide image filtering? Explain in detail.[5]

b) Explain least mean square algorithm for adaptive IIR filtering? [5]

**P.T.O.**



- Q6)** a) Decompose the following sequence using Haar wavelet [5]  
 $f = \{2, 5, 8, 9, 7, 4, -1, 1\}$   
b) Explain application of adaptive filters in adaptive noise cancellation? [5]
- Q7)** a) What are the characteristics of poly phase filters? How are the polyphase structure efficient? [5]  
b) Explain the use of subband coding for speech. What is the advantage of sub band coding. [5]
- Q8)** a) Explain design of QMF's? [5]  
b) Explain why there is need of multirate DSP ? Explain sampling rate conversion by factor of I/D? [5]



Total No. of Questions : 8]

SEAT No. :

**PD5005**

**[6405]-138**

[Total No. of Pages : 2

**First Year M.E. (Electronics - Digital System)**

**EMBEDDED SYSTEM DESIGN**

**(2017 Pattern) (Semester - I) (504103)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data wherever necessary.*

**Q1)** a) Describe the key features of Bluetooth protocol and its role in embedded applications. [5]

b) Explain the importance of timing and reference mechanisms in RTOS. [5]

**Q2)** a) Explain design metrics for embedded system. [5]

b) Provide an overview of Android technology and its applications in embedded systems. [5]

**Q3)** a) What are the features and applications of the ARM Cortex processor series? [5]

b) What is a watchdog timer, and how is it used for task execution monitoring in RTOS? [5]

**Q4)** a) What are the key features of the Arduino development platform, and list its common applications? [5]

b) Describe the task creation and management process in MicroC/OS-II. [5]

**P.T.O.**

**Q5) a)** What are the main steps in the Linux kernel initialization process? Explain briefly. [5]

b) Why is certification important in embedded system design? Discuss the significance of EMI and RFI compliance. [5]

**Q6) a)** Explain the steps to implement Keyboard device driver in detail. [5]

b) What are the key considerations in the mechanical packaging of an embedded system? [5]

**Q7) a)** What is a device driver, and why is it important in embedded systems?[5]

b) Discuss the importance of testing, reliability, and failure analysis in embedded system development. [5]

**Q8) a)** What are module utilities in Linux, and how are they used to manage device drivers? [5]

b) Describe any one real-life embedded product in detail, highlighting its design and application. [5]



Total No. of Questions : 8]

SEAT No. :

PD-5006

[Total No. of Pages : 2

[6405]-139

M.E. (Electronics) (Digital Systems)

ADVANCED DSP PROCESSORS

(2017 Pattern) (Semester - II) (504107)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Answer any five questions out of eight questions.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data if necessary.
- 4) Use of scientific calculator is allowed.

- Q1)** a) What is the role of a shifter in DSP? Explain the implementation of 4-bit shift right Barrel shifter with a diagram. [5]  
b) Explain Very Long Instruction Word Architecture. [5]
- Q2)** a) Explain the Accumulators in TMS320C54XX Processor. [5]  
b) Discuss Bus Structure of TMS320C54XX Processor. [5]
- Q3)** a) Draw and Explain TMS320C6713 Architecture. [5]  
b) Write the features of TMS320C6713 Processor. [5]
- Q4)** a) Describe pipelining operation of TMS320C54XX Processor. [5]  
b) With two examples each explains: immediate addressing mode, absolute addressing mode, direct and indirect addressing modes. [5]
- Q5)** a) How to create and build project in Code Compressor? [5]  
b) Explain software development flow of Blackfin Processor. [5]
- Q6)** a) Compare Blackfin Processor with TM5S20C6713. [5]  
b) Explain the linking process rules in Visual DSP++. [5]

P.T.O.

**Q7) a)** Describe Power Consumption and Management Aspects of a DSP Processor. [5]

b) Discuss the selection criteria of Digital Signal Processor. [5]

**Q8) a)** Explain the following terms: [5]

i) Compiler

ii) Emulator

iii) Simulator

b) Explain Coder and Decoder in DSP Processors. [5]



Total No. of Questions : 8]

SEAT No. :

**PD5007**

[Total No. of Pages : 1

**[6405]-140**

**First Year M.E. (Electronics-Digital Systems)**

**PLD'S & ASIC DESIGN**

**(2017 Pattern) (Semester - II) (504108)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume Suitable data if necessary.*

- Q1)** a) Explain Hardware and Software co Design. [5]  
b) What is System on Chip? What are advantages and Disadvantages of SOC? [5]
- Q2)** a) Explain the Behavioral and Data Flow VHDL modeling techniques with example. [5]  
b) Differentiate between functions and procedures in VHDL. [5]
- Q3)** a) Explain the complex programmable logic device XC9500 architecture. [5]  
b) Explain resource sharing in system design with suitable example. [5]
- Q4)** a) Explain the sequential and concurrent statements in VHDL Programming with suitable example. [5]  
b) Write short note w.r.t VHDL on. [5]  
i) Test Bench and Packages  
ii) Operator Interface
- Q5)** a) Draw and explain basic logic block of FPGA. [5]  
b) What is process of Debugging? Explain debugging step in FPGA design. [5]
- Q6)** a) Explain the architecture of Xilinx Spartan II. [5]  
b) What is Boundary Scan? Explain Boundary scan Method. [5]
- Q7)** a) Explain the types of Application Specific Integrated Circuits (ASIC). [5]  
b) What does EDA tool refer to? Explain different EDA tools used in ASIC. [5]
- Q8)** a) Explain RTL to GDS - II flow in detail. [5]  
b) What is Custom IC? Explain Custom IC Design Flow. [5]



Total No. of Questions : 8]

SEAT No. :

PD-5008

[Total No. of Pages : 2

[6405]-141

M.E. (Electronics) (Digital System)

IMAGE PROCESSING AND COMPUTER VISION

(2017 Pattern) (Semester - II) (504109)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Answer any five questions out of eight.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) All questions carry equal marks.
- 5) Assume suitable data; if necessary.

Q1) a) What is of binary image processing operation? Explain any one in detail. [5]

b) Explain the PCA Algorithm. [5]

Q2) a) Write a short note on Hough Transform. [5]

b) Explain the Concept of DCT image transform. [5]

Q3) a) Define the terms Hue, Saturation and Intensity. [5]

b) Explain the term noise in color images. [5]

Q4) a) Explain the HIS color model in detail. [5]

b) Write a short note on Pseudo color Image Processing. [5]

Q5) a) Explain Head and hat algorithm. [5]

b) Write a short note on Image Registration. [5]

P.T.O.

- Q6)** a) Explain the Weighted geometrical feature algorithm. [5]  
b) Give the classification of Image registration methods in brief. [5]
- Q7)** a) Write a short note on 3D surface reconstruction. [5]  
b) Explain Epipolar geometry in detail. [5]
- Q8)** a) Explain Range data merging with respect 3D reconstruction. [5]  
b) Write a short note on 3D photography. [5]





Total No. of Questions : 8]

SEAT No. :

**PD5009**

[Total No. of Pages : 2

**[6405]-142**

**S.Y.M.E. (Electronics-Digital Systems)  
SYSTEM ON CHIP DESIGN  
(2017 Pattern) (Semester - III) (604101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any Five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of electronic pocket calculators is allowed.*
- 5) Assume suitable data, if necessary.*

**Q1) a)** Differentiate five broad categories of memories. **[4]**

b) Compare Memory mapped interfaces and Coprocessor interfaces. **[4]**

c) State SOC chip subsystem design principles. **[2]**

**Q2) a)** Explain Memory mapped interfaces in brief. **[4]**

b) Elaborate simple floorplanning rules of thumb that help designer to implement and change design easily. **[4]**

c) Why SoC design needs standardized buses? **[2]**

**Q3) a)** Explain the standard design flow of software source code to processor instruction. **[4]**

b) Explain various synchronization scheme adopted by hardware/software interfaces. **[4]**

c) Tabulate different processors architectures functions and application. **[2]**

**P.T.O.**

- Q4)** a) How pipeline stall occurs in RISC architecture? What are the pipeline hazards? [4]  
b) Explain in detail array processor model. [4]  
c) What is use of via in chip design? What SoC chip designer should take care in design with this respect? [2]
- Q5)** a) How Clock gating is used to reduce switching rate? Explain spurious clocking. [4]  
b) Explain factors on which the transition time seen at the input of the gate is dependent. [4]  
c) Explain major limitations of simulation. [2]
- Q6)** a) Explain limitations of STA. [4]  
b) How to find Gating Location? Explain it with an example. [4]  
c) Explain simulation implication on synthesis. [2]
- Q7)** a) Explain Energy-Aware Device Scheduling in SOC design. [4]  
b) Draw and explain transaction level modelling. [4]  
c) Draw a typical SOC test design flow. [2]
- Q8)** a) State and explain test integration issues in SoC design? [4]  
b) Explain disadvantages of voltage scaling. [4]  
c) What problems crop-up if variable size die(s) are integrated in SoC? [2]



Total No. of Questions : 8]

SEAT No. :

**PD5010**

**[6405]-143**

[Total No. of Pages : 2

**S.Y. M.E. (Electronics(Digital Systems))**  
**WIRELESS SENSOR NETWORK FOR IOT**  
**(2017 Pattern) (Semester - III) (604102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions out of eight questions.*
- 2) Figures to the right indicate full marks.*
- 3) Assume suitable data if necessary.*
- 4) Use of scientific calculator is allowed.*

**Q1)** a) What are Challenges and constrains in wireless sensor networks. [5]

b) Explain optimization goals for network architecture. [5]

**Q2)** a) Write a short note on Gateway. [5]

b) Write in brief real life applications of WSN. [5]

**Q3)** a) Explain Low duty cycle protocol. [5]

b) Write a short note on Zigbee. [5]

**Q4)** a) Explain clustering in detail. [5]

b) What is Target detection and tracking? [5]

**P.T.O.**

- Q5)** a) Write Elements of an IoT ecosystem. [5]
- b) Compare M2M vs IOT. [5]
- Q6)** a) Explain survey of current link-layer technologies for the IoT [5]
- b) Define Low Power and Lossy networks (LLN). [5]
- Q7)** a) Explain open trust protocol (OTrP). [5]
- b) Draw IOT architecture. [5]
- Q8)** a) How IoT is used in Building Automation. [5]
- b) Explain one real time applications of IOT in detail. [5]



Total No. of Questions : 8]

SEAT No. :

**PD5011**

[Total No. of Pages : 1

**[6405]-144**

**First Year M.E. (E&TC)/(VLSI Design)/(Electronic and Communication)**

**MICROELECTRONICS & NANO-ELECTRONICS**

**(2017 Pattern) (Semester - I) (504701)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use of electronic pocket calculator is allowed.

- Q1)** a) What are the characteristic of Microelectronics? [7]  
b) What are the layout rules in Microelectronics? [7]

OR

- Q2)** a) What are parasitic elements in microelectronics? What are the effects of it on performance? [7]  
b) Explain the role of mathematical modeling in Microelectronics. [7]

- Q3)** a) What are the design aspects in Microelectronics? [6]  
b) Explain the application of Nano-technology in medical field. [6]

OR

- Q4)** a) Explain fabrication methods in Nano-technology conductor. [6]  
b) Give some emerging application of Nanotechnology. [6]

- Q5)** a) Calculate the probability of transmission that a 1 eV electron will penetrate a potential barrier of 4 eV, when the width of the barrier is 2. [6]  
b) Write short note on electronics and optical properties of nanostructure?[6]

OR

- Q6)** a) Explain energy sub-bands in nano-technology. [6]  
b) Give applications of resonant tunneling also explain what is resonant tunneling? [6]

- Q7)** a) What are deposition techniques for nano-scale devices? [6]  
b) Define Nano wires and Nano magnetic materials? [6]

OR

- Q8)** a) Write short note on Scanning Tunneling Microscope. [6]  
b) Explain fabrication methods in Nano technology conductor. [6]



Total No. of Questions : 8]

SEAT No. :

**PD5012**

[Total No. of Pages : 1

**[6405]-145**

**First Year M.E. (Electronics & Communication Engineering) (VLSI Design)**

**DIGITAL IC DESIGN**

**(2017 Pattern) (Semester - I) (504702)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Assume suitable data if necessary.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of non programmable calculator is allowed.*

- Q1)** a) Implement SRAM, DRAM structure. [5]  
b) With the help of neat diagram, Explain CMOS D-latch and edge-triggered flip-flop. [5]
- Q2)** a) Explain VLSI design flow. [5]  
b) Brief about Long channel . [5]  
i) I-V characteristics  
ii) non-linear I-V effects
- Q3)** a) Explain VLSI design styles, design quality, packaging technology in detail. [5]  
b) Explain the concept of regularity, modularity, and locality. [5]
- Q4)** a) Draw and explain inverter with n-type MOSFET load. [5]  
b) Explain any two MOS Inverters (Switching Characteristics). [5]
- Q5)** a) Compare ASIC and SoC. [5]  
b) Explain the fabrication process in CMOS n-Well process. [5]
- Q6)** a) With the help of schematic, explain the concept of ratioed circuits. [5]  
b) Explain CMOS transmission gates (pass gates). [5]
- Q7)** a) List out the layout design rules and explain the concepts of stick diagram. [5]  
b) Explain the ASIC Design Flow. [5]
- Q8)** a) How to calculate interconnect delay. [5]  
b) Brief: Network-on Chip (NoC) concept. [5]



Total No. of Questions : 8]

SEAT No. :

**PD5013**

**[6405]-146**

[Total No. of Pages : 2

**First Year M.E. (E&TC-VLSI Design)**

**ANALOG IC DESIGN**

**(2017 Pattern) (Semester - I) (504703)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions from questions (Q.1. to Q.8.)*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data wherever necessary.*

**Q1)** a) Explain the I-V characteristics of an n-channel MOSFET and describe how these characteristics change with different regions of operation. **[6]**

b) What are current mirrors? Explain the operation of a simple current mirror and how it can be modified to improve performance. **[4]**

**Q2)** a) What is Drain-Induced Barrier Lowering (DIBL)? Explain its cause and impact on MOSFET operation, especially in short-channel devices. **[6]**

b) With the help of diagrams, compare the simple, cascode, and Wilson current mirrors in terms of output impedance, accuracy, and area. **[4]**

**Q3)** a) Discuss the advantages and limitations of using a diode-connected load in a CS amplifier. How does it affect the gain and linearity of the amplifier? **[6]**

b) What is gain boosting? Explain one technique of gain boosting in single-stage amplifiers and discuss how it improves amplifier performance. **[4]**

**P.T.O.**

- Q4)** a) Compare the performance of CS amplifiers with resistive, diode-connected, and triode region loads in terms of gain, swing, and power consumption. [6]
- b) With appropriate circuit diagrams, compare the CS stage, cascode, and folded cascode amplifiers in terms of gain, output resistance, and power supply requirements. [4]
- Q5)** a) Explain the operation of a quasi-differential amplifier. How does it differ from a fully differential amplifier in terms of performance and design complexity? [6]
- b) What is Miller's theorem? Explain how it is used in the frequency response analysis of amplifiers. Provide an example with a common-source stage. [4]
- Q6)** a) Discuss the role of the tail current source in a differential amplifier. What advantages does it offer in terms of common-mode rejection? [6]
- b) Describe the open-circuit time constant (OCTC) method. How is it used to estimate the -3dB bandwidth of a multistage amplifier? [4]
- Q7)** a) Explain the concept of feedback in amplifiers. Distinguish between negative and positive feedback with examples. [6]
- b) What is fingering in IC layout? Why is it used in MOS transistor design, and how does it help reduce mismatch and parasitics? [4]
- Q8)** a) Compare voltage-series, voltage-shunt, current-series, and current-shunt feedback configurations in terms of input/output impedance and gain behavior. [6]
- b) What are process gradients in IC fabrication? How do they impact analog layout, and what techniques are used to mitigate their effects? [4]





Total No. of Questions : 8]

SEAT No. :

**PD5014**

[Total No. of Pages : 1

**[6405]-147**

**First Year M.E. (E & TC/VLSI Design)**

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - I) (504704)**

*Time : 3 Hour]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions out of eight questions.*
- 2) Figures to the right side indicate full marks.*
- 3) Assume suitable data if necessary.*
- 4) Use of scientific calculator is allowed.*

- Q1)** a) Explain any five characteristics of Research. [5]  
b) Differentiate between Quantitative and Qualitative Research. [5]
- Q2)** a) Differentiate between Research methods and Research Methodology.[5]  
b) Explain importance of literature review in defining a research problem.[5]
- Q3)** a) How to define and formulate the research problem. [5]  
b) Explain about Empirical Research in detail. [5]
- Q4)** a) What is hypothesis testing? How to develop hypothesis for a research problem. [5]  
b) Explain about simple linear regression. [5]
- Q5)** a) Explain about research design in detail. [5]  
b) Explain steps for patent searching. [5]
- Q6)** a) Explain about mean, median and mode. [5]  
b) Explain different methods of data collection in research. [5]
- Q7)** a) Describe in brief Bibliography and its importance in context of research.[5]  
b) Explain about organization and flow of Thesis Report. [5]
- Q8)** a) Write short note on Intellectual property rights and patent law. [5]  
b) Explain in short about types of technical research papers report. [5]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

PD-5015

[6405]-148

M.E. (E&TC)(VLSI Design)

SYSTEM-ON-PROGRAMMABLE CHIP DESIGN

(2017 Pattern) (Semester-II) (504707)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume Suitable data if necessary.

- Q1)** a) Discuss the major **components** of a **SoC architecture** and their roles. [5]
- b) What are the benefits and challenges of using **on-chip memory** in SoC design? [5]
- Q2)** a) What is the **AMBA bus standard**? Discuss its key components and significance. [5]
- b) Discuss different **bus topologies** used in on-chip communication. [5]
- Q3)** a) Differentiate between soft IP, firm IP, and hard IP in IP-based design. [5]
- b) What are the major **technical challenges** in **IP reuse**? [5]
- Q4)** a) Differentiate between **general-purpose and application-specific Processor IP**. [5]
- b) What is the role of an **RTOS in a SoC**? Explain with an example. [5]
- Q5)** a) Compare **RTOS with a general-purpose operating system (GPOS)**. [5]
- b) What is the IEEE P1500 standard, and why is it important for SoC testing? [5]

P.T.O.

- Q6)** a) How does **IP reusability** contribute to cost and time savings in SoC development? [5]
- b) Explain the process of **evaluating an IP core using FPGA prototypes**. [5]
- Q7)** a) Explain the **Avalon bus architecture** and its role in FPGA-based systems. [5]
- b) What is **bus arbitration**? Explain its role in multi-master bus systems. [5]
- Q8)** a) Illustrate the **design flow of a SoC**, highlighting the major stages. [5]
- b) Differentiate between **CISC** and **RISC** architectures with examples. [5]



Total No. of Questions : 8]

SEAT No. :

**PD5016**

[Total No. of Pages : 1

**[6405]-149**

**First Year M.E. (E&TC) (VLSI Design)**

**MIXED SIGNAL IC DESIGN**

**(2017 Pattern) (Semester - II) (504708) (Elective-II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume Suitable data if necessary.*

- Q1)** a) Differentiate between Analog signal Vs Discrete time signal. [5]  
b) Draw and Explain DAC. Also write its specification. [5]
- Q2)** a) Explain Power supply and grounding issue. [5]  
b) Explain Fully differential design. [5]
- Q3)** a) Explain in details R-2R ladder network. [5]  
b) Draw and Explain DAC architecture. [5]
- Q4)** a) Draw and Explain ADC architecture. [5]  
b) Explain Over sampling of ADC. [5]
- Q5)** a) Explain in details AAF and RCF. [5]  
b) Draw and Explain Sample and Hold and its spectral response. [5]
- Q6)** a) Short note on : [5]  
i) RMS quantization noise voltage  
ii) Treating quantization noise as a random variable  
b) Explain RMS quantization noise voltage. [5]
- Q7)** a) Explain SNR & SNDR. [5]  
b) Explain Decimating filters for ADCs. [5]
- Q8)** a) Short note on : [5]  
i) Clock jitter  
ii) Jitter and averaging  
b) Explain Interpolating filters for DACs. [5]



Total No. of Questions : 8]

SEAT No. :

PD-5221

[Total No. of Pages : 2

**[6405]-150**

**F.Y. M.E. (Electronics & Communications Engineering)  
(VLSI Design)**

**DESIGN OF ASICs**

**(2017 Pattern) (Semester - II) (504709)**

**Time : 3 Hours]**

**[Max. Marks : 50**

**Instructions to the candidates :**

- 1) Answer any five questions out of eight questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of scientific calculator is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) What are the main floor planning techniques in ASIC design, and how do they help optimize power and area utilization? [5]
- b) Why are timing constraints critical in ASIC design, and how do they influence circuit behavior? [5]
- Q2)** a) How does system partitioning affect ASIC performance, power efficiency, and design complexity? [5]
- b) What are some widely used EDA tools in ASIC design, and what are their primary functions? [5]
- Q3)** a) What are signal integrity (SI) concerns in ASIC design, and how can they affect circuit performance? [5]
- b) How does using an HDL-based test bench assist in verifying an ASIC design? [5]

**P.T.O.**

- Q4)** a) How does the Scan Test methodology enhance fault detection in digital circuits? [5]  
b) What role does JTAG play in ASIC testing, and how does it aid in debugging? [5]
- Q5)** a) Outline the key phases in the ASIC design flow and explain their significance. [5]  
b) What key factors influence delay estimation in ASIC circuits? [5]
- Q6)** a) What is logic synthesis, and why is it an essential step in ASIC design? [5]  
b) What role does Automatic Test Pattern Generation (ATPG) play in ASIC testing? [5]
- Q7)** a) Why is achieving timing closure crucial in the placement and routing phase of ASIC design? How do Clock Tree Synthesis (CTS) and signal integrity influence timing performance? [5]  
b) What are the primary challenges in designing mixed-signal circuits that combine analog and digital components? [5]
- Q8)** a) What are the main components of power dissipation in an ASIC, and what strategies are used to optimize power consumption? [5]  
b) What is a false path in timing analysis, and why is its identification necessary? [5]



Total No. of Questions : 6]

SEAT No. :

**PD5017**

[Total No. of Pages : 1

**[6405]-151**

**First Year M.E. (Computer Engineering)  
BIO-INSPIRED OPTIMIZATION ALGORITHMS  
(2017 Pattern) (Semester - I) (510102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any FIVE Questions, Each question carries equal marks.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) How does simulated annealing differ from hill climbing in terms of search strategy? **[6]**  
b) Illustrate the process of problem solving as a search track. **[4]**
- Q2)** a) List applications of genetic algorithm. Elaborate any one application in Details. **[6]**  
b) Describe the role of fitness functions in evolutionary algorithm. **[4]**
- Q3)** a) Interpret the biological terminology into Ant Colony Optimization and Ant Clustering Algorithm. **[6]**  
b) How does swarm intelligence differ from traditional AI algorithms? **[4]**
- Q4)** a) Define self-tuning algorithms and their significance in optimization. **[6]**  
b) Explain Bat algorithm and discuss rules of Bat algorithm. **[4]**
- Q5)** a) Discuss procedure to implement monitoring phase of Negative Selection Algorithm. **[6]**  
b) Summarize aiNet learning algorithm. **[4]**
- Q6)** a) Explain how emotion synthesis in artificial agents contributes to ALife research. **[6]**  
b) Illustrate boid flocking. **[4]**



Total No. of Questions : 12]

SEAT No. :

**PD5018**

[Total No. of Pages : 2

**[6405]-152**

**F.Y.M.E. (Computer Engineering)**

**SOFTWARE DEVELOPMENT AND VERSION CONTROL**

**(2017 Pattern) (Semester - I) (510103)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

**Q1) a)** What are the different representations used to document and communicate software design? **[4]**

b) Discuss incremental design of software development process with diagram. **[4]**

OR

**Q2) a)** What is the role of design in the software development process and why is it important? **[4]**

b) Explain the component based design process. **[4]**

**Q3)** What is data-centered architecture and in what scenarios is it most effective? **[8]**

OR

**Q4)** What are the key characteristics of distributed architecture and how does it enhance system scalability and reliability? **[8]**

**Q5) a)** What is architecture reconstruction and when is it necessary in software development? **[5]**

b) What are the key differences between traditional and agile approaches to software architecture documentation? **[4]**

OR

**P.T.O.**



- Q6)** a) How does software architecture impact system scalability and maintainability? [5]  
b) Describe two techniques for keeping code and architecture consistent. [4]

- Q7)** a) What are the core concepts of source code management and how do they contribute to SCM? [4]  
b) Explain the following terms. [4]  
i) Sandboxes and workspaces  
ii) Variant management

OR

- Q8)** a) Explain any two source code management core concepts. [4]  
b) What are the key challenges in software deployment and how can configuration management address them? [4]

- Q9)** What are the different types of version control systems and how do they differ? [8]

OR

- Q10)** How does a Distributed Version Control System (DVCS) differ from a centralized system? [8]

- Q11)** What are the fundamental concepts of Git, including commits, branching, merging and history tracking? [9]

OR

- Q12)** Explain features and facilities offered by advanced version control tools. [9]

\* \* \*

Total No. of Questions : 12]

SEAT No. :

**PD5019**

**[6405]-153**

[Total No. of Pages : 2

**First Year M.E. (Computer Engineering)**  
**EMBEDDED AND REAL TIME OPERATING SYSTEMS**  
**(2017 Pattern) (Semester - I) (510104)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8 Q9 or Q10, Q11 or Q.12.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicates full marks.*
- 4) Assume suitable data, if necessary.*

**Q1) a)** Explain the role of real-time scheduling algorithms in an RTOS. Compare Rate Monotonic Scheduling (RMS) and Earliest Deadline First (EDF) Algorithms. **[5]**

b) Define the terms hard real-time system, soft real-time system, and firm real-time system with suitable examples. **[3]**

OR

**Q2) a)** Derive an expression for CPU utilization in Rate Monotonic Scheduling (RMS) and analyze its limitations. **[5]**

b) Explain the impact of priority inversion in RTOS and discuss possible solutions. **[3]**

**Q3) a)** Discuss the significance of Inter-Process Communication (IPC) mechanisms in embedded systems. Compare message queues and shared memory. **[4]**

b) Explain the working of a Watchdog Timer (WDT) in an embedded system. **[4]**

OR

**Q4) a)** What are Task Control Blocks (TCBs) in RTOS? Explain their role in context Switching with a diagram. **[4]**

b) Describe Mutex and Semaphore with an example. 'How does priority inheritance solve priority inversion? **[4]**

**P.T.O.**

**Q5)** a) Explain the role of device drivers in RTOS. How are character and block device drivers implemented? [5]

b) Discuss power management techniques in embedded systems. [4]

OR

**Q6)** a) Explain the RTOS kernel architecture with a neat block diagram. [5]

b) What is interrupt latency? Discuss techniques to minimize it. [4]

**Q7)** a) Explain the Embedded System Development Life Cycle (ESDLC) and its Phases. [4]

b) Discuss the significance of Memory Management Units (MMU) in an RTOS. [4]

OR

**Q8)** a) Describe the role of hypervisors in real-time embedded systems. [4]

b) Explain the differences between general-purpose OS and real-time OS with suitable examples. [4]

**Q9)** A real-time medical monitoring system must process ECG signals in real-time, ensuring no delay in anomaly detection. Propose an RTOS-based architecture, considering task scheduling, communication, and real-time constraints. [9]

OR

**Q10)** Design a real-time embedded system for an autonomous vehicle's obstacle detection module. Explain the task breakdown, scheduling strategy, and synchronization mechanisms. [9]

**Q11)** Write short notes on any two : [8]

a) Embedded Linux in Real-Time Systems

b) RTOS Memory Management Techniques

c) Role of Bootloaders in Embedded Systems

OR

**Q12)** Explain the role of Fault Tolerance in Embedded Systems. Discuss techniques like Watchdog Timers, Redundant Systems, and Self-Healing Mechanisms. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5020**

[Total No. of Pages : 2

**[6405]-154**

**First Year M.E. (Computer Engineering)/(Data Science)/(Artificial Intelligence/  
Computer Networks/Artificial Intelligence and Data Sciences) (2020)**

**RESEARCH METHODOLOGY  
(2017 Pattern) (Semester - I) (510101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Explain the meaning, nature, and significance of research. Discuss how research impacts technological advancements. [5]  
b) Describe the research process workflow. How does each stage contribute to successful research outcomes? [5]
- Q2)** a) Explain the importance of archival literature in engineering research. Provide examples of key sources used in literature review. [5]  
b) What are the essential elements of a research proposal? Describe their significance in developing an effective research plan. [5]
- Q3)** a) Define the t-test and describe its application in research. Provide an example illustrating its use. [5]  
b) Explain the concept of Null Hypothesis Testing. How does it help in validating research conclusions? [5]
- Q4)** a) Describe the Monte Carlo optimization method. How is it applied in engineering research for decision-making? [5]  
b) Explain the significance of the cost function in optimization techniques. Illustrate its use with a practical example. [5]
- Q5)** a) What are the key factors to consider when designing a survey for engineering research? [5]  
b) Discuss the importance of obtaining ethical approval for conducting surveys. Provide examples where ethical issues may arise. [5]

**P.T.O.**

- Q6)** a) Describe the key components of writing an effective research paper. How do keywords and abstracts improve research visibility? [5]
- b) Explain the significance of Intellectual Property Rights (IPR) in engineering research. How can researchers protect their innovations? [5]
- Q7)** a) State the use of the following tools [5]
- i) ANOVA
  - ii) SOFA
  - iii) CAT (Qualitative analysis tool)
- b) Elaborate the significance of the following in research methodology [5]
- i) h-index
  - ii) Research Gate in literature survey
  - iii) Paraphrasing in literature survey
- Q8)** a) Clearly explain the difference between collection of data through questionnaires and schedules. [5]
- b) Discuss interview as a technique of data collection. [5]

\* \* \*

Total No. of Questions : 10]

SEAT No. :

PD-5021

[Total No. of Pages : 3

[6405]-155

M.E. (Computer Networks & All Computer branches)

OPERATION RESEARCH

(2017 Pattern) (Semester - II) (510108)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Attempt all questions.
- 2) Assume Suitable Data, if necessary.
- 3) Neat Diagram must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.

**Q1)** A firm makes two products P1 & P2 and has production capacity of 18 tons per day. P1 & P2 require the same production capacity. The firm must supply at least 4 tons of P1 and 6 tons of P2 per day. Each ton of P1 & P2 requires 60 hours of machine work each. Maximum machine hours available are 720. Profit per ton for P1 is Rs. 160 & P2 is Rs. 240. Find optimal solution by graphical method. [5]

**Q2)** Solve the following LP problem and find the dual solution : [5]

$$\text{Maximize } Z = 3x_1 + 2x_2$$

Subject to:

$$x_1 + x_2 \leq 4$$

$$2x_1 + x_2 \leq 5$$

$$x_1, x_2 \geq 0$$

Formulate the dual problem and solve it.

**Q3)** What is the Modified Distribution (MODI) Method in solving the Transportation Problem? [5]

P.T.O.

**Q4)** Solve the following  $2 \times 3$  game. [5]

| P1/P2 | $Y_1$ | $Y_2$ | $Y_3$ |
|-------|-------|-------|-------|
| $X_1$ | 1     | 3     | 11    |
| $X_2$ | 8     | 5     | 2     |

**Q5)** Calculate the total float, free float and independent float for the project whose activities are given below. [5]

| Jobs     | 1-2 | 1-3 | 2-4 | 3-4 | 3-5 | 4-5 | 4-6 | 5-6 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| Duration | 6   | 5   | 10  | 3   | 4   | 6   | 2   | 9   |

**Q6)** Compare and contrast the Weight Method with other multi-objective optimization methods such as the Preemptive Method or Goal Programming. In which situations would you prefer the Weight Method over other techniques? [5]

**Q7)** Solve the following Assignment Problem using the Hungarian Method : [5]

|       | $W_1$ | $W_2$ | $W_3$ | $W_4$ |
|-------|-------|-------|-------|-------|
| $T_1$ | 10    | 20    | 30    | 40    |
| $T_2$ | 15    | 25    | 35    | 45    |
| $T_3$ | 20    | 30    | 40    | 50    |
| $T_4$ | 25    | 35    | 45    | 55    |

**Q8)** A decision problem has been expressed as the following pay-off table. [5]  
Determine which action the executive has to choose if he adopts

- Maximin Criterion
- Maximax Criterion
- Hurwicz Criterion with  $\alpha = 0.7$
- Laplace Criterion
- Minimax Regret Criterion

| Action | Events |    |     |
|--------|--------|----|-----|
|        | I      | II | III |
| A      | 10     | 20 | 26  |
| B      | -30    | 30 | 60  |
| C      | 40     | 30 | 20  |

**Q9)** Solve the following linear programming problem using the Revised Simplex Algorithm and determine the optimal solution : **[5]**

Maximize :  $Z = 5x_1 + 4x_2$

Subject to :

$$x_1 + 2x_2 \leq 8$$

$$2x_1 + x_2 < 6$$

$$x_1, x_2 \geq 0$$

**Q10)** Describe the **[5]**

- a) Two persons - Zero Sum Game
- b) MaxiMin - MiniMax Principle





Total No. of Questions : 12]

SEAT No. :

**PD5022**

[Total No. of Pages : 2

**[6405]-156**

**First Year M.E. (Computer Engineering)  
SYSTEM SIMULATION AND MODELLING  
(2017 Pattern) (Semester - II) (510109)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.

- Q1)** a) What are basic components of System with examples? [4]  
b) Explain with a diagram different ways to study the system. [4]

OR

- Q2)** a) What is Simulation and when the Simulation is appropriate tool? [4]  
b) Explain the Taylor method and compare it with Euler Method. [4]

- Q3)** a) Explain the Linear Congruential Generator (LCG) algorithm for generating random numbers. [4]  
b) Explain the difference between white noise and colored noise. [4]

OR

- Q4)** a) Explain the difference between stationary and non-stationary random processes. [4]  
b) Calculate the mean and variance of a uniformly distributed random variable  $U[0, 1]U[0, 1]U[0, 1]$ ? [4]

- Q5)** a) Define a spatial system. Give an example of a real-world spatial system. [4]  
b) What is the finite-difference method? Explain its significance in solving differential equations numerically. [5]

OR

*P.T.O.*

- Q6)** a) Explain the difference between initial conditions and boundary conditions in solving PDEs. [4]  
b) Explain the concept of constraint satisfaction problems and how they can be solved using propagation methods? [5]

- Q7)** a) What is the M/M/c queuing model and what does “c” represent? [4]  
b) What are the key steps in simulating a queuing system with a finite capacity? [4]

OR

- Q8)** a) Explain how blocking occurs in a finite-capacity queuing system? [4]  
b) Describe the M/M/1 queuing model and explain its key assumptions. [4]

- Q9)** a) Explain the problem of initial transient. [4]  
b) Explain output analysis for termination simulation. [4]

OR

- Q10)** a) Explain statistical analysis for steady state parameters. [4]  
b) Briefly explain measures of performance for simulation system. [4]

- Q11)** a) Write short notes on Point estimation and Interval estimation. [4]  
b) Write short notes on verification and validation of model building. [5]

OR

- Q12)** a) Explain any one simulation software used for manufacturing applications? [4]  
b) What are the potential benefits from using simulation in manufacturing Analysis? [5]



Total No. of Questions : 12]

SEAT No. :

**PD5023**

**[6405]-157**

[Total No. of Pages : 2

**First Year M.E. (Computer Engineering)**

**MACHINE LEARNING**

**(2017 Pattern) (Semester - II) (510110)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of a calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** What is Machine Learning? Explain applications of Machine Learning in different fields. **[5]**

b) Differentiate between Supervised, Unsupervised and Semi-supervised learning. **[4]**

OR

**Q2) a)** Explain Probabilistic Models in Machine Learning. **[5]**

b) Explain Reinforcement Learning with suitable examples. **[4]**

**Q3) a)** Write a short note on: **[4]**

i) Principal Component Analysis.

ii) Linear Discriminant Analysis.

b) Explain Bias/Variance tradeoff in detail. **[4]**

OR

**Q4) a)** Enlist various Dimensionality Reduction techniques. Explain any one in detail. **[4]**

b) What is feature selection? Explain with suitable example. **[4]**

**P.T.O.**

**Q5) a)** Explain Simple Neural Network. Discuss various activation functions in the Neural Network. **[4]**

b) Calculate the regression coefficient and obtain the lines of regression for the following data: **[4]**

|   |   |   |    |    |    |    |    |
|---|---|---|----|----|----|----|----|
| X | 1 | 2 | 3  | 4  | 5  | 6  | 7  |
| Y | 9 | 8 | 10 | 12 | 11 | 13 | 14 |

OR

**Q6) a)** Discuss Support Vector Machines as a linear and non-linear classifier. **[4]**

b) Compare Simple Linear Regression and Logistic Regression. **[4]**

**Q7) a)** Explain Association Rule Mining with suitable example. **[5]**

b) Differentiate between Bagging and Boosting. **[4]**

OR

**Q8) a)** Discuss alternative measures for selecting attributes of the Decision Tree. **[4]**

b) What is the use of ID3 algorithm? Enlist and explain the steps of ID3 algorithm. **[5]**

**Q9) a)** Explain Naive Baye's classifier with an example. **[4]**

b) Explain Hidden Markov Model in detail. **[4]**

OR

**Q10)a)** Discuss Discriminative Learning with Maximum Likelihood. **[4]**

b) Explain Bayesian network with suitable example. **[4]**

**Q11)Write short note on:** **[8]**

a) Profiling the online storefronts of counterfeit merchandise.

b) Credit card fraud detection.

OR

**Q12)Write short note on:** **[8]**

a) Learning to rate vulnerabilities and predict exploits.

b) Detecting malicious websites in adversarial classification.

**x x x**

Total No. of Questions : 8]

SEAT No. :

**PD5024**

[Total No. of Pages : 2

**[6405]-158**

**S.Y. M.E. (Computer Engg.)**

**FAULT-TOLERANT SYSTEMS**

**(2017 Pattern) (Semester - III) (610101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume suitable data if necessary.

**Q1) a)** Describe and explain in detail hardware redundancy? How the passive and active techniques applied in hardware redundancy. **[6]**

b) Establish the relationship between reliability modelling and evaluation. Justify your answer with suitable example. **[6]**

OR

**Q2) a)** Explain in detail time redundancy. **[6]**

b) What are the measures that can be used to assess the reliability of a multi-stage interconnection network (MIN)? **[6]**

**Q3) a)** Explain the e-cube routing algorithm in detail? **[6]**

b) Explain FT routing scheme for meshes with Non-Convex Faults in Mesh Networks. **[6]**

OR

**Q4) a)** Define BSN Connectivity? Explain BSN reliability in detail. **[6]**

b) Explain in detail the General architecture of the HTN. **[6]**

*P.T.O.*

- Q5)** a) Define an n-dimensional Hypercube and explain how Hamming difference between two addresses is calculated. Draw 4-cube architecture. [6]
- b) Explain how the number of hops between nodes can be reduced in Daisy-Chain Architectures. [6]

OR

- Q6)** a) Draw a suitable diagram to describe the main components of fault simulator. [6]
- b) Draw and explain One-Fault Tolerance Switch Architecture. [6]

- Q7)** a) Discuss in detail Check Point Techniques in Mobile Network. [7]
- b) Discuss in detail Fault Tolerance in Loop Network. [7]

OR

- Q8)** a) Discuss in detail [BSN]Block Shift Network. [7]
- b) Discuss in detail Iterative-Based Heuristic Routing Algorithm. [7]



Total No. of Questions : 12]

SEAT No. :

**PD5025**

**[6405]-159**

[Total No. of Pages : 2

**S.Y.M.E. (Computer Engineering)**  
**INFORMATION RETRIEVAL**  
**(2017 Pattern) (Semester - III) (610102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8 Q9 or Q10, Q11 or Q.12.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicates full marks.*
- 4) Assume suitable data, if necessary.*

- Q1)** a) Explain k-gram indexes for wildcard queries with suitable example. [4]  
b) What are the different search structures used for dictionaries in information retrieval? [5]

OR

- Q2)** Give an example of a sentence that falsely matches the wildcard query mon\*h if the search were to simply use a conjunction of bigrams. [9]

- Q3)** Compute variable byte code and gamma codes for the posting list [9]  
(777, 17743, 294068, 312511336)

OR

- Q4)** Explain Heaps' law and Zipfs law with suitable example. [9]

- Q5)** How are dot products used to compute similarity scores in the vector space model? [8]

OR

- Q6)** How does weighted zone scoring work, and what factors influence the weighting process? [8]

**P.T.O.**

- Q7)** a) Explain the challenges in XML retrieval. [4]
- b) What are the basic concepts of XML, and how is it used in information retrieval? [4]

OR

- Q8)** a) Explain the need of component coverage and topical relevance in evaluation of XML document. [4]
- b) What are the key techniques used for evaluating XML retrieval effectiveness? [4]

- Q9)** How is the query generation probability estimated in language models? [8]

OR

- Q10)** Describe Language modeling versus other approaches in Information Retrieval. [8]

- Q11)** What is Naive Bayes algorithm, When we can use this algorithm in text analysis? [8]

OR

- Q12)** What is fusion and meta-learning, and how are they used in information retrieval? [8]





**F.Y.M.E. (Computer Engineering)/(Data Science)/(AIDS)**  
**MATHEMATICAL FOUNDATION FOR DATA SCIENCE**  
**(2020 Pattern) (Semester - I) (510301)**

Time : 3 Hours]

[Max. Marks : 50]

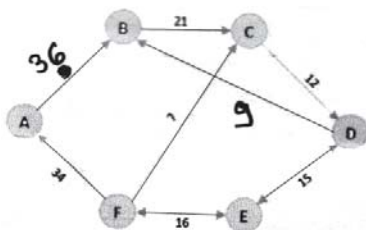
*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.
- 2) Assume suitable data wherever necessary.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.

**Q1)** Explain insertion and deletion of data in B+ tree with example. **[8]**

OR

**Q2)** Represent given graph using adjacency list. Explain any one algorithm for finding minimum cost spanning tree and apply same algorithm to find minimum cost spanning tree for given graph. **[8]**



**Q3)** Turbo Generators plc manufacture seven large turbines for a customer. Three of these turbines do not meet the customer's specification. Quality control inspectors choose two turbines at random. Let the discrete random variable X be defined to be the number of turbines inspected which meet the customer's specification. **[9]**

- a) Find the probabilities that X takes the values 0, 1 or 2.
- b) Find and graph the cumulative distribution function.

OR

**Q4)** Bag A contains 10 marbles of which 2 are red and 8 are black. Bag B contains 12 marbles of which 4 are red and 8 are black. A ball is drawn at random from each bag. Find the probability that: **[9]**

- a) both are red
- b) both are black
- c) one black and one red
- d) at least one red

**Q5)** Explain Central tendency and dispersion measures of numerical data with example and applications. **[9]**

OR

**P.T.O.**

**Q6)** The following data is given: [9]

| Types of Animals | Number of animals | Average Domestic animals | Standard Deviation |
|------------------|-------------------|--------------------------|--------------------|
| Dogs             | 5                 | 12                       | 2                  |
| Cats             | 5                 | 16                       | 1                  |
| Hamsters         | 5                 | 20                       | 4                  |

Calculate the Anova coefficient.

**Q7)** Discuss different methods of to calculate Karl Pearson's Coefficient of Correlation. [8]

OR

**Q8)** A student wrote 2 quizzes. In the first quiz, he scored 80 and in other, he scored 75. The mean and standard deviation of first quiz are 70 and 15 respectively, while the mean and standard deviation of the second quiz are 54 and 12 respectively. The results follow the normal distribution. What can you conclude about the student's result by seeing their z scores? [8]

**Q9)** a) Find the eigenvalues and associated eigenvectors of the matrix. [4]

$$\begin{bmatrix} -1 & 2 \\ 0 & -1 \end{bmatrix}$$

b) Explain one example of each Jacobian Matrix and Hessian Matrix. [4]

OR

**Q10)** Solve the system of equations  $x_1 + x_2 + x_3 = 1$ ,  $3x_1 + x_2 - 3x_3 = 5$  and  $x_1 - 2x_2 - 5x_3 = 10$  by LU decomposition method. [8]

**Q11)** a) Overfitting and Multicollinearity with respect to regression. [4]

b) Discuss advantages and disadvantages of Multivariate Regression. [4]

OR

**Q12)** Suppose we have the following dataset with one response variable y and two predictor variables X1 and X2. Fit a multiple linear regression model to this dataset. [8]

|    |     |     |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|-----|-----|
| X1 | 60  | 62  | 67  | 70  | 71  | 72  | 75  | 78  |
| X2 | 22  | 25  | 24  | 20  | 15  | 14  | 14  | 11  |
| Y  | 140 | 155 | 159 | 179 | 192 | 200 | 212 | 215 |



Total No. of Questions : 12]

SEAT No. :

**PD5027**

[Total No. of Pages : 2

**[6405]-161**

**F.Y.M.E.(Computer Data Science)/(AIDS)(2020)**

**BASICS OF DATA SCIENCE**

**(2017 Pattern) (Semester - I) (510302)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.
- 2) Neat diagrams must be drawn wherever necessary
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data if necessary.

**Q1) a)** Apply the Data Science process to analyze customer purchase behavior in an e-commerce platform. **[5]**

b) Differentiate between Big Data and Little Data. **[4]**

OR

**Q2) a)** Explain the Data Science process. **[4]**

b) How does the role of a Data Scientist differ from a Data Analyst? **[5]**

**Q3) a)** Describe the significance of kernel density estimation (KDE) in data visualization. **[5]**

b) Justify why Spearman's correlation might be more appropriate than Pearson's correlation in non-linear relationships. **[4]**

OR

**Q4) a)** Differentiate between symmetrical and skewed distributions with examples. **[5]**

b) Examine the advantages and limitations of Spearman's rank correlation over Pearson's correlation. **[4]**

**Q5) a)** Explain how the choice of K value affects the K-means clustering results. **[4]**

b) Explain how the Least Squares method is used in Linear Regression. **[4]**

**P.T.O.**

OR

- Q6)** a) What are the key differences between Naïve Bayes and k-NN? [4]  
b) Explain process of web scraping and list openly available web scraping tools? [4]

- Q7)** a) Explain the importance of data visualization in decision-making. [4]  
b) Differentiate between categorical and numerical data in visualization. [4]

OR

- Q8)** a) Describe the relationship between data types and visual encodings. [4]  
b) How do retinal variables help in mapping data visually? [4]

- Q9)** a) Differentiate between content-based recommendations and collaborative filtering. [4]  
b) Explain, How does clustering help in improving recommendation systems? [4]

OR

- Q10)a)** Explain the duality of similarity in recommendation systems with an example. [4]  
b) Illustrate how tags can be used to generate item features in a recommendation system. [4]

- Q11)** Describe different types of social networks and explain how they influence information flow. [8]

OR

- Q12)** Explain how social networks can be represented as graphs. Compare and contrast directed and undirected graphs in social networks with suitable examples. [8]

\* \* \*

Total No. of Questions : 12]

SEAT No. :

**PD5028**

**[6405]-162**

[Total No. of Pages : 2

**F.Y. M.E. (Computer Engineering) (Data Science) (2020)**

**BIG DATA ANALYTICS**

**(2017 Pattern) (Semester - I) (510303)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.*
- 2) Figures to the right indicates full marks.*
- 3) Draw neat diagrams wherever necessary.*
- 4) Assume suitable data, if necessary.*

**Q1)** List out the characteristics of Big Data. What are the Market and Business Drivers for Big Data Analytics. **[9]**

OR

**Q2)** Draw & explain data analytics lifecycle in detail. **[9]**

**Q3)** Explain the important features and core components of Hadoop. **[8]**

OR

**Q4)** Differentiate between Distributed and Parallel Computing of Big Data. Discuss about In-Memory Computing Technology for Big Data. **[8]**

**Q5)** What is Impala and why is it needed? Explain the different components of Impala? How can data access be controlled in Impala? **[8]**

OR

**Q6)** Describe the features of Apache Pig for Big Data Analysis? Differentiate between Pig and Hive. **[8]**

**P.T.O.**

**Q7)** What is Apache Spark KDD? Explain optimization Techniques in Spark. [8]

OR

**Q8)** Explain the important components of the Spark ecosystem. What are the different cluster manages available in Apache Spark. [8]

**Q9)** What is Pyspark? Is Pyspark-faster than pandas. If yes explain it. What are the industrial applications of Pyspark. [8]

OR

**Q10)** 'Scala is a fusion of object-oriented and functional programming concepts' Justify? List out different packages in Scala? [8]

**Q11)** Explain characteristics of good data visualization techniques with examples. [9]

OR

**Q12)** Explain features of Tableau/Power BI used for Big Data Analytics visualization. [9]



Total No. of Questions : 6]

SEAT No. :

[Total No. of Pages : 2

**PD-5029**

**[6405]-163**

**M.E. (Comp.-M.D.S/Data Science/AI&DS)**

**DATA WAREHOUSING AND MINING**

**(2017 Pattern) (Semester-II) (510308)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

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

**Q1)** a) Write a short note on escalating need for strategic information with respect to need of data warehousing. [5]

b) Discuss in brief about Trends in warehousing. [5]

**Q2)** a) Explain dimensional modeling basics and data warehouse architecture. [5]

b) What is data mart in data warehouse? What is the need for creating data mart? [5]

**Q3)** a) Write a short note on star schema and give its advantages. [5]

b) What are the different integration approaches in data warehouse? [5]

**Q4)** a) Discuss OnLine Analytical Processing in the data warehouse in brief. [5]

b) What are the advantages of web-based information delivery in data warehousing? [5]

*P.T.O.*

**Q5) a)** Write a short note on Data mining as a process of Knowledge Discovery. [5]

b) Explain in brief about classification and clustering in data mining. [5]

**Q6) a)** Discuss Monitoring of the data warehouse, user training and support, managing the data warehouse. [5]

b) Describe processes involved in Physical design of data warehouse. [5]





Total No. of Questions : 12]

SEAT No. :

**PD5030**

[Total No. of Pages : 2

**[6405]-164**

**F.Y.M.E. (Computer Engg.)/(AIDS&Data Science)/(AI)/**

**(Data Science) (2020)**

**MACHINE LEARNING**

**(2017 Pattern) (Semester - II) (510309)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data, if necessary.*
- 5) *Figures to the right indicate full marks.*

**Q1) a)** Define Machine learning. Explain following types of machine learning with example. **[5]**

- i) Supervised learning
  - ii) Unsupervised learning
  - iii) Semi-supervised learning
  - iv) Reinforcement learning
- b) Differentiate between Generative and Discriminative Machine Learning Model. **[4]**

OR

**Q2) a)** Define Multi-class classification. Explain following methods of multi-class classification in detail with example. **[5]**

- i) One vs One
  - ii) One vs All
- b) Explain grouping and grading models in detail. **[4]**

**Q3)** Explain bias and variance. What is the relationship between bias and variance? **[8]**

OR

**Q4)** What is dimensionality reduction? Describe how principal component analysis is used for dimensionality reduction in detail with example. **[8]**

**Q5)** Define and explain Logistic regression with example. **[9]**

OR

**Q6)** What is Artificial Neural Network? Discuss different activation function of ANN. **[9]**

**P.T.O.**

**Q7)** Construct decision tree for following example. [8]

| Size   | Color   | Shape | Class |
|--------|---------|-------|-------|
| Medium | Magenta | Round | A     |
| Large  | Magenta | Round | A     |
| Large  | Blue    | Round | A     |
| Medium | Blue    | Round | A     |
| Medium | Black   | Round | B     |
| Large  | Black   | Cube  | B     |
| Large  | Magenta | Cube  | B     |
| Large  | Black   | Round | B     |
| Medium | Magenta | Cube  | B     |

OR

**Q8)** Using k-means algorithm, cluster following data into two clusters. Show each step of clustering. {2, 4, 10, 12, 3, 20, 30, 11, 25}. [8]

**Q9)** Define Bayes Theorem. Elaborate Naïve Bayes Classifier working with example. [8]

OR

**Q10)** Explain in detail Gaussian Mixtures and compression based models. [8]

**Q11)** Write short note on : [8]

- a) Fraud Detection
- b) Author identification

OR

**Q12)** Write short note on : [8]

- a) Diagnosis of human disease
- b) Learning to rate vulnerabilities and predict exploits



Total No. of Questions : 12]

SEAT No. :

**PD5031**

[Total No. of Pages : 2

**[6405]-165**

**F.Y.M.E. (Computer Engineering ) (Data Science) (2020)**

**SOFT COMPUTING**

**(2017 Pattern) (Semester - II) (510310)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10 and Q11 or Q12
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.

- Q1)** a) Compare soft computing approach with hard computing approach. [5]  
b) Explain the different paradigms of soft computing along with their features, components, and techniques. [4]

OR

- Q2)** a) How do neural networks, fuzzy logic, and genetic algorithms contribute to soft computing applications? [5]  
b) What is soft computing? Explain the methods in soft computing. [4]

- Q3)** a) Explain the Fuzzy set operators, Union, Intersection, complement, cross product and max product composition with example. [5]  
b) What is fuzzification? Why it is required? [4]

OR

- Q4)** a) What is Fuzzy relation? explain with example [5]  
b) What is defuzzification? Explain two methods of defuzzification. [4]

- Q5)** Explain the operators in Genetic algorithms with two examples each. [8]

OR

- Q6)** Explain the working principle of Genetic Algorithms (GA) with a focus on search space, operators, and the role of the fitness function. How does GA Support multi-level optimization? [8]

**P.T.O.**

**Q7) a)** Explain the architecture of a Back propagation (BP) network and its working principle. **[4]**

b) Describe different types of activation functions used in neural networks. **[4]**

OR

**Q8) a)** What is perceptron learning? Explain its significance in neural. **[4]**

b) Discuss the role of learning rules in training neural networks. **[4]**

**Q9)** What is Recurrent Neural Network (RNN)? Explain its applications and advantages over feed forward networks. **[8]**

OR

**Q10)** Discuss the role of Auto encoders in deep learning. How are they used for feature extraction and dimensionality reduction? **[8]**

**Q11)** Describe the design and working of fuzzy controllers for robotic applications. Provide a real -world example. **[8]**

OR

**Q12)** How can Genetic Algorithms be used to optimize the Traveling salesman problem (TSP)? Explain with an example. **[8]**



Total No. of Questions : 12]

SEAT No. :

**PD5032**

[Total No. of Pages : 2

**[6405]-166**

**S.Y.M.E. (Computer) ( Data Science) /(2020)**

**DEEP LEARNING**

**(2017 Pattern) (Semester - III) (610301)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.
- 2) Neat Diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

**Q1)** Explain the significance of activation functions in deep learning. Discuss commonly used activation functions such as ReLU, Sigmoid, and Tanh, highlighting their advantages and limitations. Provide practical examples of their usage. **[9]**

OR

**Q2)** Compare and contrast recurrent neural networks (RNNs) with feedforward neural networks (FNNs). Highlight the scenarios where RNNs are more suitable, and discuss their computational challenges. **[9]**

**Q3)** Explain the concept of batch normalization in neural networks. Discuss its advantages and limitations with examples. How does it improve the training process in deep learning? **[9]**

OR

**Q4)** What is the role of learning rate scheduling in optimization? Discuss different learning rate scheduling strategies and their impact on convergence. **[9]**

**Q5)** What is dropout regularization? Explain how dropout helps prevent overfitting in neural networks. Provide examples of its implementation and its effect on training performance. **[8]**

OR

**P.T.O.**

**Q6)** Explain the importance of transfer learning in deep learning. Discuss its applications with examples of pretrained models like ResNet and BERT. **[8]**

**Q7)** Describe the architecture of a Transformer model. Explain its significance in natural language processing and how it differs from traditional RNN-based models. **[8]**

OR

**Q8)** Discuss the role of pooling layers in Convolutional Neural Networks (CNNs). Explain different types of pooling and their effect on feature extraction. **[8]**

**Q9)** Discuss the concept of Generative Adversarial Networks (GANs) and their role in generating realistic data samples. Additionally, analyze and contrast GANs with Variational Autoencoders (VAEs), highlighting their respective architectures, training processes, and applications in generating synthetic data. **[8]**

OR

**Q10)** How to apply autoencoders for dimensionality reduction? Discuss the types of Autoencoders. **[8]**

**Q11)** When would you opt for Long Short-Term Memory (LSTM) networks over traditional feedforward neural networks? Elaborate on the LSTM architecture, detailing its components and mechanisms. **[8]**

OR

**Q12)** Explain how the self-attention mechanism improves the performance of sequence-to-sequence models. Discuss its application in machine translation. **[8]**



Total No. of Questions : 12]

SEAT No. :

**PD5033**

[Total No. of Pages : 2

**[6405]-167**

**S.Y. M.E. (Computer Engineering) (Data Science) (2020)**

**DATA MODELING AND VISUALIZATION**

**(2017 Pattern) (Semester - III) (610302)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or 2, Q.3 or 4, Q.5 or 6, Q.7 or 8, Q. 9 or 10, Q. 11 or 12.*
- 2) *Figure to the right indicates full marks.*

**Q1)** What is the need of data visualization? What are the four steps in working with data? [8]

OR

**Q2)** Explain the three state model of visual information processing. [8]

**Q3)** Which parameters can be used to Measure the Dispersion of Data? Give examples. [8]

OR

**Q4)** What are the different types of data visualizations, explain with example. [8]

**Q5)** Explain the dendrograms and heat maps with example. [8]

OR

**Q6)** Explain shaded maps and tree maps with examples. [8]

**P.T.O.**

**Q7)** Explain the method of subspace clustering in high dimensional data. [9]

OR

**Q8)** Explain the steps of Principle Component Analysis (PCA) with example. [9]

**Q9)** Explain the Gestalt laws of Proximity and similarity with Examples. [9]

OR

**Q10)** Describe the process of Pattern perception of figure and ground with examples. [9]

**Q11)** What are the criteria to evaluate a good visualization? Justify. [8]

OR

**Q12)** Explain the various components of Tableau Desktop Dashboard. [8]





Total No. of Questions : 12]

SEAT No. :

**PD5034**

[Total No. of Pages : 2

**[6405]-168**

**First Year M.E. (Computer Networks)**

**NETWORK SECURITY**

**(2017 Pattern) (Semester - I) (510202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.
- 2) Figures to the right indicates full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.

**Q1)** Enlist the challenges involved in detecting attacks on Wireless Sensor Networks (WSNs). Choose three specific detection approaches and provide a detailed explanation of each. **[9]**

OR

**Q2)** Differentiate between data security and network security with suitable examples. **[9]**

**Q3)** Define network sniffing and elaborate on its significance in network security. **[8]**

OR

**Q4)** What is network sniffing? Explain how it works and its importance in cybersecurity. **[8]**

**Q5)** Explain the concept of web injections. What are SQL injections and how they operate? **[8]**

OR

**Q6)** Write a note on: **[8]**

- a) BeEF with Better Cap
- b) BeEF with man-in-the-middle framework (MITMF)

**Q7)** Discuss the preventative measures against XSS attacks and how to reduce your chances of being attacked. **[8]**

OR

**Q8)** What is an MITM attack? Types of MITM attacks, and tools for MITM attacks. **[8]**

**P.T.O.**

**Q9)** Describe ARP cache poisoning and provide examples of ARP poisoning commands with detailed explanation. **[8]**

OR

**Q10)** Write a note on: **[8]**

- a) VLAN hopping
- b) Wireless sniffing

**Q11)** Elaborate the dangers of public Wi-Fi and evil twins, also explain how to detect an evil twin? **[9]**

OR

**Q12)** Address spoofing is a common technique used in network attacks. Describe what address spoofing is, how it is carried out, and its impact on network security. **[9]**



Total No. of Questions : 8]

SEAT No. :

**PD5035**

[Total No. of Pages : 2

**[6405]-169**

**First Year M.E. (Computer Networks)**

**WIRELESS SENSOR NETWORKS**

**(2017 Pattern) (Semester - I) (510203)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.
- 4) Use of non-programmable scientific calculator is allowed.

**Q1) a) Explain data-centric storage. [6]**

**b) Draw and Explain architecture of Wireless Sensor Network. [6]**

**OR**

**Q2) a) Differentiate between traditional networks and wireless sensor networks. [6]**

**b) Describe data aggregation as an optimization problem. [6]**

**Q3) a) Describe Contention-Free MAC Protocol: The Lightweight Medium Access Control (LMAC) protocol. [6]**

**b) Explain Single-hop localization: Approximate point in triangle. [6]**

**OR**

**Q4) a) Explain IEEE 802.15.4. [6]**

**b) Describe Contention-Based MAC Protocol: The Data-Gathering MAC (DMAC)? [6]**

**Q5) a) Explain the Poisson point processes as uniform random deployments. [6]**

**b) Explain with suitable diagram how to determine the k-coverage. [7]**

**OR**

**Q6) a) Explain Mechanisms for congestion detection and congestion handling in WSN. [7]**

**b) Describe the Reliability requirements in sensor networks. [6]**

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

- Q7)** a) Explain with figure examples of attacks and the CIA model. [7]  
b) Explain Security Protocols for Sensor Networks. [6]

OR

- Q8)** a) Write Short Notes on. (Any Two) [13]  
b) Key Management.  
c) Security attacks on Routing and on Transport Layer.  
d) Defenses Against DoS Attack.



Total No. of Questions : 12]

SEAT No. :

**PD5036**

**[6405]-170**

[Total No. of Pages : 2

**First Year M.E. (Computer Networks)**  
**HIGH PERFORMANCE NETWORKS**  
**(2017 Pattern) (Semester - I) (510204)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.No. 1 or 2, Q.No. 3 or 4, Q.No. 5 or 6, Q.7 or 8, Q. 9 or 10, Q. 11 or 12.*
- 2) Figure to the right indicates full marks.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Assume suitable data, if necessary.*

**Q1)** a) Write a short note on : **[4]**

i) 802.11

ii) MPLS

b) Explain ISO/OSI in details. **[4]**

OR

**Q2)** a) Distinguish between SONET and ATM. **[4]**

b) Write a short note on: **[4]**

i) Fast Ethernet

ii) 802.16

**Q3)** a) Explain architecture of Gigabit Ethernet with neat labeled diagram. **[4]**

b) Explain Gigabit Ethernet Physical layer. **[4]**

OR

**Q4)** a) Describe in detail Ethernet frame structure. **[4]**

b) Explain Ethernet 10/100/1000. **[4]**

**Q5)** a) Explain in detail Switch fabric in Router. **[5]**

b) Explain in detail how Packet Scheduling is done in Router. **[4]**

OR

**P.T.O.**

- Q6)** a) Explain in detail Resource Reservation Protocol. [5]  
b) Write a short note on: [4]  
i) Resource Allocation in routers.  
ii) Multicasting packets in routers.

- Q7)** a) Explain in detail working of IP over MPLS and its terminologies. [5]  
b) Explain MPLS signaling and routing protocols. [4]

OR

- Q8)** a) Explain in details MPLS forwarding operation. [5]  
b) What are the MPLS Distribution Control Protocol Attributes? [4]

- Q9)** a) Explain about Large-Scale Optical Switches. [4]  
b) Explain structure of Optical Cross Connects (OXC's). [4]

OR

- Q10)** a) Explain the term in detail WDM with their application. [4]  
b) Explain Wavelength Allocation in networks. [4]

- Q11)** a) Distinguish between Borderless Network Architecture and Borderless Campus Network. [4]  
b) Explain Campus distribution layer Network Design [4]

OR

- Q12)** a) Explain Multi-tier Borderless Campus Design Model. [4]  
b) List and explain design principles of Campus Network. [4]



Total No. of Questions : 12]

SEAT No. :

**PD5037**

[Total No. of Pages : 2

**[6405]-171**

**First Year M.E. (Computer Networks)  
NETWORK DESIGN AND ANALYSIS  
(2017 Pattern) (Semester - II) (510209)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.*
- 2) Figures to the right indicate full marks.*
- 3) Draw neat diagram wherever necessary.*
- 4) Use of scientific calculator is allowed.*
- 5) Assume suitable data, if necessary.*

**Q1)** What are the different phases of network design and explain it in detail. **[8]**

OR

**Q2)** Write a note on : **[8]**

- a) Routing & forwarding
- b) Resource allocation

**Q3)** What is fragmentation? How it is handled in IPv4 and IPv6? Explain in detail with header format. **[9]**

OR

**Q4)** Explain Network Address Translation (NAT) in detail. **[9]**

**Q5)** Explain application of queuing system in network design. Analyze M/M/n queuing system using state transition diagram. **[8]**

OR

**Q6)** Write a note on (Any two) : **[8]**

- a) M/G/1 queues with vacations
- b) M/M/1/N queuing
- c) Priority Queuing

**P.T.O.**

**Q7)** What is need of routing algorithm? Explain Dijkstra's algorithm in detail. [8]

OR

**Q8)** Explain Floyd's incremental shortest path algorithm with example. [8]

**Q9)** State and explain various QoS mechanism to ensure in QoS network. [9]

OR

**Q10)** Explain Resource reservation and Traffic engineering in detail. [9]

**Q11)** What is Wireshark? Explain features of Wireshark. [8]

OR

**Q12)** Write a note on : [8]

- a) Network Testing
- b) Cyber Physical System





Total No. of Questions : 12]

SEAT No. :

**PD5038**

[Total No. of Pages : 2

**[6405]-172**

**First Year M.E. (Computer Networks)**

**DATA ALGORITHMS**

**(2017 Pattern) (Semester - II) (510210)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3or Q4, Q5or Q6, Q7or Q8, Q9or Q10 and Q11 or Q12.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.

**Q1)** In secondary sorted, Give the example of your choice to explain the following terms and their importance: Logical (Key, value) pair, Natural Key, Natural value and composite key **[8]**

OR

**Q2)** Explain Secondary sort in Hadoop and how it works? **[8]**

**Q3)** What is left outer join operations in database? What is significance of left outer join in real world situation? Give suitable SQL for the same. With the help of SQL explain what is mean by Left in left outer join. **[8]**

OR

**Q4)** Explain Left outer join data flow in phase 1 and 2 with the help of classes in Hadoop. **[8]**

**Q5)** Take any suitable example to secondary sort algorithm to demonstrate MapReduce/Hadoop solution and explain various Classes used in Map Reduce/Hadoop solution. **[9]**

OR

**Q6)** What is Order inversion? Write down code for order inversion and in what sense does it invert order? Give the advantages of order inversion. **[9]**

**P.T.O.**

**Q7)** What is the significance of following terms in Market basket analysis (Justify your answer with suitable example): **[8]**

- a) Minimum support
- b) Minimum improvement
- c) Minimum confidence

OR

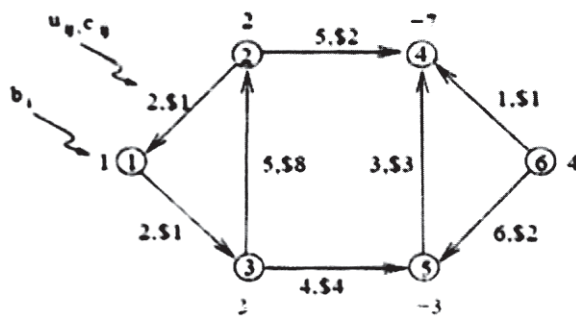
**Q8)** Write and explain MapReduce Phases for generating association rule in Spark with step by step approach **[8]**

**Q9)** What is the scatter search algorithm? What are its characteristics? And Give the algorithmic procedure. **[9]**

OR

**Q10)** Describe five key method templates used in the implementation of Scatter Search. **[9]**

**Q11)** Apply The Min Cost Flow Linear Program using network simplex method for the following graph to find the network linear program. **[8]**



OR

**Q12)** How does the Network Simplex Algorithm work and how is it applied to the Minimum Cost Flow Problem? **[8]**



Total No. of Questions : 12]

SEAT No. :

**PD5039**

[Total No. of Pages : 2

**[6405]-173**

**S.Y.M.E. (Computer Networks)  
FAULT TOLERANT SYSTEMS  
(2017 Pattern) (Semester - III) (610201)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer six questions.*
- 2) Neat diagram must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1)** Explain various error correction codes in detail with examples. **[9]**

OR

**Q2)** Explain Discrete (Markov) Model in detail with example. **[9]**

**Q3)** What is fault modeling? Explain fault modeling levels in detail. **[9]**

OR

**Q4)** Explain in detail about deductive fault simulation algorithm. **[9]**

**Q5)** Explain Iterative-Based Heuristic Routing Algorithm with example. **[8]**

OR

**Q6)** Explain in detail Node Labeling Technique. **[8]**

**Q7)** What is Block-Shift Network (BSN)? Explain Edges Groups, Construction, Degree and Diameter in detail. **[8]**

OR

**Q8)** Explain in detail about degree and diameters in Hierarchical cubic networks **[8]**

**P.T.O.**

**Q9)** Explain various Classifications of Fault-Tolerant Switching Architectures. **[8]**

OR

**Q10)** Explain in detail about Daisy-Chain Architectures and Multi-Drop Architectures. **[8]**

**Q11)** Explain the following terms **[8]**

- a) Faults
- b) Errors
- c) Failures
- d) Process resilience

OR

**Q12)** What is Mutable checkpoint? Explain in detail with example. **[8]**



Total No. of Questions : 8]

SEAT No. :

**PD5040**

[Total No. of Pages : 2

**[6405]-174**

**S.Y.M.E. Computer (Computer Networks)**

**MOBILE AD HOC NETWORKS**

**(2017 Pattern) (Semester - III) (610202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Assume suitable data, if necessary.*

**Q1) a)** Explain various applications of ADHOC wireless networks. **[6]**

b) Differentiate between cellular networks and Ad Hoc wireless networks. **[6]**

OR

**Q2) a)** Discuss the differences in topology reorganization in DSDV and CGSR routing protocols. **[6]**

b) What are the issues in designing a MAC protocol for ADHOC wireless networks? Explain any one in detail. **[6]**

**Q3) a)** Discuss distributed point coordination function and point coordination function in IEEE802.11e protocol. **[6]**

b) Comment on the scaling properties of source-initiated and receiver initiated multicast protocols with respect to the number of sources and receivers in the group. **[6]**

OR

**Q4) a)** What are the advantages of multicast routing protocols based on Zone routing? **[6]**

b) Explain predictive location-based QoS routing protocol. **[6]**

**P.T.O.**

- Q5)** a) What are the issues and challenges in designing a wireless sensor network? [7]
- b) Explain Low Energy Adaptive Clustering Hierarchy (LEACH) network architecture. [6]

OR

- Q6)** a) List the various data dissemination methods in sensor network. Explain any one in details. [6]
- b) Explain Power-Efficient data gathering method for sensor information systems. [7]
- Q7)** a) What are the important features that make the UWB systems applicable for high-speed mobile communications? [6]
- b) Explain the MSN Architecture for Next-Generation Hybrid wireless networks. [7]

OR

- Q8)** a) Explain Meghadoot Architecture. [6]
- b) Explain Optical Wireless WDM. [7]



Total No. of Questions : 12]

SEAT No. :

**PD5041**

[Total No. of Pages : 2

**[6405]-175**

**F.Y.M.E. (Computer Engineering)/(Cyber Security 2020)**  
**MATHEMATICAL FOUNDATIONS FOR CYBER SECURITY**  
**(2017 Pattern) (Semester - I) (510401)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.

- Q1)** a) Explain how inverses work in modular arithmetic with an example. [4]  
b) Is addition a binary operation on the set of integers? Why or why not?[4]

OR

- Q2)** a) What is a residue matrix? Provide an example with mod 5. [4]  
b) What is a linear congruence? Give an example. [4]

- Q3)** a) What is a coset in group theory? Explain how cosets are formed in modulo groups, with an example. [4]  
b) How are polynomials used in finite fields? Explain with example. [4]

OR

- Q4)** a) What is a generator in a finite field? Explain how a generator is used to generate all elements of the field. [4]  
b) What is a lattice in algebra? provide an example of a simple lattice structure. [4]

- Q5)** a) What are relative prime numbers? Are 15 and 28 relative primes? Justify your answer. [4]  
b) What is the cardinality of the set of prime numbers less than 20? List them. [5]

OR

- Q6)** a) What is Euler's Theorem? Explain with example with the process. [4]  
b) Explain the Miller-Rabin primality test with example. [5]

**P.T.O.**

- Q7)** a) State the Fundamental Theorem of Arithmetic. Use it to express the number 30 as a product of prime factors. [4]  
b) What is the Pollard p-1 method of factorization? Explain how it helps in finding factors of a number. [4]

OR

- Q8)** a) Explain the concept of exponentiation in modular arithmetic. How is it related to logarithms? [4]  
b) Explain Chinese Remainder Theorem (CRT)? [4]
- Q9)** a) Explain Bayes' Theorem with example. [4]  
b) What is a Monte Carlo algorithm? Provide an example of how Monte Carlo methods can be used to estimate the value of  $\pi$ . [4]

OR

- Q10)** a) What is a pseudorandom number generator (PRNG)? How does it differ from a true random number generator? [4]  
b) What is a stochastic process? Provide an example of a simple stochastic process and explain how it works. [4]
- Q11)** a) What is the minimum distance of a code? How does the minimum distance affect the error detection and correction capabilities of a code? [4]  
b) What are Hamming codes? How do they correct single-bit errors? Provide an example of encoding and decoding using a (7, 4) Hamming code. [5]

OR

- Q12)** a) What is a linear code? Explain how a linear code is different from a non-linear code, and provide an example of a linear code. [5]  
b) What is syndrome decoding? Explain how syndrome decoding is used to detect and correct errors in a received codeword. [4]





Total No. of Questions : 6]

SEAT No. :

**PD5042**

[Total No. of Pages : 1

**[6405]-176**

**M.E. - I (Computer Engineering) (Cyber Security - 2020)**

**MODERN CRYPTOGRAPHY**

**(2017 Pattern) (Semester - I) (510402)**

**Time : 3 Hours]**

**[Max. Marks : 50**

**Instructions to the candidates:**

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) State and Explain the third principle of Modern Cryptography: Rigorous Proofs of Security. **[4]**  
b) Provide a formal definition of the Gen, Enc and Dec algorithms for mono-alphabetic substitution. **[4]**
- Q2)** a) Discuss a secure fixed-length encryption scheme. **[4]**  
b) Explain International Data Encryption Algorithm. **[4]**
- Q3)** a) Discuss Diffie-Hellman key exchange algorithm. **[4]**  
b) Explain the pros and cons of RSA. **[4]**
- Q4)** a) What is steganography? Explain types of steganography. **[4]**  
b) What is the difference between a Digital Signature and a Digital Certificate? **[4]**
- Q5)** a) Discuss the cyber security management cycle. **[4]**  
b) Explain cyber security policy & Laws. **[4]**
- Q6)** a) What are Cyber Security Goals or Objectives? List and Explain. **[5]**  
b) Discuss the security framework in detail. **[5]**



Total No. of Questions : 8]

SEAT No. :

**PD5043**

**[6405]-177**

[Total No. of Pages : 2

**F.Y. M.E. (Computer Engineering) (Cyber Security) (2020)**  
**SECURE SOFTWARE DESIGN, CODING PRACTICES AND**  
**ETHICS**  
**(2017 Pattern) (Semester - I) (510403)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) Figure to the right indicate full marks.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Assume suitable data, if necessary.*

**Q1)** a) What is mean by system complexity? What is role of software assurance in system development? [4]

b) Discuss about benefits of early detection of defects in software development? [5]

OR

**Q2)** a) What are the threats and sources present in system design? Explain each in detail. [4]

b) Discuss about properties of secure software and perspectives in software development? [5]

**Q3)** a) Discuss about SQUARE Model and output in detail. [4]

b) What are the architectural risk analysis in secure software? Explain in detail. [5]

OR

**Q4)** a) Discuss about requirement elicitation method in detail. [4]

b) Write short note on [5]

i) Security analysis

ii) Coding practices.

**P.T.O.**

**Q5) a)** Write short note on : [8]

i) Security failures

ii) Maturity of practice

b) Discuss about Governance and security. [8]

OR

**Q6) a)** Write short note on : [8]

i) System complexity drivers

ii) Deep technical problem

b) Discuss about enterprise level security framework adoption. [8]

**Q7) a)** What do you mean by Agile development process? Explain with suitable example. [8]

b) Describe agile vulnerability management with example. [8]

OR

**Q8) a)** Explain agile threat modelling with suitable example. [8]

b) Discuss about Risk based Software testing. [8]



Total No. of Questions : 12]

SEAT No. :

**PD5044**

[Total No. of Pages : 2

**[6405]-181**

**F.Y.M.E. (Cyber Security) (2020)/(Computer Engg.)  
FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY  
(2017 Pattern) (Semester - II) (510410)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer questions Q1 or Q2, Q3or Q4, Q5or Q6, Q7or Q8, Q9or Q10 and Q11 or Q12.*
- 2) Neat diagram must be drawn, wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1) What are the modeling Faults and Adversaries in Blockchain Explain. [9]**

OR

**Q2) Explain Memory hard Algorithm and digital cash. [9]**

**Q3) Differentiate Between [9]**

- i) Public and Private Blockchain.
- ii) Soft & Hard Fork

OR

**Q4) Explain Blockchain Network and Life of Blockchain Applications. [9]**

**Q5) What is Sybil Attack? Explain in detail Sybil Attack. [8]**

OR

**Q6) Explain in detail Verifiable random functions. [8]**

**Q7) Discuss Double Spending in a Blockchain system. [8]**

OR

**Q8) Write a short note on Hardness of mining. [8]**

**P.T.O.**

**Q9)** What is a ledger? Name the common type of ledgers that can be considered by users in Blockchain? **[8]**

OR

**Q10)** How the Wallets for Ethereum be created Explain in detail. **[8]**

**Q11)** What is Anonymity? Explain different methods of Anonymity Preservation. **[8]**

OR

**Q12)** Explain Selfish mining and Sharding based Consensus Algorithm. **[8]**



Total No. of Questions : 12]

SEAT No. :

**PD5045**

[Total No. of Pages : 2

**[6405]-183**

**Second Year M.E. (Cyber Security) (2020)**

**CYBER SECURITY AND IT INFRASTRUCTURE PROTECTION  
(2017 Pattern) (Semester - III) (610402)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or 4, Q.5 or Q.6, Q.7or Q.8, Q.9 or Q.10, Q.11 or Q.12.*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Assume suitable data if necessary.*

**Q1)** What is Cyber Crime ? Explain with suitable example. **[8]**

OR

**Q2)** What are Cyber Target and Cyber Threats? Give examples of each. **[8]**

**Q3)** What is Risk management? Explain with diagram. **[8]**

OR

**Q4)** Write a note on “Cyber Security Steps”. **[8]**

**Q5)** What is Infrastructure management? What are its types? **[8]**

OR

**Q6)** Write a note on : **[8]**

- a) Network Management
- b) Storage Management

**P.T.O.**

**Q7)** What are components of IT Infrastructure? [9]

OR

**Q8)** What are types of Computer Software used for Infrastructure Management in Business? [9]

**Q9)** How operational excellence and customer intimacy is achieved ? Explain in detail. [8]

OR

**Q10)** Write a note on “Ethical and social Issues in Information systems”. [8]

**Q11)** What are the challenges in Storage Infrastructure Management? Brief. [9]

OR

**Q12)** What are storage security domains ? What are its impact on implementation in storage networking. [9]



Total No. of Questions : 8]

SEAT No. :

**PD5046**

[Total No. of Pages : 1

**[6405]-184**

**First Year M.E. (Electrical)/(Control System)  
OPTIMIZATION TECHNIQUES IN CONTROL SYSTEM  
(2017 Pattern) (Semester - I) (503101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Use of algorithmic tables slide rule, mollier charts, and electronic pocket calculator and steam table is allowed.
- 5) Assume suitable data if necessary.

**Q1) a)** State whether function is convex, concave or neither  $F(x) = x^4 + 12x^2 + 24x$ . **[4]**

b) Find the Maxima & Minima if any of the function  $F(x) = 4x^3 - 18x^2 + 20x - 6$ . **[5]**

OR

**Q2)** Explain the method of obtaining extreme point of multi-variable optimization with equality constraints. **[9]**

**Q3)** Use analytical method to investigate for extremum points of  $-3X^4 + 10X^3 - 20$ . **[9]**

OR

**Q4)** Write the steepest descent method of optimization of a problem. **[9]**

**Q5)** Explain the multistage Decision process in Dynamic Programming. **[16]**

OR

**Q6)** Explain multistage decision process with its types of problem. **[16]**

**Q7)** Explain the graphical representation of Integer Linear Programming. **[16]**

OR

**Q8)** Explain Stochastic Linear Programming. **[16]**





Total No. of Questions : 6]

SEAT No. :

**PD5047**

[Total No. of Pages : 2

**[6405]-185**

**M.E. - I (Electrical)/(Control Systems)  
AUTOMATION IN MANUFACTURING  
(2017 Pattern) (Semester - I) (503102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2 , Q.3 or Q.4, Q.5 or Q.6.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.

- Q1)** a) Illustrate the limitations of data conversion devices, and how can they be improved. [5]
- b) Explain a microsensor, and how does it differ from conventional sensors. [5]
- c) Explain the directional control Valve. Also explain operation of single Solenoid valve. [4]
- d) Discuss the main components of cyber Physical System and explain its features. [4]

OR

- Q2)** a) How does a proximity sensor detect the presence of an object, explain in detail? [4]
- b) Explain the differences between radial (disk) cams and cylindrical cams?[5]
- c) Classify between a flow control valve and a pressure control valve? [5]
- d) Elaborate the challenges of implementing Cyber Physical System in manufacturing? [4]

- Q3)** a) How do digital manufacturing systems improve efficiency, flexibility, and automation? [8]
- b) Illustrate the key layers in a Digital Manufacturing System Architecture.[8]

OR

- Q4)** a) Discuss the key modeling approaches used in digital manufacturing. [8]
- b) Explain Operation Reference Mode of Digital Manufacturing. [8]

**P.T.O.**

- Q5)** a) Explain the Industry 4.0, and why is it called the Fourth Industrial Revolution. **[8]**
- b) Explain the rise of cyber-physical systems (CPS) drive industrial transformation. **[8]**

OR

- Q6)** a) Explain the core principles and objectives of Industry 4.0. **[8]**
- b) Illustrate the benefits of real-time data collection and monitoring in a smart factory. **[8]**



Total No. of Questions : 5]

SEAT No. :

**PD5048**

**[6405]-186**

[Total No. of Pages : 2

**First Year M.E. (Electrical) (Control Systems)**

**NON LINEAR CONTROL SYSTEM**

**(2017 Pattern) (Semester - I) (503103)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Q5 is compulsory.*
- 2) *Answer Q.1 or Q.2, Q.3 or Q.4.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Use of algorithmic tables slide rule, Mollier charts, and electronic pocket Calculator and steam table is allowed.*
- 6) *Assume suitable data if necessary.*

**Q1) a)** Explain following terms **[6]**

- i) Hysteresis
- ii) Critical Jump resonance
- iii) Limit Cycle

**b)** Draw the phase plane trajectory for the following equation using Isocline method **[6]**

$$\ddot{x} + 2\varepsilon w\dot{x} + w^2x = 0, \text{ given } \varepsilon = 0.5, w = 1. \text{ Initial point } (0, 6)$$

**c)** An autonomous system is given by **[6]**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 3 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Examine the Stability using Liapunov Direct Method.

OR

**P.T.O.**

**Q2)** a) Express Scalar function given below in Quadratic form & test it for definiteness. [6]

$$V(x) = 4x_1^2 + 5x_2^2 + x_3^2 - 8x_1x_2 + 4x_1x_3 - 4x_2x_3$$

b) Explain delta method of constructing a phase plane trajectory for a given system. [6]

c) Explain Popov criterion for absolute stability. [6]

**Q3)** a) Explain the terms : [6]

i) Sliding Phase

ii) Reaching Phase

iii) Chattering as used in sliding control

b) Write a short note on Input - Output Linearization. [5]

c) Write a short note on Chattering as used in Sliding Control. [5]

OR

**Q4)** Explain the following (any two) : [16]

a) Concept of Variable Structure Control.

b) Properties of Sliding Mode Control.

c) Matched & Unmatched uncertainty in case of Sliding Mode Control

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

a) Explain any non-linear system design using sliding mode technique.

b) Effect of disturbance on Sliding Mode Control.

c) Matched & Unmatched uncertainty in case of Sliding Mode Control.



Total No. of Questions : 6]

SEAT No. :

**PD5049**

[Total No. of Pages : 2

**[6405]-187**

**First Year M.E. (Electrical/Control Systems)**

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - I) (503104)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Questions from Q.1 or Q.2, Q.3 or Q.4, Q5 or Q.6.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.

**Q1) a)** What are different steps involved in report writing of project? **[5]**

b) Write short notes on **[5]**

i) Field

ii) Scalar

iii) Vector

iv) Vector Space

v) Linear equation

c) Explain different steps involved in defining a research problem. **[4]**

d) Elaborate about the role of literature survey in writing research report. **[4]**

OR

**Q2) a)** Write short notes on **[4]**

i) Copy write

ii) Royalty

b) Enlist the various funding agencies for engineering research grants. Explain any one in detail. **[5]**

c) Explain the purpose of literature survey. Explain with example the Purpose and use of three different literature sources. **[5]**

d) What are the criteria or characteristics of good research problem? **[4]**

**Q3) a)** Explain in detail homogeneous and non-homogeneous systems with illustration. What are various types of linear equations? **[8]**

b) Explain Echelon form & free variable form linear equations. **[8]**

OR

**P.T.O.**

- Q4)** a) Explain sampling concept with different sampling design in brief. [8]  
b) Explain different types of research hypothesis with suitable example. [8]

- Q5)** a) What are the different tools used for making oral presentation effective?[8]  
b) Describe in brief, the structure of report. What do you mean by plagiarism? [8]

OR

- Q6)** a) Explain Eigen vectors, Eigen vector pair & Eigen values. Also elaborate properties of Eigen values & Eigen vector. [8]  
b) Explain Diagonalization Algorithm for  $n$  square matrix. [8]

\* \* \*

Total No. of Questions : 6]

SEAT No. :

**PD5050**

**[6405]-188**

[Total No. of Pages : 2

**First Year M.E. (Electrical Engineering) (Control Systems)**  
**MULTIVARIABLE AND OPTIMAL CONTROL SYSTEM**  
**(2017 Pattern) (Semester - II) (503107)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain the definition of controllability and observability of multivariable control system. **[4]**
- b) Define observer. What are advantages of observer in a given system. **[5]**
- c) Explain Concept of state observer and disturbance observer, with it's advantages and limitations. **[5]**
- d) State the infinite time state regulator problem. **[4]**

OR

- Q2)** a) Explain the state space model theory. **[4]**
- b) Elaborate sliding mode observer and give it's robustness properties. **[5]**
- c) Discuss the nonlinear Extended state observer with it's advantages, applications and limitations. **[5]**
- d) Explain **[4]**
- i) Minimum fuel problem
  - ii) State regulator problem

**P.T.O.**

- Q3)** a) State the Pontryagin's minimum principle and its importance. [6]  
b) Discuss step by step procedure of solving optimal control problem using Pontryagin's minimum principle. [10]

OR

- Q4)** a) Explain the optimal control theory. [10]  
b) Define Hamiltonian. Derive state, Co-state and control equations. [6]

- Q5)** a) Explain the minimum time optimal control problem. [8]  
b) Define and explain singular control solution. [8]

OR

- Q6)** a) Discuss in detail the Bang - bang control strategy. [8]  
b) Explain the optimal control law with example. [8]

**x x x**



Total No. of Questions : 6]

SEAT No. :

**PD5051**

[Total No. of Pages : 1

**[6405]-189**

**First Year M.E. (Electrical) (Control System)**  
**CONTROL OF POWER ELECTRONIC CIRCUITS**  
**(2017 Pattern) (Semester - II) (503108)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of algorithmic tables slide rule, Mollier charts, and electronic pocket Calculator and steam table is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Explain the roles & objectives of power electronic converters. [6]  
b) Explain different control families of power electronic converter [6]  
c) Write a note on Sampled data type model. [6]

OR

- Q2)** a) Explain in brief Control principals of Power Electronic Converters. [12]  
b) State Relations Between Modelling and Control. [6]

- Q3)** a) Draw the circuit diagram of Buck-Boost Converter & explain circuit topologies of it. [12]  
b) Write a note on switched type model. [4]

OR

- Q4)** a) Explain pole placement based on observer design for linear feedback control. [8]  
b) State equilibrium point and static transfer function for Buck and Boost converter. [8]

- Q5)** a) Explain variable structure control of power electronic converters. [8]  
b) Explain in detail grid connected single phase DC-AC converter with examples. [8]

OR

- Q6)** Explain variable structure control design with one application as DC-DC power stage. [16]



Total No. of Questions : 8]

SEAT No. :

**PD5052**

[Total No. of Pages : 2

**[6405]-190**

**First Year M.E. (Electrical-Control Systems)**

**DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS**

**(2017 Pattern) (Semester - II) (503109)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary.

**Q1) a)** For two-sided z- transform state and prove following properties: **[4]**

- i) Time shifting
  - ii) Scaling in z- domain or Multiplication by exponential
- b) Discuss the sampling theorem. Explain the Sampling and processing of any continuous time signal. **[5]**

OR

**Q2) a)** What is the difference between DFT and DTFT? Compare Radix-2 DIT and DIF FFT algorithms. **[5]**

- b) Define DFT of discrete-time sequence. Explain the various properties of DFT. **[4]**

**Q3) a)** Explain the time response of discrete time systems. **[5]**

- b) Define transfer function. Explain the steady state and transient response of first order and second order systems. **[4]**

OR

**Q4) a)** Explain in detail low pass Butterworth filter approximation. Comment on the Passband and Stopband characteristics of Butterworth filter. **[5]**

- b) Realize the IIR systems by Direct form I and Direct form II. **[4]**

**P.T.O.**

- Q5) a)** Explain the process of windowing using illustrations. What is a Kaiser window function? Obtain its frequency-domain characteristics. **[8]**
- b)** Compare FIR and IIR filters. What is Hanning window function? Obtain its frequency-domain characteristics. **[8]**

OR

- Q6) a)** Obtain Direct form and Cascade form realizations for the transfer function of an FIR system. **[6]**
- b)** A low pass filter is to be designed with the following desired frequency response: **[10]**

$$H_d(e^{j\omega}) = \begin{cases} e^{-j2\omega} & \pi/4 \leq \omega \leq \pi \\ 0 & -\pi/4 \leq \omega \leq \pi/4 \end{cases}$$

Determine the filter coefficients  $h_d(n)$ , if the window function is defined

$$\text{as } w(n) = \begin{cases} 1 & 0 \leq n \leq 4 \\ 0 & \text{otherwise} \end{cases}$$

Also, determine the frequency response  $H(e^{j\omega})$  of the designed filter.

- Q7) a)** Discuss the various methods of speed control of electrical machines by DSP. **[8]**
- b)** Discuss advanced PWM generation by DSP. **[8]**

OR

- Q8) a)** Explain various methods of measurement of power by DSP. **[8]**
- b)** Discuss design of Discrete PID controller using DSP. **[8]**



Total No. of Questions : 6]

SEAT No. :

PD-5053

[Total No. of Pages : 2

**[6405]-191**

**M.E. (Electrical Engineering) (Control Systems)**

**Advanced Drives and Control**

**(603101) (2017 Credit Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) All questions are compulsory.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*

- Q1)** a) Prove the steady state stability criterion of electrical drive [5]
- b) Write in detail about torque pulsation in separately excited d.c. motor supplied from solid state controllers [4]
- c) Write in detail about necessity of derating of induction motor fed from inverter [5]
- d) Write a note on Dynamic D-q model in connection with speed control of induction motor [4]

OR

- Q2)** a) Write a note on " Matching of Power Electronics Controller and electric motor to drive its Load" [4]
- b) With neat diagram, explain system model and derive the transfer function of the converter fed D.C.motor [5]
- c) Write a note on Pulse Width Modulated invertér [4]
- d) Explain static krammer control of drive using induction motor [5]

**P.T.O.**

**Q3)** Explain in detail with reference to synchronous motor drive

- a) Trapezoidal SPM drive [8]
- b) Wound field machine drive [8]

OR

**Q4)** Write a note on :

- a) Switched Reluctance motor drive [8]
- b) Sinusoidal SPM drive [8]

**Q5)** a) Write a note on modern trends in electric drives control [8]

- b) Explain the working principle of Phase Locked Loop (PLL) system and discuss the application of PLL in the closed loop controlled drives [8]

OR

**Q6)** Explain in detail the role of following in the closed loop control system of the electrical drive

- a) PI controller [8]
- b) PID controller [8]



Total No. of Questions : 6]

SEAT No. :

**PD5054**

**[6405]-192**

[Total No. of Pages : 2

**S.Y.M.E. (Electrical) (Control Systems)**  
**SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL**  
**(2017 Pattern) (Semester - III) (603102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Qu 1 or 2, Qu 3 or 4, Qu 5 and Qu6 are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of algorithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) With the help of neat diagram explain the process of system identification. **[5]**  
b) Derive least square estimate of  $\theta$  for model given by  $y = \Phi\theta$ . **[4]**

OR

- Q2)** a) Compute the QR factorization of matrix : **[5]**

$$\begin{bmatrix} 12 & 27 \\ 4 & 2 \\ 6 & 10 \end{bmatrix}$$

- b) Explain the parametric and non-parametric methods of system identification. **[4]**

- Q3)** a) With the help of block diagram explain 'self tuning regulator'. **[5]**  
b) Prove the matrix inversion lemma: **[4]**

$$[A + BCD]^{-1} = A^{-1} - A^{-1}B[C^{-1} + DA^{-1}B]^{-1}DA^{-1}$$

$$[A + BCD]^{-1} = [A + BCD] \left\{ A^{-1} - A^{-1}B[C^{-1} + DA^{-1}B]^{-1}DA^{-1} \right\} I = I$$

OR

**P.T.O.**

**Q4)** Write short notes on any three :

[9]

- a) Recursive estimation
- b) Instrumental variable method
- c) Model structure
- d) Maximum likelihood method
- e) Bayesian learning
- f) Pattern recognition

**Q5)** a) Explain pole placement design and derive the Diophantine equation. [8]

b) What do you understand by persistently existing signal?

What is the order of following signals:

[8]

- i) white noise
- ii) step signal
- iii) sum of sinusoids

**Q6)** With the help of both MIT rule and Lyapunov theory, design an MRAS for

system described by  $G(s) = \frac{b}{s+a}$  where  $a$  and  $b$  are unknown. The controller

is given by  $u(t) = \theta_1 u_c(t) + \theta_2 y(t)$  and the desired closed loop model is

$\frac{dy_m}{dx} = -a_m y_m + b_m u_c$ . Draw simulation diagram and compare two methods.

Assume  $V(\theta) = \frac{1}{2} \left[ e^2 + \frac{1}{b\gamma} (b\theta_2 + a - a_m)^2 + \frac{1}{b\gamma} (b\theta_1 - b_m)^2 \right]$ . [16]



Total No. of Questions : 4]

SEAT No. :

PD5055

[Total No. of Pages : 2

[6405]-193

First Year M.E. (Electrical)/(Power Electronics & Drives)

LINEAR SYSTEMS THEORY AND DESIGN

(2017 Pattern) (Semester - I) (503301)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of calculator is allowed.
- 4) Assume suitable data if necessary.

Q1) a) Check whether the following vectors are linearly dependent or independent. [5]

i)  $a = (1,1,1)$   $b = (1,2,0)$   $c = (0,-1,1)$

ii)  $a = (1,0,0)$   $b = (0,1,0)$   $c = (0,0,1)$

b) If  $a = 5i + 4j + 2k$ ,  $b = 4i - 5j + 3k$  and  $c = 2i - 1j - 2k$ , compute [4]

i) the scalar product  $a \cdot b$  and the angle between the vectors  $a$  and  $b$

ii) the magnitude and direction cosines of the vector product  $(a \times b)$  and also the angle that the product vector makes with the vector  $c$ .

OR

c) Consider the vectors  $a = 3i + 8j + k$  and  $b = 6i + 8j + 2k$  [4]

i) Deduce the direction cosines of  $\vec{OA}$  and  $\vec{OB}$

ii) Deduce the direction cosines of  $\vec{AB}$

Q2) a) For the following matrices [5]

$$A = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix} \quad B = \begin{bmatrix} 1/3 & -2/3 & 2/3 \\ 2/3 & 2/3 & 1/3 \\ -2/3 & 1/3 & 2/3 \end{bmatrix}$$

Perform:

- i) Orthogonality
- ii) Symmetry
- iii) Skew symmetry

P.T.O.



- b) Explain, with examples, the following characteristics of square matrices: [4]
- i) Symmetric
  - ii) Skew-symmetric
  - iii) Diagonal
  - iv) Unit

OR

- c) Determine if the following sets of vectors is linearly independent or dependent. [4]

$$v_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}, v_2 = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \text{ and } v_3 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

- Q3) a)** The actual volume of liquid in 500 ml jar follows a normal distribution with mean 500 ml and variance 16 ml. If  $X$  denotes the actual volume liquid in a jar, find what is: [8]
- i)  $P(X > 496)$
  - ii)  $P(X < 498)$
  - iii)  $P(492 > X < 512)$

- b) The number of hours of life of a torch battery is normally distributed with a mean of 150  $h$  and standard deviation 12 hours. In a quality control test, two batteries are chosen at random from a batch. If both batteries have a life less than 120 hours, the batch is rejected. Find the probability that the batch is rejected. [8]

OR

- c) A manager wants to see how the mac computers are distributed in his company branches according to region. Data collected were as follows: North East (12), South West (21), East (10) and Mid West (7). Total number of mac computers was 50. Calculate the chi-square statistic for this data.

- Q4) a)** Fit the curve  $y=a/x^2$  using method of least square to the following data:[8]

|     |         |         |         |         |         |         |
|-----|---------|---------|---------|---------|---------|---------|
| $x$ | 10      | 20      | 30      | 40      | 50      | 60      |
| $y$ | 0.02245 | 0.00545 | 0.00295 | 0.00145 | 0.00095 | 0.00065 |

- b) State and explain central limit theorem. [8]

OR

- c) Explain method of sequential differences and method of least square for graphical data representation and parameter determination. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5056**

[Total No. of Pages : 2

**[6405]-194**

**First Year M.E. (Electrical)/(Power Electronics and Drives)  
MODELLING AND ANALYSIS OF ELECTRICAL MACHINES  
(2017 Pattern) (Semester - I) (503302)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2 , Q.3 or Q.4, Q.5 or Q.6 ,Q.7 or Q.8.
- 2) Figure to the right indicate full marks.
- 3) Use of electronic calculator is allowed.
- 4) Assume suitable data, if necessary.

- Q1)** a) Explain Kron's primitive machine with respective equations. [5]  
b) Explain transformation of 3 phase to 2 phase stationary axes with respective mathematical expressions. [4]

OR

- Q2)** a) With respective mathematical expression justify that the magnitude of the speed voltages is maximum, when the moving coil is magnetically at right angles to the other coil. [5]  
b) Explain transformations from a displaced brush axis with respective mathematical expressions. [4]

- Q3)** a) Derive transfer function of separately excited motor with usual notations. [5]  
b) State the advantages and limitations of d-q model in case of 3 phase induction motor. [4]

OR

- Q4)** a) Explain dynamics of DC motor with respective equations when load is applied to the motor. [5]  
b) Explain rotor reference frame model of 3 phase induction motor with respective mathematical expressions. [4]

- Q5)** a) Derive expression of instantaneous torque of synchronous motor by impedance matrix method. State the meaning of notations used. [8]  
b) Write down dynamic equations of synchronous machine. State the meaning of each term used in the equation. [8]

OR

**P.T.O.**

- Q6)** a) Derive the expressions for dq0 transformations in case of synchronous machines. [8]  
b) Write down the stator voltage equations in terms of arbitrary reference frame variables. State the meaning of each notation used in the equation. [8]

- Q7)** a) Write a detail note on small displacement stability. [8]  
b) Write a detail note on linearization of machine equation. Also write voltage, torque equations for linearization. [8]

OR

- Q8)** a) Explain the dynamic model of induction machine with reference to eigen values. Write down respective equations. [8]  
b) State the applications of linearization. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5057**

**[6405]-195**

[Total No. of Pages : 2

**First Year M.E. (Electrical)/(Power Electronics and Drives)**

**POWER CONVERTERS - I**

**(2017 Pattern) (Semester - I) (503303)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Explain static V-I characteristic of SCR with its modes of operation. **[5]**

b) Explain 1 ph fully controlled converter with RL load write output voltage equation. **[4]**

OR

**Q2) a)** Explain 3 ph fully controlled converter with its circuit diagram and output voltage equation. **[5]**

b) Compare SCR and MOSFET for its different features. **[4]**

**Q3) a)** Explain Buck converter with its modes of operation, output voltage waveform and output equation. **[5]**

b) Explain 1ph VSI inverter with its modes of operation. **[4]**

OR

**Q4) a)** Explain Buck Boost converter. **[4]**

b) Explain 3 Ph inverter in 120 degree mode of operation with switching sequence output phase voltage waveform. **[5]**

**P.T.O.**

- Q5)** a) Explain single phase bi directional controller with R load, RL load with its circuit diagram and output voltage waveform. [8]
- b) Explain integral control method and Phase angle control method in a single phase AC/AC voltage regulator. [8]

OR

- Q6)** a) Explain PWM control of single phase AC voltage regulator. [8]
- b) Explain effect of source inductance on operation of AC voltage regulator. [8]
- Q7)** a) With a neat diagram and relevant waveform explain the working of a single phase to single phase midpoint step down type cycloconverter supplying RL load for discontinuous load current. [8]
- b) Explain limitations and applications of cycloconverters. [8]

OR

- Q8)** a) With a neat diagram and relevant waveform explain the working of a three phase to three phase step down bridge type cycloconverter supplying RL load. [8]
- b) A three phase cycloconverter feeds a single phase load of 190 V at 45 A at power factor of 0.7 lagging Determine [8]
- i) required supply voltage
- ii) thyristor rating power factor of supply current



Total No. of Questions : 8]

SEAT No. :

**PD5058**

[Total No. of Pages : 1

**[6405]-196**

**First Year M.E. (Electrical Engineering)/(Power Electronics & Drives)**

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - I) (503304)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Questions from Q.1 or Q.2, Q.3 or Q.4 Q,5 or Q.6, Q,7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable additional data, if necessary.
- 5) Use of non-programmable calculator is allowed.

**Q1) a)** List out the objectives of the Research. **[4]**  
**b)** Explain the necessity of defining and formulating the research problem. **[5]**

OR

**Q2) a)** Explain the methods of data analysis. **[4]**  
**b)** What are the measures of asymmetry? **[5]**

**Q3) a)** Discuss the important features of LaTeX for report writing. **[4]**  
**b)** Explain how to include graphics using LaTeX for a thesis. **[5]**

OR

**Q4) a)** What is plagiarism and how to avoid it? **[4]**  
**b)** Explain the various types of intellectual property rights. **[5]**

**Q5) a)** What are the steps in research proposal writing? Explain all the steps. **[8]**  
**b)** Explain the structure of a poster paper in detail. **[8]**

OR

**Q6) a)** Explain the various parts of the project report writing. **[8]**  
**b)** Compare conference papers and journal papers in detail. **[8]**

**Q7) a)** Explain referencing and footnotes. Explain the various formats of writing a bibliography. **[8]**  
**b)** Explain the significance of the thesis. **[8]**

OR

**Q8) a)** Explain the importance of effective communication. **[8]**  
**b)** What exactly do you mean by “oral presentation?” Comment on the planning, preparation, and execution of it. **[8]**

\* \* \*

Total No. of Questions : 6]

SEAT No. :

**PD5059**

**[6405]-197**

[Total No. of Pages : 2

**First Year M.E. (Electrical) (Power Electronics & Drives)**

**AC & DC DRIVES**

**(2017 Pattern) (Semester - II) (503307)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) Explain about different types of industrial loads. **[6]**
- b) Discuss speed control of D.C. separately excited motor fed from single phase full converter for continuous mode operation. **[6]**
- c) Explain about Steady state analysis of separately excited DC motor fed by chopper. **[6]**

OR

- Q2)** a) Write a short note on heating and cooling of industrial drives. **[6]**
- b) Discuss various types of braking system followed in D.C. drives. **[6]**
- c) Explain with suitable diagram working principle of VSI fed induction motor. **[6]**

- Q3)** a) Explain Direct vector control method to control the speed of the Induction Motor with neat circuit diagrams. **[8]**
- b) Explain about Principle of operation for Sensor less vector control method to control the Induction Motor with neat circuit diagrams. **[8]**

OR

**P.T.O.**

**Q4) a)** Explain what do you understand by D.C. Motor analogy? How it is achieved in Induction motor? **[8]**

b) Explain Indirect vector control method to control the speed of the Induction Motor with neat circuit diagrams. **[8]**

**Q5) a)** Explain about speed control strategies and performance characteristics for stepper motor with neat circuit diagrams. **[8]**

b) Explain about Principle of operation for Brushless DC motor and stepper motor with neat circuit diagrams. **[8]**

OR

**Q6) a)** Explain about Principle of operation for PMDC motor drive and draw the performance characteristics. **[8]**

b) With necessary sketches explain the operation of multi-stack stepper motor. Also discuss torque Vs stepping rate characteristics. **[8]**

**x x x**



Total No. of Questions : 6]

SEAT No. :

**PD5060**

[Total No. of Pages : 2

**[6405]-198**

**First Year M.E. (Electrical)/(Power Electronics & Drives)**

**POWER CONVERTERS - II**

**(2017 Pattern) (Semster - II) (503308)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of electronic calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain about Voltage Control of three phase Inverter and explain about Phase displacement control with neat circuit diagrams. **[10]**

b) Explain about the Purpose of Multilevel inverters and explain about any two types of multi-level inverters. **[8]**

OR

**Q2) a)** Explain about necessity resonant circuit and their Classification with neat circuit diagrams. **[10]**

b) Explain the concept of Zero Voltage Switching and Zero Current Switching with neat diagram and waveforms. **[8]**

**Q3) a)** With neat diagram explain about Thermal Modelling of MOSFET. **[8]**

b) Explain about Electrical equivalent thermal model of heat sink and derive the necessary equations. **[8]**

OR

**Q4) a)** Explain about the necessity of heat sink for power electronics devices and derive the required equations. **[8]**

b) Explain about the Selection procedure for Heat Sink. **[8]**

*P.T.O.*

- Q5)** a) With a neat diagram and relevant waveform explain the Magnetic design for Specific inductor and its procedure. [8]
- b) Explain about the Need of Snubber circuit and explain about design procedure for snubber circuits for IGBT. [8]

OR

- Q6)** a) With a neat diagram and relevant waveforms explain about the working of [8]
- i) Turn-On snubber
- ii) Over voltage Snubber
- b) With a neat diagram and relevant waveform explain about the working of Turn-off snubber and its design procedure. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5061**

[Total No. of Pages : 2

**[6405]-199**

**First Year M.E. (Electrical) (Power Electronics & Drives)**

**ADVANCED CONTROL SYSTEMS**

**(2017 Pattern) (Semester - II) (503309)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume Suitable data if necessary.
- 4) Use of Calculator is allowed.

**Q1) a)** Define and explain PID controller and tuning methods. **[4]**

**b)** Define Sliding Mode Control and List the salient features of it. **[5]**

OR

**Q2) a)** Define and explain performance indices related to the optimal control system. **[4]**

**b)** Explain why chattering is observed in sliding mode control? How it is to be eliminated. **[5]**

**Q3) a)** Explain in detail any one observer. **[5]**

**b)** Explain observer based sliding control for Boost DC/DC converter **[4]**

OR

**Q4) a)** Explain in detail nonlinear extended state observer. **[5]**

**b)** Write the short note on application of non linear slide mode observer in real life system. **[4]**

**Q5) a)** A system is described by **[8]**

$$\dot{x}_1 = -x_1 + x_2(1 + x_1) \quad \dot{x}_2 = -x_1(1 + x_1)$$

Find all the equilibrium points. Find the nature of any one singular point.

**b)** Describe direct method for constructing the Lyapunov function to determine the stability of nonlinear system. **[8]**

OR

**P.T.O.**

**Q6)** a) Explain the following singular points saddle, stable focus, unstable focus and vortex. [8]

b) Using Lyapunov function, state the condition for the system to be [8]

i) Stable

ii) Asymptotically stable in the large and

iii) Unstable.

**Q7)** a) What are zero dynamics? Explain with a suitable example [8]

b) What is feedback linearization technique? [8]

OR

**Q8)** a) What is Input state linearization? Give an example. [8]

b) What is the concept of Input output linearization? [8]



Total No. of Questions : 8]

SEAT No. :

PD-5062

[Total No. of Pages : 2

[6405]-200

**M.E. (Electrical Engineering) (Power Electronics & Drive)**  
**SPECIAL APPLICATION OF POWER ELECTRONICS**  
**(2017 Pattern) (Semester - III) (603301)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) Figures to the right indicate full marks.*
- 3) Neat diagrams must be drawn where ver necessary.*
- 4) Assume suitable additional data, if necessary.*
- 5) Use of non-programmable calculator is allowed.*

- Q1)** a) Write the Advantages of the Multi-terminal HVDC (MTDC) system. **[4]**  
b) What are the different operating modes of a Thyristor Controlled Series Capacitor (TCSC). **[5]**

OR

- Q2)** a) Explain how Voltage source converter (VSC) systems manage reactive power. **[4]**  
b) Explain the working of Thyristor-Controlled Reactor (TCR). **[5]**

- Q3)** a) Explain the key components of an Internet of Things (IoT) system. **[4]**  
b) Compare different communication networks like Zigbee, and Bluetooth. **[5]**

OR

- Q4)** a) What is a smart home? **[4]**  
b) Describe the types of sensors used in smart metering applications for power systems. **[5]**

**P.T.O.**

- Q5) a)** What are distributed energy resources (DERs), and how do they differ from centralized generation? **[8]**
- b)** What are the challenges associated with the integration of microgrids into the main grid? **[8]**

OR

- Q6) a)** What are the main functions of a smart grid in modern power systems? **[8]**
- b)** Explain the components of a Wide area measurement system (WAMS) and their respective functions. **[8]**
- Q7) a)** Explain the working principle of an electronic ballast and its advantages over magnetic ballasts. **[8]**
- b)** What is the role of power electronics in AC-DC electric locomotive systems? **[8]**

OR

- Q8) a)** Compare the role of power electronics in Switched Mode Power Supply (SMPS) and Uninterruptible Power Supply (UPS) systems. **[8]**
- b)** Explain the role of power electronics in arc welding machines. **[8]**



Total No. of Questions : 6]

SEAT No. :

**PD5063**

**[6405]-201**

[Total No. of Pages : 2

**S.Y. M.E. Electrical - (Power Electronics & Drives)**  
**ENERGY MANAGEMENT AND POWER QUALITY**  
**(2017 Pattern) (Semester - III) (603302)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4 and Q.5 or Q.6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of Calculator is allowed.*
- 4) *Assume Suitable data if necessary.*

**Q1)** a) Write note on optimal selection of Pumps and Fans. **[9]**

b) What are the various effects of the power quality disturbances? **[9]**

OR

**Q2)** a) Discuss various control equipments used for motors to increase Energy efficiency. **[9]**

b) Write note on Variable speed drive with advantages and disadvantages. **[9]**

**Q3)** a) Discuss in detail various voltage regulation devices. **[8]**

b) Write detail note on Voltage sags and interruptions. **[8]**

OR

**P.T.O.**

- Q4)** a) Enlist the different power quality monitoring standards and explain them. [8]
- b) What are the various causes of voltage flicker? [8]

- Q5)** a) Write detail note on Power quality monitoring standards. [8]
- b) Write the procedure to design a harmonic filter. [8]

OR

- Q6)** a) Explain objectives and consideration of power quality monitoring. [8]
- b) Explain the application of intelligent system in power quality monitoring. [8]





[6405]-202

**First Year M.E. (Electrical-Power Systems)**  
**COMPUTER APPLICATION IN POWER SYSTEMS**  
**(2017 Pattern) (Semester - I) (503201)**

Time : 3 Hours]

[Max. Marks : 50]

*Instructions to the candidates:*

- 1) Solve Q.1, Q.2. and Q.3.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary

**Q1) Solve any THREE** **[18]**

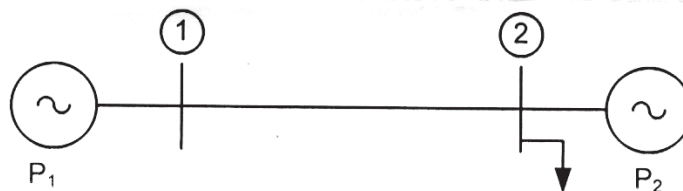
- a) Draw surface constraint diagram showing behavior and side constraints. Also indicate bounded and unbounded, acceptable and unacceptable points on surface constraint.
- b) Explain Lagrange's method for multivariable optimization.
- c) Explain AC-DC load flow analysis.
- d) What are the assumptions decoupled and fast decoupled load flow.

**Q2) Solve any TWO** **[16]**

- a) Explain NR load dispatch with algorithm considering limits.
- b) A two bus system is shown figure is having following incremental cost curves of the plants:

$$\frac{dF_1}{dP_1} = 0.025P_1 + 15 \text{ and } \frac{dF_2}{dP_2} = 0.05P_2 + 20$$

When load of 125MW is transmitted from plant 1 to the load, a loss of 15.625MW is incurred. Determine the generation schedule and load demand if the cost of received power is Rs.24/MWhr. Solve the problem using penalty factor.



- c) State economical load dispatch.
  - i) With loss and inequality constraints
  - ii) Without loss and inequality constraints

P.T.O.

**Q3) Solve any TWO**

**[16]**

- a) Write short note on GSD and GSSD.
- b) Show that transmission loss formula is a function of generation and load.
- c) The transmission loss coefficients  $B_{mn}$  expressed in  $pu$  on the base of 100MVA of a power system network having three plants are given by

$$B = \begin{bmatrix} 0.01 & -0.001 & -0.002 \\ -0.001 & 0.02 & -0.003 \\ -0.002 & -0.003 & 0.03 \end{bmatrix}$$

Three plants supply power of 100MW, 200MW and 300MW respectively into the network. Calculate the transmission loss and incremental transmission losses of the plant.



Total No. of Questions : 5]

SEAT No. :

**PD5065**

[Total No. of Pages : 2

**[6405]-203**

**First Year M.E. (Electrical /Power Systems)  
POWER SECTOR ECONOMICS AND MANAGEMENT  
(2017 Pattern) (Semester - I) (503202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat labeled diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) Attempt any three from following. [18]**

- a) Explain the role of Planning Commission and Central Electricity Authority in power sector.
- b) Discuss tariff setting principles.
- c) Calculate net present value for a project with following cash flows. Take discounting factor as 10%. The cash flow for consecutive five years are as follows Rs. 50000, Rs. 60000, Rs. 70000, Rs. 80000 and Rs. 70000 with initial investment of Rs. 300000.
- d) Explain performance price cap regulation and rate of return regulation used in power system.
- e) Explain Whole Sale Competition and Retail Competition Models.
- f) Give salient features of Electricity Act 2003.

**Q2) a) What is market power. Why it is present? [8]**

b) Explain ancillary services and market to obtain it. [8]

OR

**Q3) a) How market efficiency is estimated? Discuss factors affecting the same.[8]**

b) Discuss Zonal pricing and Spot pricing methods. [8]

**P.T.O.**

- Q4) a)** What is congestion in power network? Explain congestion management. **[8]**
- b) Discuss different methods of transmission pricing. **[8]**

OR

- Q5) a)** Explain **[8]**
- i) Role of dispatch centres
- ii) ABT tariff
- b) What is arbitrage? Why does it exist? Explain with suitable examples. **[8]**



Total No. of Questions : 6]

SEAT No. :

PD5066

[6405]-204

[Total No. of Pages : 2

**M.E. - I (Electrical) (Power Systems)**  
**POWER SYSTEM MODELING**  
**(2017 Pattern) (Semester - I) (503203)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Total Three questions. Answer 1 question from Q1 or Q2, Q3 or Q4, and Q5 or Q6 each.*
- 2) *Assume suitable data if necessary.*
- 3) *Write down all the assumptions made.*
- 4) *Given  $F^{abc} = [P] F^{dq0}$ , where Park's transformation*

$$[P] = \begin{bmatrix} k_d \cos \theta & k_q \sin \theta & k_0 \\ k_d \cos \left( \theta - \frac{2\pi}{3} \right) & k_q \sin \left( \theta - \frac{2\pi}{3} \right) & k_0 \\ k_d \cos \left( \theta + \frac{2\pi}{3} \right) & k_q \sin \left( \theta + \frac{2\pi}{3} \right) & k_0 \end{bmatrix}$$

$\left( \text{where, } K_d = K_q = \sqrt{2/3} \text{ and } K_0 = \sqrt{1/3} \right)$

- Q1)** a) Explain with the help of suitable example, need of modeling in a power system? [6]
- b) With the help of suitable assumptions and diagram, derive the expression for stator to stator Mutual inductance (winding 'a' and 'c') for the synchronous machine model considering generator convention. Write each step in detail. [12]

OR

- Q2)** Derive the model 'pi' circuit medium transmission line. Draw its equivalent circuit diagram. Also comment about the symmetry of the model. Write down assumptions involved in it if any. [18]

**P.T.O.**

**Q3)** Explain with the help of suitable diagram working of brushless excitation control scheme of alternator. [16]

OR

**Q4)** Discuss with the help of suitable diagram working of static excitation control scheme of alternator. [16]

**Q5)** State need of Clarke's transformation and Kron's transformation and write about their applications in power system. Also write down their relationship with Park's transformation. [16]

OR

**Q6)** Develop the model of an induction motor with the help of the synchronous machine having one damper and field winding on 'd' axis and two damper windings on 'q' axis. Write down the assumptions and approximations involved in it. [16]



Total No. of Questions : 6]

SEAT No. :

**PD5067**

[Total No. of Pages : 1

**[6405]-205**

**First Year M.E. (Electrical /Power Systems)**

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - I) (503204)**

*Time :3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Questions from Q.1 or Q.2, Q.3 or Q.4 Q,5 or Q.6.
- 2) Figures to the right indicate full marks.

- Q1)** a) Explain the significance of the survey paper. [4]  
b) Describe the importance of a literature survey in defining the research problem. [4]  
c) Explain how to avoid plagiarism in research. [5]  
d) Elaborate hyperplane and convex set. [5]

OR

- Q2)** a) Explain the significance of research report writing. [4]  
b) What are the different types of literature? [4]  
c) Explain how the research can be commercialized. [5]  
d) Describe the standard form of the linear programming problem. [5]

- Q3)** a) Describe the characteristics of a standard Constrained problem. [8]  
b) Classify constraint optimization techniques. [8]

OR

- Q4)** a) What is the basic approach of the penalty function method. [8]  
b) Provide a detailed explanation of the convex programming problem. [8]

- Q5)** a) Describe particle swarm optimization with an example. [8]  
b) Provide a comparison of the genetic algorithm and simulated annealing. [8]

OR

- Q6)** a) Describe the ant colony optimization algorithm with an example. [8]  
b) Explain linear regression with mathematical expressions. [8]

\* \* \*

Total No. of Questions : 6]

SEAT No. :

**PD5068**

**[6405]-206**

[Total No. of Pages : 2

**First Year M.E. (Electrical /Power Systems)**

**POWER SYSTEM DYNAMICS**

**(2017 Pattern) (Semester - II) (503207)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable additional data, if necessary.*
- 5) *Use of non-programmable calculator is allowed.*

**Q1) a)** State and explain the methods of improving the transient stability. **[6]**

b) State the objective of Power System Stabilizers & explain tuning of PSS using **[12]**

- i) field test results
- ii) Analytical techniques

OR

**Q2) a)** Explain, in relation with Islanding **[6]**

- i) under frequency sensitivity and
- ii) under voltage trip sensitivity.

b) Describe the various steps in the investigation of dynamic stability of a multi machine power system. State any assumptions made. **[12]**

**Q3) a)** Obtain the system simulations of model 1.1. **[6]**

b) State the types of synchronous Machine models based on number of damper winding used. Derive the stator equations of machine model 1.1. **[10]**

OR

**P.T.O.**



- Q4) a)** Obtain the rotor flux linkage equations of model 2.2. **[6]**
- b) Derive the expressions for calculation of initial conditions for analysis of dynamics of synchronous machine connected to infinite bus bar. **[10]**

- Q5) a)** Explain the synchronizing & damping torque without AVR. **[6]**
- b) Derive the characteristic equation & apply the Routh- Hurwitz criterion with & without AVR of SIMB. **[10]**

OR

- Q6) a)** Obtain the stability criterion for the synchronizing & damping torque using fast excitation system. **[6]**
- b) Derive the state equations of for small signal simplified synchronous machine model. **[10]**

**x x x**

Total No. of Questions : 6]

SEAT No. :

**PD5069**

[Total No. of Pages : 1

**[6405]-207**

**First Year M.E. (Electrical) (Power System)**  
**POWER SYSTEM PLANNING & RELIABILITY**  
**(2017 Pattern) (Semester - II) (503208)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.No. 1 or Q.No. 2, Q.No. 3 or Q.No. 4, Q.No. 5 or Q.No.6.*
- 2) Figures to the right indicate full marks.*
- 3) Assume suitable data, if necessary.*
- 4) Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Explain weather sensitive forecasting in details. [6]  
b) Explain Markov process in details for reliability evaluation. [6]  
c) Explain steepest descent method for reliability evaluation. [6]

OR

- Q2)** a) Explain co-relation method of load forecasting. [6]  
b) A power system having 5 units of 100 MW each with of FOR - 0.03. The load model is linear in nature having maximum load of 400 MW and minimum load of 150 MW. Calculate the system LOLE. [6]  
c) Write short note on reliability cost. [6]

- Q3)** a) Explain the role of construction monitoring of transmission line projects. [8]  
b) Write short note on analysis of causes of failure of transmission line. [8]

OR

- Q4)** a) Explain causes of failure of transmission line in details. [8]  
b) Explain goals of short term transmission planning in details. [8]

- Q5)** a) Explain network re-configuration method in distribution systems. [8]  
b) Explain effects of dis-connectors, circuit breakers and isolators on distribution systems. [8]

OR

- Q6)** a) Explain the effect of weather in distribution system planning in details. [8]  
b) Explain effects of weather on distribution system. [8]



Total No. of Questions : 3]

SEAT No. :

**PD5070**

[Total No. of Pages : 1

**[6405]-208**

**First Year M.E. (Electrical) (Power Systems)  
HVDC AND FLEXIBLE AC TRANSMISSION  
(2017 Pattern) (Semester - II) (503209)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Assume Suitable data, if necessary.*
- 3) Figures to the right indicates full marks.*
- 4) Use of calculators is allowed.*

**Q1) Answer any three**

- a) Describe the harmonics in HVDC Systems. **[6]**
- b) Write short note on Twelve pulse converters used in HVDC system. **[6]**
- c) Explain the term angle of advance and its significance in inverter control. **[6]**
- d) Describe the difference between EHVAC and HVDC transmission. **[6]**
- e) Compare HVDC light (VSC) with HVDC classic (LCC) with advantages & disadvantages. **[6]**

**Q2) Answer Any two**

- a) Explain working principle, V-I characteristics & control schemes of STATCOM **[8]**
- b) Write the comparison of different SVC's in terms of performance, efficiency & limitations. **[8]**
- c) With the help of power angle curve explain how transient stability is improved with the help of series controllers. **[8]**

**Q3) Answer Any Two**

- a) Explain TCSC & effect of delay angle on its reactance. **[8]**
- b) What are the different modes of operation of UPFC? Give the details of working in each mode. **[8]**
- c) Explain how a UPFC is different than a simple VSC **[8]**



Total No. of Questions : 3]

SEAT No. :

PD-5071

[Total No. of Pages : 2

[6405]-209

**M.E. (Electrical) (Power Systems)**

**ADVANCED POWER SYSTEM PROTECTION**

**(2017 Pattern) (Semester - III) (603201)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicats full marks.*
- 4) *Assume suitable data wherever necessary.*
- 5) *Use of non-programmable scientific calculator is allowed.*

**Q1) Attempt any three :**

- a) What are the assumptions made for conducting short circuit studies of a power system network? **[6]**
- b) Classify faults of synchronous generator, Explain how earth fault protection is provided to synchronous generator. **[6]**
- c) Explain Fourier analysis and least error squared technique. **[6]**
- d) Draw and explain in detail equivalent circuit of protection PT. **[6]**
- e) A 1200/5, C400 with secondary resistance  $0.61\Omega$  and a  $2.0\Omega$  is the relay burden. Based on the accuracy classification, what is the maximum symmetrical fault current that may be applied to this CT without exceeding a 10% ratio error? **[6]**

**Q2) Attempt any two :**

- a) Explain the working of impedance relay, mho relay and quadrilateral relay for protection of transmission line with the help of R-X diagram. **[8]**
- b) Explain Fourier analysis and least error squared technique. **[8]**
- c) Explain phase comparison travelling wave relay scheme for protection of transmission line. **[8]**

**P.T.O.**

**Q3) Attempt any two :**

- a) Write a note on integrated operation of national power system in terms of features, size and trends. **[8]**
- b) Explain various feature involved in coordination of over current relays. **[8]**
- c) What is meant by Over-reach of distance relay? How this problem is solved in three - stepped distance protection? **[8]**



Total No. of Questions : 3]

SEAT No. :

**PD5072**

[Total No. of Pages : 1

**[6405]-210**

**S.Y.M.E. (Electrical) (Power Systems)**

**POWER QUALITY ASSESSMENT AND MITIGATION**

**(2017 Pattern) (Semester - III) (603202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All Questions are compulsory.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume suitable data wherever necessary.*
- 5) *Use of non-programmable scientific calculator is allowed.*

**Q1)** Attempt any three

- a) How power quality events are classified? [6]
- b) Explain source of voltage flicker & mitigation techniques. [6]
- c) Explain different types of voltages sags. Also explain phase angle jumps associated with voltage sag. [6]
- d) Explain major causes of voltage sag and also discuss economic impact of voltage sag. [6]
- e) Explain CBEMA and ITI curves. [6]

**Q2)** Attempt any two

- a) Explain the role of computer tools in harmonic analysis. [8]
- b) Explain with suitable diagram operation of shunt active filters. What is the role of coupling reactors? [8]
- c) Explain parallel resonance in presence of harmonics. How these can be avoided? [8]

**Q3)** Attempt any two

- a) With suitable diagram explain power quality monitors. [8]
- b) Discuss the need of power quality monitoring. Also discuss site selection for monitoring locations. [8]
- c) Explain different approaches used for power quality monitoring. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5073**

**[6405]-211**

[Total No. of Pages : 2

**F.Y.M.E. Computer Engg. (Artificial Intelligence and Data Science) (2020)**

**ARTIFICIAL INTELLIGENCE**

**(2017 Pattern) (Semester - I) (510501)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** Explain the evolution of Artificial Intelligence till current development. **[9]**

OR

**Q2)** Explain how Bayes theorem is applied in probabilistic reasoning with example. **[9]**

**Q3)** Differentiate between informed and uninformed searches. Give an uninformed search with example and pseudocode. **[9]**

OR

**Q4)** Explain reinforcement learning. **[9]**

**Q5) a)** How planning algorithm is applied in moving cargo on aeroplane from one airport to another airport. **[8]**

b) Explain the elements of First Order Logic. **[8]**

OR

**P.T.O.**

- Q6)** a) Explain the applications of AI in different fields. [8]
- b) What is sentiment analysis? Give the steps of using classification algorithm in sentiment analysis. [8]

- Q7)** a) How Wumpus world problem can be solved using knowledge based agent? [8]
- b) Explain the inference in FOL using any method. [8]

OR

- Q8)** a) Explain A\* algorithm with an example and state its limitations. [8]
- b) How genetic algorithm is applied for 8 Queens problem? [8]





Total No. of Questions : 10]

SEAT No. :

**PD5074**

[Total No. of Pages : 2

**[6405]-212**

**F.Y. M.E. Computer Engg. (Artificial Intelligence and  
Data Sciences) (Data Science) (2020) (AI)**

**VIRTUAL REALITY AUGMENTED REALITY  
(2017 Pattern) (Semester - II) (510504)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1) a)** What is Augmented Reality? How is Augmented Reality (AR) different from Virtual Reality (VR)? **[5]**

b) What technologies have been integrated into virtual reality? **[5]**

OR

**Q2) a)** Which are the different components are involved in System architecture of Augmented reality? **[5]**

b) What are the Applications of Augmented Reality? **[5]**

**Q3) a)** Explain Perception of Depth, Motion and Color. **[5]**

b) Write a note on Combining Sources of information **[5]**

OR

**Q4) a)** Explain Ray Tracing and Shading Models. **[5]**

b) How to Improve Latency and Frame Rates? **[5]**

**Q5) a)** How many AR toolkits available that can be integrated with Visual Studio for AR development? **[5]**

b) What are Major Software Components for Augmented Reality Systems? **[5]**

OR

**P.T.O.**

**Q6)** a) How can cameras be used in VR concept integration, and give some examples of camera-based VR systems? [5]

b) Explain Software used to Create Content for the Augmented Reality Application. [5]

**Q7)** a) List out different Marker types and explain in brief any two. [5]

b) Discuss about marker camera pose and identification [5]

OR

**Q8)** a) Explain feature based tracking [5]

b) Discuss on Interaction Patterns and techniques [5]

**Q9)** a) What are some common challenges in debugging VR projects, and how can developers overcome them? [5]

b) What is Google VR SDK, and what are its key features? [5]

OR

**Q10)a)** What types of motion tracking systems are commonly used in VR, and what are their advantages and limitations? [5]

b) Explain Features of ARToolkit [5]



Total No. of Questions : 8]

SEAT No. :

PD-5075

[Total No. of Pages : 2

**[6405]-213**

**M.E. (Artificial Intelligence & Data Science)**

**SOFT COMPUTING & DEEP LEARNING**

**(610501) (2017 Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

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

**Q1) a)** Compare Soft computing approach with hard computing approach. **[4]**

b) What are various fuzzy set operations? Explain 3 operations with examples. **[4]**

c) What are features of soft computing? **[2]**

**Q2) a)** Draw block diagram for Fuzzy Expert system and explain working of each Block. **[4]**

b) Explain any three fuzzy membership functions. **[4]**

c) Explain concept of Fitness function with example. **[2]**

**Q3) a)** Explain Neural network architectures: feedforward Neural Networks. **[4]**

b) Consider some suitable problems and compare necessity of Shallow neural networks and Deep neural networks for solving such a problems. **[4]**

c) What is perceptron? Explain its working. **[2]**

**P.T.O.**

- Q4)** a) Explain Learning Parameters of a feedforward neural network. [4]  
b) Discuss the vanishing gradient problem and ways to mitigate the same [4]  
c) Explain in short heuristics for faster training in deep learning [2]
- Q5)** a) What are features of GoogleNet, Discuss in detail. [4]  
b) What is the problem of the vanishing/exploding gradient. How RenNet Handles the problem of the vanishing/exploding gradient? [4]  
c) Write Any two applications of Convolutional Neural Networks. [2]
- Q6)** a) Explain how CNN can be applied to solve problem of Image classification for identifying cat vs dogs using CNN. [4]  
b) Design hybrid system for customer segmentation applying any suitable sequential model. [4]  
c) Explain how GRU is different than LSTM? [2]
- Q7)** a) Design a system for disease detection, applying Back propagation algorithm. [5]  
b) Design washing machine controller applying fuzzy techniques. [5]
- Q8)** a) Design solution to resolve traveling salesman problem by applying Genetic algorithm. [5]  
b) Explain how you will apply Fuzzy inference system for Air Conditioner. [5]



Total No. of Questions : 12]

SEAT No. :

**PD5076**

[Total No. of Pages : 2

**[6405]-214**

**S.Y. M.E. (Artificial Intelligence & Data Science)**

**SCALABLE DATA SCIENCE**

**(2017 Pattern) (Semester - III) (610502)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.
- 2) Neat Diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

**Q1)** Elaborate various challenges associated with big data analysis and discuss the use of blooms filter with suitable example. **[9]**

OR

**Q2)** Explain the concept of locality-sensitive hashing (LSH). **[9]**

**Q3)** Compare and contrast RDDs versus Data Frames. What are the benefits of using Data frames over RDDs? **[9]**

OR

**Q4)** Explain the concept of pipelining in Apache Spark and its role in optimizing data processing workflows. **[9]**

**Q5)** Explain the concept of leptokurtic and platykurtic distributions. **[9]**

OR

**Q6)** Describe in detail Apache Spark RDD and How parallelism in applying basic statistical calculations in Apache Spark RDD? **[9]**

**P.T.O.**

**Q7)** Compare and contrast the RDD, DataFrame, and Dataset APIs in Apache Spark. [9]

OR

**Q8)** Explain how Spark determines the default number of partitions for RDDs and DataFrames. [9]

**Q9)** Illustrate the application of structural operators in Graph X using a sample graph dataset. [9]

OR

**Q10)** Can Apache Spark handle graph processing? Justify your answer. [9]

**Q11)** Explain function name masking and column functions in SparkR. [5]

OR

**Q12)** Elaborate set operations using SparkR data frames. [5]



Total No. of Questions : 8]

SEAT No. :

PD5077

[Total No. of Pages : 2

[6405]-215

**First Year M.E. (Chemical Engineering)**  
**MATHEMATICAL AND STATISTICAL METHODS**  
**(2017 Pattern) (Semester - I) (509101)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer total 5 questions from the following.
- 2) Neat Diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1) a)** Solve the differential equation using power series. [5]

$$y' - y = 0$$

b) What does convergence of a power series mean? Why it is important? [5]

**Q2)** Solve the following heat equation using Fourier series. [10]

$$\frac{du}{dy} = c^2 \nabla^2 u$$

**Q3) a)** Obtain the Laplace's equation in two dimensions for heat flow. [5]

b) Find the Laurent series expansion of  $(z - 1)/z^2$  for  $|z - 1| > 1$ . [5]

**Q4) a)** Evaluate  $\int_0^{1+i} (x^2 + iy) dz$  along the paths  $y = x$  and  $y = x^2$ . [5]

b) Find the Laurent's expansion of  $f(z) = (7z - 2)/[(z + 1)z(z - 2)]$  in the region  $1 < z < 3$ . [5]

**Q5) a)** A random variable X has the following probability distribution. [5]

- i) Find K
- ii) Evaluate  $P(X < 2)$
- iii) Find the cdf of X
- iv) Evaluate the of X

|      |     |    |     |    |     |    |     |
|------|-----|----|-----|----|-----|----|-----|
| X    | -2  | -1 | 0   | 1  | 2   | 3  | 4   |
| P(X) | 0.1 | K  | 0.2 | 2K | 0.3 | 3K | 0.3 |

b) Compute the coefficient of correlation between X and Y using the following data. [5]

|   |   |    |    |    |    |    |
|---|---|----|----|----|----|----|
| X | 1 | 3  | 5  | 7  | 8  | 10 |
| Y | 8 | 12 | 15 | 17 | 18 | 20 |

P.T.O.

**Q6)** a) The mean of two single large samples of 1000 and 2000. members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from same population of standard deviation 2.5 inches (Test at 5% level of significance). [5]

b) What types of errors are associated in testing hypothesis. [3]

c) Distinguish between experimental and extraneous variables. [2]

**Q7)** a) To know the mean weights of all 10-year-old boys in Delhi, a sample of 225 is taken. The mean weight of the sample is found to be 67 pounds with a S.D. of 12 pounds. Can you draw any inference from it about the mean weight of the population? [6]

A normal population has a mean 0.1 and a S.D. of 2.1. Find the probability that the mean of sample of 900 members will be negative.

b) Discuss brief about test of goodness of fit. [4]

**Q8)** The following data resulted from an experiment to compare three burners  $B_1$ ,  $B_2$  and  $B_3$ . A Latin square design was used as the tests were made on 3 engines and were spread over days. [10]

|      | Engine 1  | Engine 2  | Engine 3  |
|------|-----------|-----------|-----------|
| Day1 | $B_1$ -16 | $B_2$ -17 | $B_3$ -20 |
| Day2 | $B_2$ -16 | $B_3$ -21 | $B_1$ -15 |
| Day3 | $B_3$ -15 | $B_1$ -12 | $B_2$ -13 |

Test the hypothesis that there is no difference between the burners.

Take  $F_{5\%}(v_1 = 2, v_2 = 2) = 19$

|      |      |      |      |
|------|------|------|------|
| A122 | B121 | C123 | B122 |
| B124 | C123 | A122 | D125 |
| A120 | B119 | D120 | C121 |
| C122 | D123 | B121 | A121 |





Total No. of Questions : 8]

SEAT No. :

**PD5078**

[Total No. of Pages : 2

**[6405]-216**

**First Year M.E. (Chemical)**

**PROCESS OPTIMIZATION**

**(2017 Pattern) (Semester - I) (509102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Assume suitable data, if necessary.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of electronic pocket calculator is allowed.*

**Q1)** Determine the best (L/D) dimension (length L and diameter D) ratio of a cylindrical pressure vessel that minimizes its capital costs based on minimum surface area of the vessel. The tank volume V is fixed and both the ends of the vessel are closed and flat. **[10]**

**Q2)** Optimize the given function:  $f(x) = x^2 + 54/x$ , to compute its minimum using the Gradient-based Newton Raphson method. Solve for three iterations from any appropriate initial guess of your choice. **[10]**

**Q3)** Enlist the optimization methods for one dimensional objective functions. Describe the interval halving method in detail with specific example. **[10]**

**Q4)** Describe the Cauchy's Steepest Descent method of multivariable optimization in detail along with the algorithm. **[10]**

**Q5)** Determine the optimum of the following Linear Programming problem: **[10]**

Maximize:  $f = x_1 + 3x_2$

Subject to:  $-x_1 + x_2 + x_3 = 1$

$x_1 + x_2 + x_4 = 2$

$x_i > 0$ , for  $i = 1, 2, 3, 4$

where  $x_3, x_4$  are slack variables

**P.T.O.**

**Q6)** Explain the concept of a penalty function in constrained optimization. Describe important penalty functions with equations. **[10]**

**Q7)** Write a short note on successive quadratic programming optimization method. **[10]**

**Q8)** Describe the differences between Genetic Algorithms (GA) and Traditional Optimization methods. **[10]**



Total No. of Questions : 8]

SEAT No. :

**PD5079**

**[6405]-217**

[Total No. of Pages : 2

**First Year M.E. (Chemical)**  
**ADVANCED SEPARATION PROCESSES**  
**(2017 Pattern) (Semester - I) (509103)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any Five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculators is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** a) What are recent advances in separation techniques based on size and surface properties? [5]

b) Discuss cross flow filtration and electro-filtration. [5]

**Q2)** a) Discuss details of spiral wound and hollow fibre membrane reactors & their relative merits. [8]

b) Explain Donnan dialysis. [2]

**Q3)** a) Describe in brief HPLC technique of analytical separation with a neat diagram. [8]

b) State applications of reverse osmosis. [2]

**Q4)** a) What are different ion chromatographic techniques? Enlist different applications of Ion Exchange Chromatography. [7]

b) Explain electrodialysis. [3]

**P.T.O.**

- Q5)** a) Explain design aspects of Nanofiltration and Microfiltration membrane processes. [8]
- b) What are types of adsorbents? [2]
- Q6)** a) Explain in brief supercritical fluid extraction with its advantages & disadvantages. [5]
- b) Explain Reactive absorption and distillation. [5]
- Q7)** a) Explain in brief Adductive Crystallisation with its applications. [5]
- b) Describe GPC technique of analytical separation. [5]
- Q8)** a) Discuss about the different types of materials used for membranes. [4]
- b) Explain in brief Foam separation technique. [6]



Total No. of Questions : 8]

SEAT No. :

PD-5326

[Total No. of Pages : 2

[6405]-218

**M.E. (Chemical Engineering)**  
**RESEARCH METHODOLOGY**  
**(2017 Pattern) (Semester - I) (509104)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** What is Research and explain the Process with a neat sketch? **[5]**

b) Discuss a fundamentals of time series analysis and spectral analysis along with one application in research work. **[5]**

**Q2) a)** Compute the coefficient of data between X and Y using following data**[5]**

|   |   |    |    |    |    |    |
|---|---|----|----|----|----|----|
| X | 1 | 3  | 5  | 7  | 8  | 10 |
| Y | 8 | 12 | 15 | 17 | 18 | 20 |

b) Explain the importance of research. **[5]**

**Q3) a)** Explain One-way and Two-way ANOVA with suitable example. **[5]**

b) Justify “Design of experiments generates information on the effect of various factors have on a response variable”. **[5]**

**Q4) a)** What do you mean by a ‘case study’? Explain the steps involved in designing a case study to solve a research problem. **[5]**

b) Write an explanatory note on time series analysis of probability distribution with a suitable example. **[5]**

**P.T.O.**

- Q5)** a) Discuss the steps involved in publishing a research idea in a journal. [5]  
b) A sample of 10 is drawn randomly from a certain population. The sum of the squared deviation from the mean of the given sample is 50. Test the hypothesis that the variance of the population is 5 at 5 percent level of significance. [5]
- Q6)** a) Explain citation methods for manuscript writing. [5]  
b) Please write citation by various methods for manuscript writing. [5]
- Q7)** a) Write a note on the layout and content of research report. [5]  
b) Explain the scenario of Copyrights in India. [5]
- Q8)** a) Write an explanatory note on “interdisciplinary research”. [5]  
b) Explain the importance of a Research hypothesis. [5]



**First Year M.E. (Chemical)**  
**ADVANCED TRANSPORT PHENOMENA**  
**(2017 Pattern) (Semester - II) (509107)**

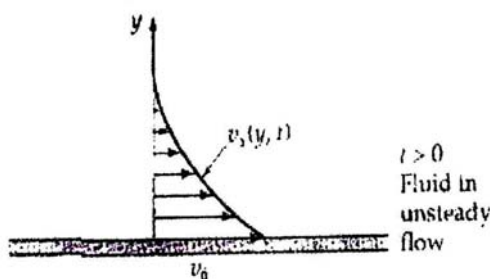
Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates:*

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary.

**Q1)** A semi-infinite body of liquid with constant density and viscosity is bounded below by a horizontal surface (the  $xz$ -plane). Initially the fluid and the solid are at rest. Then at time  $t = 0$ , the solid surface is set in motion in the positive  $x$  direction with velocity  $v_0$  as shown in Fig. Find the velocity  $v$ , as a function of  $y$  and  $t$ . There is no pressure gradient or gravity force in the  $x$  direction, and the flow is presumed to be laminar. **[10]**



**Q2)** Develop the dimensionless wall heat flux relation for the temperature distribution for turbulent flow in tubes equipped with an heating coil which provide a constant wall flux  $q_0$ . **[10]**

**Q3)** Gas A is absorbed by a stationary liquid solvent S, the latter containing solute B. Species A reacts with B in an instantaneous irreversible reaction according to the equation  $aA + bB \rightarrow \text{Products}$ . It may be assumed that Fick's second law adequately describes the diffusion processes, since A, B, and the reaction products are present in 'S' in low concentrations. Obtain expressions for the concentration profiles. **[10]**

- Q4)** A copper wire, 5 mm in diameter and 15 ft long, has a voltage drop of 0.6 volts. Find the maximum temperature in the wire if the ambient air temperature is 25°C and the heat transfer coefficient  $h$  is 5.7 Btu/hr. ft<sup>2</sup> . F; Compare the temperature drops across the wire and the surrounding air. **[10]**
- Q5)** Discuss the macroscopic mass, momentum and energy balance for multicomponent System. **[10]**
- Q6)** Derive the expression for velocity distributions with more than one independent variables. **[10]**
- Q7)** A liquid 'B' is flowing very slowly around a spherical bubble of gas 'A' of radius 'R' (creeping flow). Develop the relation for the determination of the rate of mass transfer of 'A' into the surrounding fluid ' $NA_0$ ', if the solubility of gas 'A' in liquid 'B' is  $CA_0$ . State the assumptions. **[10]**
- Q8)** a) Discuss in Detail Chilton & Colburn J Factor analogy in brief. **[5]**
- b) Discuss the analogy between heat, mass and momentum transfer. **[5]**

**x x x**



[6405]-220

**First Year M.E. (Chemical Engg.)**  
**ADVANCED PROCESS CONTROL**  
**(2017 Pattern) (Semester - II) (509108)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.
- 2) Assume suitable data, if necessary.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Use of electronic pocket calculator is allowed.

**Q1)** What is Degrees of Freedom Analysis of a Dynamic Process from Control point of view? Determine the degree of freedom of a Liquid Level in Tank system by developing its dynamic model and listing all the input, output variables. [10]

**Q2)** Explain the concept of Process Identification. State the differences between theoretical modeling and process identification (empirical modeling). [10]

**Q3)** a) Explain the concept of Stability of a dynamic process in detail. [4]  
 b) Discuss about the Routh-Hurwitz stability criteria and determine the stability of a system with the following characteristic equation using the Routh stability criteria. [6]

$$CE = s^4 + 4s^3 + 6s^2 + 2s + 3 = 0 .$$

**Q4)** Develop the mathematical model of the 2-Tank Liquid Level system as shown in the Figure. Convert the basic model into MIMO state-space form. [10]

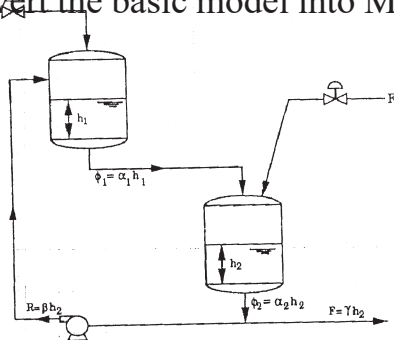


Fig. Two-Tank Liquid Level system.

P.T.O.

**Q5)** Discuss about the Singular Value Analysis of MIMO systems along with relevant equations. State how the Condition Number (CN) of a MIMO system determines the level of ill-conditioning of the system? [10]

**Q6)** What are Digital Control systems? List its advantages over the analog control systems. Derive the discrete-time model of a dynamic 1<sup>st</sup> order process. [10]

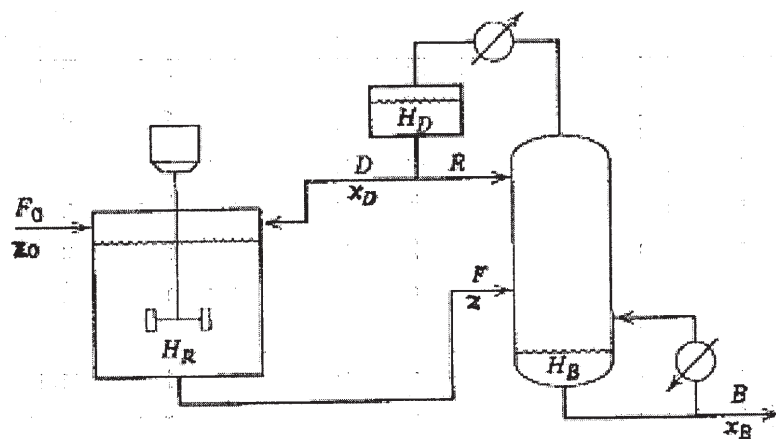
**Q7)** Discuss about the following Model-based Control Systems with important relations: [10]

- a) Direct Synthesis (DS)
- b) Generic Model Control (GMC)
- c) Internal Model Control (IMC)

**Q8) a)** What are sensitivities of output (controlled) variable changes to input disturbance changes for a process? How they are related to the Snowball effect when Recycle streams are present in a process? [3]

- b) The following figure shows a hypothetical plant having a CSTR and a product separator(Binary distillation column) with a Recycle.where,  $F_0$ = Feed flowrate to reactor,  $z_0$ =Reactor feed composition,  $H_R$  = Reactor liquid level,  $F$  = Reactor outlet flowrate =  $k_R H_R$ ,  $D$  = Distillate flowrate (recycled back to reactor),  $R$  = Reflux flowrate,  $B$  = Bottoms flowrate and  $x_B$  = Bottoms composition.

Develop steady-state material balance relations for the Reactor and the Distillation Column and prove that the distillate flowrate  $D$  is highly sensitive to feed flowrate  $F_0$  and feed composition  $Z_0$  when the reactor liquid level is controlled by manipulating the reactor effluent stream. [7]



Total No. of Questions : 8]

SEAT No. :

**PD5082**

[Total No. of Pages : 2

**[6405]-221**

**First Year M.E. (Chemical)**

**ADVANCED REACTION ENGINEERING**

**(2017 Pattern) (Semester - II) (509109)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Uniform-sized spherical particles  $\text{UO}_3$  are reduced to  $\text{UO}_2$  in a uniform environment with the following results: **[10]**

|        |       |       |       |       |       |
|--------|-------|-------|-------|-------|-------|
| t (hr) | 0.180 | 0.347 | 0.453 | 0.567 | 0.733 |
| $X_B$  | 0.45  | 0.68  | 0.80  | 0.95  | 0.98  |

If reaction follows the SCM, find the controlling mechanism and a rate equation to represent this reduction.

**Q2)** Develop the RTD for the plug flow reactor and a single ideal stirred tank reactor with known mixing conditions **[10]**

**Q3)** Explain in detail modelling diffusion with reaction. **[10]**

**Q4)** Derive the expression for the effectiveness factor of the single cylindrical pore of the catalyst. **[10]**

**Q5)** Explain Trickle bed reactor model. **[10]**

**P.T.O.**

**Q6)** Explain Rideal Eiley Model in brief **[10]**

**Q7)** Write a short note on **[10]**

- a) Residence Time Distribution
- b) Weisz Prater Criterion for internal diffusion.

**Q8)** Write a short note on **[10]**

- a) Mears' Criterion for external diffusion
- b) Fixed Bed Reactor



Total No. of Questions : 8]

SEAT No. :

PD-5083

[Total No. of Pages : 2

**[6405]-222**  
**M.E. (Chemical)**  
**PROCESS MODELING & SIMULATION**  
**(509113) (2017 Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any 5 questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Assume suitable data, if necessary.*
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is permitted.*

**Q1)** Define Model and also give its applications in chemical engineering. **[10]**

**Q2)** What are Unsteady State Models? Explain it with suitable example. **[10]**

**Q3)** Explain Factorial Design of Experiment. **[10]**

**Q4)** Develop a model for an absorption unit. **[10]**

**Q5)** Write an assumption for a model of Extractor & develop a model. **[10]**

**Q6)** Give the simulation scheme for PFR. Explain it with a case study. **[10]**

**P.T.O.**

**Q7)** A patient just had surgery and is required to have at least 81 units of drug D1 and 120 units of drug D2 each day. Assume that an over dosage of either drug is harmless. Each gram of substance M contains 10 units of D1 and 8 units of drug D2 and each gram of substance N contains 2 units of D1 and 4 units of D2. Now suppose that both M and N contain an undesirable drug D3, 3 units per gram in M and 1 unit per gram in N. Find how many grams of substances M and N should be taken in order to meet the requirements and minimize the intake of D3 at the same time. **[10]**

**Q8)** Explain Classification of partial differential equations. **[10]**



Total No. of Questions : 8]

SEAT No. :

PD5084

[Total No. of Pages : 2

[6405]-223

S.Y.M.E. (Chemical Engg.)

**ADVANCED THERMODYNAMICS**  
**(2017 Pattern) (Semester - III) (509114)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Assume suitable data, if necessary.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of electronic pocket calculator is allowed.*

**Q1)** Discuss about the following Local-Composition Models applicable for Liquid-Liquid or Vapour-Liquid Phase Equilibrium: **[10]**

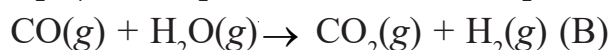
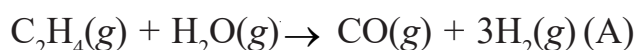
- a) NRTL (Non-Random-Two-Liquid) Model
- b) UNIQUAC (Universal Quasi-Chemical) Model
- c) UNIFAC (Universal Quasi-Chemical Functional Group Activity Coefficient) Model

**Q2)** a) Describe the common three types of binary LLE solubility diagrams in detail. **[5]**

- b) Derive the following relation for a 2-phase binary LLE system at constant pressure: **[5]**

$$\ln \frac{\gamma_2^\alpha}{\gamma_2^\beta} = \ln \frac{1 - x_1^\beta}{1 - x_1^\alpha}$$

**Q3)** One mole each of  $C_2H_4$  and  $H_2O$  is feed to an equilibrium reactor at 1000 K and 1 bar, where the following reactions occur: **[10]**



The equilibrium constants for the reactions (A) and (B) are:  $K_A = 30$  and  $K_B = 1.5$ . Assuming ideal gas behaviour of the reaction gas mixture determine the equilibrium composition of the reactor effluent. Assume the conversion of  $H_2O$  in reaction (A) to be 0.798.

**P.T.O.**

**Q4)** Discuss about the effects of following factors on the reaction equilibrium from thermodynamic point of view: [10]

- a) Pressure for gas-phase reactions
- b) Temperature
- c) Effect of inerts concentration

**Q5)** What is an Ensemble? Discuss the types of Statistical Ensembles in detail.[10]

**Q6) a)** Explain the concept of Available and Unavailable Energies for a heat engine in terms of a T-S diagram. [5]

b) Discuss about Chemical Affinity and the First Law of Thermodynamics.[5]

**Q7)** Discuss the effect of curvature on surface thermodynamic properties by deriving appropriate relations. [10]

**Q8)** Write a short note on the thermodynamics of Biochemical systems. [10]





Total No. of Questions : 8]

SEAT No. :

**PD5085**

[Total No. of Pages : 2

**[6405]-224**

**M.E. - I (Environmental Engineering) (Chemical)**  
**APPLIED STATISTICS FOR ENVIRONMENTAL ENGINEERS**  
**(2017 Pattern) (Semester - I) (509131)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator is allowed.*
- 5) Assume suitable data, if necessary.*

**Q1)** Explain residual error in regression model with suitable illustration. **[10]**

**Q2)** An analysis of monthly wages paid to the workers to two firms A & B belonging to the same industry given following results. **[10]**

| Items                    | Firm A     | Firm B     |
|--------------------------|------------|------------|
| No. of workers           | 500        | 600        |
| Average daily wage       | Rs. 186=00 | Rs. 175=00 |
| Variance of distribution | 81         | 100        |

Calculate :

- a) The average daily wage
- b) The variance of distribution of wages of all workers in firm A & B taken together.

**Q3)** Discuss the procedure for calculating the mean from ungrouped data : **[10]**

**Q4)** What is population standard deviation. **[10]**

**P.T.O.**

- Q5)** a) Distinguish between statistics and parameters. [5]  
b) State the steps in constructing Latin square. [5]
- Q6)** What is transportation model explain in detail. [10]
- Q7)** Explain purposive sampling and random sampling. [10]
- Q8)** Explain graphical sensitivity analysis in the light of simplex method. [10]



Total No. of Questions : 8]

SEAT No. :

**PD5086**

[Total No. of Pages : 1

**[6405]-225**

**M.E. - I (Chemical/Environmental Engineering)**

**ENVIRONMENTAL MANAGEMENT**

**(2017 Pattern) (Semester - I) (509132)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Explain various approaches for Environmental Management in detail. [5]  
b) Discuss the various advantages of Environmental Auditing. [5]

- Q2)** a) Discuss Green funding and taxes. [5]  
b) Explain EIA evaluation in India. [5]

- Q3)** a) What is 74<sup>th</sup> amendment of the constitutions. [5]  
b) What are the impacts of Economical sub-systems of environment on Business? [5]

- Q4)** a) Explain how a rule is notified and gazetted. [5]  
b) What are the different environmental acts? [5]

- Q5)** Explain in detail the difference between Regulation, Law and Notification Bills. [10]

- Q6)** a) Discuss the various steps in rule notification. [5]  
b) Discuss the various factory acts passed by Indian government. [5]

- Q7)** a) Explain the role of Maharashtra Pollution Control Board for sustainable growth. [5]  
b) Discuss carbon trading. [5]

- Q8)** a) Discuss general features of annual report of Ministry of Environment for current year. [5]  
b) Write short note on Ministry of Environment and Forests. [5]



Total No. of Questions : 8]

SEAT No. :

**PD5087**

**[6405]-226**

[Total No. of Pages : 1

**First Year M.E. (Chemical - Environmental)**

**ENVIRONMENTAL CHEMISTRY**

**(2017 Pattern) (Semester - I) (509133)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any 5 questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of logarithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam table is allowed.*
- 5) Assume suitable data, if necessary.*

**Q1)** What is COD? Explain its environmental significance and determination Technique. **[10]**

**Q2)** What is the role of Chemical kinetics in Environmental Engineering? Explain it in detail. **[10]**

**Q3)** How to do the Reclamation of oily soil? **[10]**

**Q4)** Explain the formation of photochemical smog? In which region of India it is been observed and why? **[10]**

**Q5)** What is CO<sub>2</sub> capture mechanism? **[10]**

**Q6)** What are the promising areas of Environmental Sciences & Engineering?**[10]**

**Q7)** What is Anion exchange capacity? How to determine it. **[10]**

**Q8)** What are different effects of Air pollutants on materials? **[10]**



Total No. of Questions : 8]

SEAT No. :

**PD5088**

[Total No. of Pages : 2

**[6405]-227**

**First Year M.E. (Environmental Engg./Chemical Engg.)**

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - I) (509134)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** Discuss about the various types of Research and elaborate on the key differences between the “Applied” and “Fundamental” types of research. **[10]**

**Q2)** Explain the various steps in Research Process in detail. **[10]**

**Q3)** What is Factorial Designs? **[10]**

Explain the:

- a) Simple Factorial Design
- b) Complex Factorial Design.

**Q4) a)** The foreman of a mining company has estimated the average quantity of iron ore extracted to be 36.8 tons per shift and the sample standard deviation to be 2.8 tons per shift, based upon a random selection of 4 shifts. Construct a 90 percent confidence interval around this estimate. Table Data required : Critical value of ‘t’ for 90 percent confidence interval or at 10 percent level of significance is 2.353 for 3 degree of freedom. **[3]**

- b) What should be the size of the sample if a simple random sample from a population of 4000 items is to be drawn to estimate the percent defective within 2 percent of the true value with 95.5 percent probability? What would be the size of the sample if the population is assumed to be infinite in the given case? **[7]**

Data given:

$z = 2.005$  (as per table of area under normal curve for the given confidence level of 95.5%), Assume  $p = 0.02$

**P.T.O.**

- Q5)** Describe the mathematical method for one-way (or single factor) ANOVA technique. **[10]**
- Q6)** Explain the fundamentals of Genetic Algorithms and its role in Research. **[10]**
- Q7)** Write a short note on Research Report Preparation. **[10]**
- Q8)** Discuss about Licensing and transfer of technology in Intellectual Property Rights. **[10]**

\* \* \*

Total No. of Questions : 8]

SEAT No. :

**PD5089**

[Total No. of Pages : 2

**[6405]-228**

**First Year M.E. (Chemical)/(Environmental Engineering)**

**WASTE WATER TREATMENT & DESIGN**

**(2017 Pattern) (Semester - II) (509137)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any 5 questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.
- 5) Assume suitable data, if necessary.

**Q1)** Explain configurations for ideal and nonideal reactors. **[10]**

**Q2)** A treated wastewater with a flow rate of 1000 L/min is to be treated with PAC to reduce the concentration of residual organics measured as TOC from 5 to 1 mg/L. The Freundlich adsorption isotherm parameters were developed. Assuming the following data apply, determine the PAC requirements to treat the wastewater flow. If the PAC costs Rs. 0.50/ kg, estimate the annual cost for treatment, assuming the PAC will not be regenerated. **[10]**

Compound - mixed organics.

Initial Concentration  $C_0 = 5$  mg/L

Final Concentration  $C_g = 1$  mg/L

GAC density = 450 g/L

Freundlich capacity factor,  $k_f = 150$  (mg/g) (L/mg) $^{1/n}$

Freundlich intensity parameter,  $1/n = 0.5$

**Q3)** a) Explain PSA in the process of adsorption. **[5]**

b) Explain the design of GAC contractors. **[5]**

**Q4)** Determine the theoretical amount of air required at 20 °C to reduce the ammonia concentration from 40 to 1 mg/L in a treated wastewater with a flow rate of 4000 m<sup>3</sup>/d. Assume the pH of the wastewater has been increase to a value of 11, the Henry's constant for ammonia at 20 °C is 0.75 atm., and the air entering the bottom of the tower does not contain any ammonia. **[10]**

**P.T.O.**

- Q5)** a) How activated carbons are prepared and explain carbon regeneration and reactivation? [5]  
b) Explain the concept of uptake capacity. [5]
- Q6)** a) Discuss process design consideration for rotating biological contactors (RBC). [5]  
b) What are the biological properties of waste. [5]
- Q7)** Determine the capacity of a chlorinator for a treatment plant with an average wastewater flow of  $1000 \text{ m}^3/\text{d}$ . The peak daily factor for the treatment plant is 3.0 and the maximum required chlorine dosage is to be 20 mg/L. [10]
- Q8)** a) Explain Principle and working of Trickling filter. [5]  
b) Discuss the general design consideration for anaerobic treatment process. [5]





Total No. of Questions : 8]

SEAT No. :

**PD5090**

[Total No. of Pages : 1

**[6405]-229**

**First Year M.E. (Environmental Engg.) (Chemical Engg.)**

**SOLID WASTE MANAGEMENT**

**(2017 Pattern) (Semester - II) (509138)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any 5 questions.*
- 2) Neat diagram must be drawn wherever necessary*
- 3) Assume suitable data, if necessary.*

**Q1)** Explain the various types of solid waste. **[10]**

**Q2)** Illustrate the compositions of solid waste. **[10]**

**Q3)** Explain the transportation of the solid waste in detail. **[10]**

**Q4)** Give the various types of solid waste collection system and explain the general consideration for waste storage at source. **[10]**

**Q5)** Explain the typical material recovery facility for a commercial solid waste. **[10]**

**Q6)** Explain the biomethanation and its impact on the environment. **[10]**

**Q7)** Explain the energy recovery process from the solid waste. **[10]**

**Q8)** Explain the various landfilling methods in detail. **[10]**



Total No. of Questions : 8]

SEAT No. :

**PD5339**

[Total No. of Pages : 1

**[6405]-230R**

**First Year M.E. Environmental Engineering (Chemical)**

**INDUSTRIAL WASTE TREATMENT**

**(2017 Pattern) (Semester-II) (509139)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any 5 Questions.*
- 2) Assume suitable data, if necessary.*
- 3) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is permitted*

**Q1)** Explain the treatment techniques for removal of the following pollutants from Industrial waste: **[10]**

- a) Phosphates
- b) Oil & Grease.

**Q2)** Write short notes Plate and frame Filters. **[10]**

**Q3)** Explain Primary treatments for industrial Wastewater. **[10]**

**Q4)** What are clean up and cleaner technologies? Explain with proper examples. **[10]**

**Q5)** Explain the treatment techniques for the removal of Heavy Metals from industrial wastewater with neat flow diagram. **[10]**

**Q6)** Define BOD. Explain the procedure to determine BOD. What are the limitations of BOD test? **[10]**

**Q7)** Explain the concept, objective, design and cost-benefit analysis of common STP plant. **[10]**

**Q8)** Write notes on: Fluidized Bed Reactor. **[10]**



Total No. of Questions : 8]

SEAT No. :

PD-5092

[Total No. of Pages : 2

[6405]-231

**M.E. (Chemical - Environmental Engineering)**  
**REMOTE SENSING AND GIS APPLICATION IN**  
**ENVIRONMENTAL ENGINEERING**  
**(2017 Pattern) (Semester - III) (509143)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** What are the limitations of GIS? Explain it with case study. **[10]**

**Q2)** Explain how GIS is useful in monitoring water pollution studies? **[10]**

**Q3)** a) What is FCC and explain its significance in identification of surface object? **[5]**

b) Explain Digital system of remote sensing. **[5]**

**Q4)** Explain the principle of classifying Imaging sensor. Explain thermal sensing system. **[10]**

**Q5)** Explain concept of G.I.S. and state any four components of G.I.S. **[10]**

**Q6)** Explain in brief about the various satellites in orbit and their sensors. **[10]**

**P.T.O.**

**Q7)** What is remote sensing? Explain its application? Discuss Passive Remote Sensing system. **[10]**

**Q8)** Explain different GIS software's and explain one of them with suitable example. **[10]**



Total No. of Questions : 8]

SEAT No. :

**PD5093**

**[6405]-232**

[Total No. of Pages : 2

**S.Y.M.E. (Chemical (Environmental ))**  
**INDUSTRIAL POLLUTION PREVENTION & CLEANER**  
**PRODUCTION**  
**(2017 Pattern) (Semester - III) (509144)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of calculator is allowed.*
- 5) Assume suitable data if necessary.*

**Q1)** Explain the importance of industrialization and sustainable development. **[10]**

**Q2)** a) Discuss the various key indicators for the sustainability. **[5]**

b) Explain the cleaner technology and cleaner production concept. **[5]**

**Q3)** a) Enlist the Environmental Management Hierarchy for pollution control and cleaner production. **[5]**

b) Discuss the historical revolution of pollution prevention and control. **[5]**

**Q4)** a) Discuss the source reduction techniques in pollution control in chemical industries. **[5]**

b) Explain the applications of Internet Information pollution prevention and cleaner production. **[5]**

**P.T.O.**

**Q5)** Explain the pollution prevention and control by following ways. **[10]**

- a) Reuse
- b) Recover
- c) Recycle
- d) Raw material substitution

**Q6)** Discuss in detail the role of total cost analysis in pollution prevention and cleaner production program. **[10]**

**Q7) a)** Write down about the Pollution Prevention and Cleaner Production Awareness Plan. **[5]**

b) Write a note on Environmental Audit. **[5]**

**Q8)** Write short notes on.

a) International Environmental Standards- ISO 14001 **[5]**

b) Life cycle costing **[5]**



Total No. of Questions : 8]

SEAT No. :

**PD5094**

[Total No. of Pages : 2

**[6405]-233**

**First Year M.E. (Civil-Construction & Management)**  
**APPLICATION OF STATISTICAL METHODS IN CONSTRUCTION**  
**(2017 Pattern) (Semester - I) (501021)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figure to the right indicates full marks.
- 4) Assume suitable data, if necessary and clearly state.
- 5) Use of cell phone is prohibited in the examination hall.
- 6) Use of electronic pocket calculator is allowed.

- Q1)** a) Define probability and state its rules. **[4]**  
b) As only 3 students came to attend the Class today, find the Probability for exactly 4 students to attend the Classes tomorrow. solve with Poisson Distribution method. **[5]**

OR

- Q2)** a) What is the use of standard deviation in Quality Control of concreting?**[5]**  
b) What do you mean by sampling and what are the various types of sampling. **[4]**

- Q3)** a) Explain the significance based t-distribution. **[4]**  
b) A Civil Engineer is analyzing traffic accident at a particular intersection. Based on historical data, accident Occur at an average rate of 2 accident Per 5 week. Calculate the probability of the following scenarios using the Poisson Distribution **[5]**  
i) Exactly 3 accidents occur in a week  
ii) Almost 1 accident occurring in a day

OR

- Q4)** a) Discuss the role of effect size measures in interpreting the results of hypothesis tests and their significance in practical decision-making processes. **[5]**  
b) Calculate the Pearson corelation coefficient for the Following data **[4]**

|   |   |   |   |   |    |
|---|---|---|---|---|----|
| X | 2 | 4 | 6 | 8 | 10 |
| Y | 3 | 5 | 7 | 9 | 11 |

**P.T.O.**

- Q5) a)** A Civil Engineer is studying the waiting time of vehicles at a toll booth during peak hours. The engineer randomly selects 50 vehicles and records their waiting times (in minutes) as follows: **[8]**

8, 6, 10, 7, 5, 9, 11, 8, 7, 6, 10, 12, 7, 6, 8, 9, 10, 5, 8, 7, 6, 9, 11, 8, 6, 10, 7, 5, 9, 11, 8, 7, 6, 10, 12, 7, 6, 8, 9, 10, 5, 8, 7, 6, 9, 11, 8, 6, 10, 7.

Using waiting line models, determine the average Waiting time, the average number of vehicles waiting in line and the average number of vehicles in the system at the toll booth.

- b)** What is simulation explain with suitable example and what is significance of random numbers? **[8]**

OR

- Q6) a)** What do you mean by Downtime of equipment. How can it hamper on company profit. Explain with example. **[8]**

- b)** Explain Cox and Nunnally model in brief? **[8]**

- Q7) a)** Explain the “sensitivity Analysis mathematical model” in detail. **[8]**

- b)** How do mathematical models based on probabilistic and statistical Methods contribute to risk identification analysis and mitigation in civil engineering projects? **[8]**

OR

- Q8) a)** “Ambika Agrotech” monthly demands 1000 bags of Urea. The unit cost of bag is Rs. 200/- and inventory carrying cost per unit per annum is 20% of average inventory cost. If the cost of procurement is Rs. 70 /- **[8]**

Determine:

- i) EOQ
  - ii) Number Order per annum
  - iii) Total cost of purchasing
- b)** Describe in brief EOQ in Civil Engineering? **[8]**





Total No. of Questions : 8]

SEAT No. :

**PD5095**

[Total No. of Pages : 2

**[6405]-234**

**First Year M.E. (Civil-Construction & Management)**  
**MANAGEMENT & PROJECT PLANNING IN CONSTRUCTION**  
**(2017 Pattern) (Semester - I) (501022)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if required & state clearly.*
- 5) *No cell phones allowed.*
- 6) *Use of electronic pocket calculator allowed.*

- Q1)** a) After the pandemic period, write the SWOT analysis of construction industry. **[4]**
- b) Explain importance of project management consultant in construction project. **[5]**

OR

- Q2)** a) Write a note on “Line of Balance Technique”. **[4]**
- b) Following table shows activities of a construction project. **[5]**

| Name of activity | Immediate Predecessor | Duration (Days) |
|------------------|-----------------------|-----------------|
| A                | -                     | 4               |
| B                | -                     | 3               |
| C                | A                     | 6               |
| D                | A                     | 5               |
| E                | B                     | 4               |
| F                | C                     | 3               |
| G                | C, D, E               | 7               |
| H                | F, G                  | 5               |

- i) Draw a CPM network. Show the critical path & find out the total project duration.
- ii) Calculate :
  - 1) Total float
  - 2) Free float
  - 3) Independent float
  - 4) Interfering float for each activity

**P.T.O.**

- Q3) a)** What is meant by network crashing? Explain step by step procedure of crashing network. [4]  
b) Explain factors to be considered while selecting a job for work study.[5]

OR

- Q4) a)** Explain in brief the application of MIS in construction. [5]  
b) Write a note on “Micro motion study”. [4]

- Q5) a)** Enlist & Explain in detail various causes of trench collapse during excavation work. [8]  
b) Write notes on.  
i) Personal protective equipments. [4]  
ii) General causes of accidents on construction sites. [4]

OR

- Q6) a)** What is HAZOP Technique? Explain HAZOP analysis process in detail.[8]  
b) Write detail note on “Minimum Wages Act”. [8]

- Q7) a)** What are different types of incentives? Explain the prerequisites for an effective incentive system. [8]  
b) Write notes on  
i) Application of BIM in construction. [4]  
ii) Application of Artificial Neural Network in construction. [4]

OR

- Q8) a)** Explain any two types of incentives in detail. [8]  
b) Write notes on.  
i) Application of Genetic Algorithm in construction. [4]  
ii) Application of fuzzy logic Technique in construction. [4]



Total No. of Questions : 8]

SEAT No. :

**PD5096**

**[6405]-235**

[Total No. of Pages : 2

**First Year M.E. (Civil - Construction & Management)**

**CONSTRUCTION TECHNOLOGY**

**(2017 Pattern) (Semester - I) (501023)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary and clearly state.*
- 5) Use of cell phone is prohibited in the examination hall.*
- 6) Use of electronic pocket calculator is allowed.*

**Q1) a)** Write a note on micro tunneling. **[4]**

b) What are the objectives of dewatering? Explain well point system with neat sketch. **[5]**

OR

**Q2) a)** Explain the factors affecting soil compaction. Explain any one method of soil compaction in detail. **[5]**

b) Explain jet grouting technique and its applications. **[4]**

**Q3) a)** Write a short note on self compacting concrete. **[4]**

b) Explain the process of construction of micropiles. **[5]**

OR

**Q4) a)** Explain in detail operations involved in construction of diaphragm wall. **[5]**

b) Explain in detail tremie method of underwater concreting with suitable diagram. **[4]**

**P.T.O.**

- Q5)** a) Explain the operations involved in sheet pile cofferdam construction for a bridge pier. [8]
- b) Explain the cofferdam wall by ICOS method in detail. [4]
- c) Explain the various types of cofferdams with their advantages. [4]

OR

- Q6)** a) Explain the operations involved in diaphragm wall construction using bentonite slurry used for pedestrian tunnel. [8]
- b) Explain the components of cofferdam with neat sketch. [4]
- c) Explain the soldier construction method in detail. [4]
- Q7)** a) What is a Well foundation? Explain the different shapes of well foundation with their merits and demerits. [8]
- b) Explain the construction procedure of box caisson with neat sketch. [8]

OR

- Q8)** a) Explain the construction procedure of pneumatic caisson with neat sketch. [8]
- b) Explain the various components of well foundation with neat sketch. [8]



Total No. of Questions : 10]

SEAT No. :

**PD5097**

[Total No. of Pages : 2

**[6405]-236**

**First Year M.E. (Civil)/(Construction & Management)**

**TQM IN CONSTRUCTION**

**(2017 Pattern) (Semester - I) (501024)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator is allowed.*

- Q1)** a) Explain in details training is effective for an employee within the company.  
b) Explain in details checklist necessary for RCC retaining wall work, for commonly used formats for improve quality work.

OR

- Q2)** a) Explain in details checklist necessary for RCC Slab work, for commonly used formats improve quality work.  
b) Explain in details on and off-the-job training in construction industry.

- Q3)** a) Explain in details quality circle activities be integrated into existing organizational structures and processes in construction industry.  
b) Explain in details success of quality circles be measured and evaluated.

OR

- Q4)** a) Explain in details the limitations of quality circles.  
b) Explain in details difference between ISO 9004 and 9001.

- Q5)** a) Explain in details “Effectiveness of Quality Management System (QMS) on Construction Projects”.  
b) Explain in details continuous improvement an important aspect of applying quality standards?

OR

**P.T.O.**

- Q6)** a) Explain in details the role of a civil engineer in Total Quality Management.
- b) Explain in details the 5 important factors of TQM?

- Q7)** a) Explain in details “Workmanship is important parameter of quality work’ in construction sector.
- b) Explain in details barriers affecting on the implementation of TQM in construction sector?

OR

- Q8)** a) Explain in details probability distribution Six sigma ratings in concrete properties.
- b) Explain in details six sigma as an effective tool in TQM.

- Q9)** a) Explain application of Six Sigma tool in RCC Work in building construction.
- b) Explain application of Six Sigma tool in DLC and PQC layers in road construction.

OR

- Q10)**a) Six Sigma is a methodology which uses in building construction.
- b) Explain in details the steps civil engineer should take to improve quality of work as per customer service based on data in construction.

\* \* \*

Total No. of Questions : 10]

SEAT No. :

**PD5098**

[Total No. of Pages : 2

**[6405]-237**

**First Year M.E. (Civil)/(Construction & Management)**  
**CONSTRUCTION CONTRACTS ADMINISTRATION AND**  
**MANAGEMENT**  
**(2017 Pattern) (Semester - II) (501027)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2 , Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator is allowed.*

**Q1) a)** Define contract as per the Indian Contract Act (1872) and explain the term Valid contract. **[5]**

b) Define the role of project management services in construction project. **[5]**

OR

**Q2) a)** What are the potential remedies available to a contractor in case of a breach of contract by the client? **[5]**

b) Briefly explain the methods of inviting tenders and their suitability for different types of construction projects. **[5]**

**Q3) a)** State the circumstances under which the lowest tender is rejected? **[5]**

b) Discuss circumstances under which the contractor shall be entitled to terminate the contract. **[5]**

OR

**Q4) a)** Discuss the advantages of DRB over dispute resolution mechanism. **[5]**

b) What are model forms of contracts and why are they important in the construction industry? **[5]**

**Q5) a)** Explain Construction Claims, Types of construction claims and explain settlement of claims. **[5]**

b) List the FIDIC Colour-Coded Books and describe the purpose of the Red Book. **[5]**

OR

**P.T.O.**

- Q6)** a) Explain the purpose of the Design & Build Contract under FIDIC conditions. [5]  
b) What are the common causes of construction claims, and how can they impact a project? [5]
- Q7)** a) Describe the clauses of escalation of cost: What is an arbitral proceeding? Explain with example. [5]  
i) Escalation formula for Material cost.  
ii) Escalation formula for Labour cost.  
b) Explain in detail defect –liability period [5]
- OR
- Q8)** a) Explain in detail difference between 1940 Act and 1996? [5]  
b) Discuss the advantages and limitations of using mediation for resolving construction disputes. [5]
- Q9)** a) Define Indian Arbitration and Conciliation Act 1996. [5]  
b) Explain the procedure for appealing against an arbitral award under the Arbitration and Conciliation Act, 1996 [5]
- OR
- Q10)** a) Explain Conciliation and its provisions in the Act; also explain conduct of conciliation and arbitral proceedings? [5]  
b) Discuss how the Arbitration and Conciliation Act, 1996 aligns with international arbitration practices. [5]





Total No. of Questions : 8]

SEAT No. :

PD-5099

[Total No. of Pages : 2

[6405]-238

**M.E. (Civil) (Construction & Management)**  
**PROJECT ECONOMICS & FINANCIAL MANAGEMENT**  
**(2017 Pattern) (Semester - II) (501028)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculators allowed.*

- Q1)** a) Discuss in brief about factors bearing on size of firms. **[4]**
- b) Elaborate the process about cash management for small construction firm. **[5]**

OR

- Q2)** a) Discuss in brief about factors drives to growth of any firm. **[4]**
- b) Explain the method about managing payments to suppliers and outstanding for any construction firm. **[5]**

OR

- Q4)** a) Develop the cost implication for residential housing construction firm with suitable example. **[5]**
- b) What is long term financial planning? **[4]**

**P.T.O.**

- Q5)** a) Explain constituents of master budget. [8]  
b) Explain about budgetary control system with an example. [8]

OR

- Q6)** a) Write a note on budget manual. [8]  
b) Discuss in detail about various types of budgets. [8]

- Q7)** a) Explain in detail CIDC-IRA grading of construction entities. [8]  
b) Describe how venture capital financing made impact on any business entity. [8]

- Q8)** a) Write a note on SEBI regulation. [8]  
b) What is the past of financial institutes in construction? Explain in detail. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5100**

[Total No. of Pages : 3

**[6405]-239**

**First Year M.E. (Civil-Construction & Management)**

**OPERATIONS RESEARCH**

**(2017 Pattern) (Semester - II) (501029)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume Suitable data if necessary. and clearly state.
- 5) Use of cell phone is prohibited in the examination hall.
- 6) Use of electronic pocket calculator is allowed.

- Q1) a)** Discuss the scope of Operations Research In Civil Engineering. **[4]**  
**b)** Solve by Graphical method LPP **[5]**

$$\text{Max. } Z = 3x_1 + 9x_2$$

$$\text{Subject to } x_1 + 4x_2 \leq 8$$

$$x_1 + 2x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

OR

- Q2) a)** Define - Linear Programming. Enlist applications of Linear Programming in OR. **[4]**  
**b)** Elaborate the stepwise procedure for Big-M method for Linear Programming method Problems. **[5]**

- Q3) a)** Define-Transportation Problem. Enlist applications of Transportation Problem. **[4]**  
**b)** A sales manager has to assign 4 sales man to 4 territories. The possible profit for salesman in each territory is given below. Find the assignment which maximize the profit. **[5]**

Territories

| Salesman | A  | B  | C  | D  |
|----------|----|----|----|----|
| 1        | 35 | 27 | 28 | 37 |
| 2        | 28 | 37 | 29 | 40 |
| 3        | 35 | 24 | 32 | 33 |
| 4        | 24 | 32 | 25 | 28 |

OR

**P.T.O.**

- Q4) a)** In an irrigation project, 6 million  $m^3$  of water is to be allured to 3 irrigation districts. The net returns depending upon the quantity of water supplied are given below. Using dynamic programming, determine the allotment of water to each district so that the return maximum. [5]

| Quantity of water<br>in Million $m^3$ | Returns from District |    |    |
|---------------------------------------|-----------------------|----|----|
|                                       | 1                     | 2  | 3  |
| 0                                     | 0                     | 0  | 0  |
| 1                                     | 5                     | 6  | 4  |
| 2                                     | 9                     | 11 | 9  |
| 3                                     | 14                    | 15 | 13 |
| 4                                     | 17                    | 19 | 18 |
| 5                                     | 21                    | 22 | 20 |
| 6                                     | 25                    | 26 | 23 |

- b) Explain with neat sketch-Uni-modal function and Local maxima & minima [4]

- Q5) a)** Minimize  $f(x) = 2x_1^2 + 2x_1x_2 + 2x_2^2 - 4x_1 - 6x_2$  [8]

Take  $x^0 = (0,0)$ . Use Newton's method.

- b) Maximize  $f(x) = z = 6x_1 - 2x_1^2 + 4x_2 - 2x_2^2 - 2x_1x_2$  with initial value (1,1) using Steepest Ascent/ Descent Method [8]

OR

- Q6) a)** Minimize  $f = x^3 - x$  in the interval (0, 1) to an accuracy of 0.1% using Fibonacci method. [8]

- b) Maximize  $f(x) = 3x_1 + x_1x_2 - x_1^2 - x_2^2$  with initial value (0,0) using Steepest Ascent/Descent Method [8]

**Q7) a)** Define-Simulation. Write advantages & dis-advantages of simulation. Explain the steps required for Monte Carlo Simulation. **[8]**

**b)** Five jobs P, Q, R, S & T are to be made on 3group of machines  $F_1$ ,  $F_2$  and  $F_3$  in that order. The time required for each job is given below. **[8]**

| Job | Time Required in Min. |       |       |
|-----|-----------------------|-------|-------|
|     | $F_1$                 | $F_2$ | $F_3$ |
| P   | 20                    | 7     | 27    |
| Q   | 27                    | 9     | 31    |
| R   | 31                    | 6     | 16    |
| S   | 15                    | 12    | 11    |
| T   | 19                    | 14    | 12    |

Sequence the jobs on machines for minimum elapsed time from starting of the first job on  $F_1$  to the finishing of the last job on  $F_3$ . Also determine total waiting time of each job and idle time of machines during elapsed time.

OR

**Q8) a)** Explain the following: **[8]**

i) Queuing Theory

ii) Various cost associated with Replacement Analysis

**b)** Reduce the following game by dominance and find game value. **[8]**

|          |  |          |   |   |   |
|----------|--|----------|---|---|---|
|          |  | Player B |   |   |   |
| Player A |  | 3        | 2 | 4 | 0 |
|          |  | 3        | 4 | 2 | 4 |
|          |  | 4        | 2 | 4 | 0 |
|          |  | 0        | 4 | 0 | 8 |



Total No. of Questions : 8]

SEAT No. :

PD-5101

[Total No. of Pages : 2

[6405]-240

**M.E. (Civil - Construction & Management)**  
**ENVIRONMENT & ENERGY FOR SUSTAINABLE**  
**CONSTRUCTION**  
**(2017 Pattern) (Semester - III) (601033)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator is allowed.*

- Q1)** a) Define the concept of the environment and explain its relevance to mega projects like highways. **[4]**
- b) Describe the environmental, social, and economic impacts of highways and how they can be mitigated for sustainable development. **[5]**

OR

- Q2)** a) Evaluate the role of fiscal impact analysis in understanding the long-term economic viability of development projects. **[4]**
- b) Discuss the significance of physical environment changes on socio-economic factors during the development of highways. **[5]**

OR

- Q3)** a) Describe the key provisions of the Energy Conservation Act, 2001, and its role in promoting energy efficiency in India. **[4]**
- b) What is the role of the Conference of Parties (COP) in global climate governance? Highlight some key outcomes of recent COP meetings. **[5]**

**P.T.O.**

- Q4)** a) Outline the major provisions of the Electricity Act, 2003, and its relevance to the energy sector in India. [5]
- b) Explain the Clean Development Mechanism (CDM) under the Kyoto Protocol. How does it benefit both developed and developing countries? [4]

- Q5)** a) What policies and incentives can governments implement to encourage financial institutions to invest in energy-efficient projects? [8]
- b) What are the key steps involved in evaluating energy-efficient projects? Discuss the criteria used for assessment. [8]

OR

- Q6)** a) Discuss the different types of energy performance contracts (EPCs) and their relevance to energy-efficient project implementation. [8]
- b) How do Public-Private Partnerships (PPPs) contribute to the financing and execution of energy-efficient projects? Provide examples. [8]

- Q7)** a) Define the Clean Development Mechanism (CDM) and explain its objectives in the context of global climate change. [8]
- b) Explain how the UNFCCC ensures the alignment of CDM projects with global climate goals. [8]

OR

- Q8)** a) Discuss the eligibility criteria for energy conservation projects under the CDM framework. [8]
- b) Provide an example of a successful CDM project in India and analyze how it met the eligibility criteria. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5102**

**[6405]-241**

[Total No. of Pages : 2

**Second Year M.E. (Civil- Construction & Management)**

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - III) (601034)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q.No.1 or 2, 3 or 4, 5 or 6, 7 or 8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagram wherever necessary.*
- 4) *Assume suitable data if necessary, stating it clearly.*

**Q1) a)** Discuss the general objective of research funding agency. **[4]**

b) Write short note on objectives of literature survey and different sources of literature. **[5]**

OR

**Q2) a)** Write a short note on criteria of good research. **[4]**

b) What is the necessity of defining a research problem? Give three examples to illustrate your answer. **[5]**

**Q3) a)** Explain the criteria of goodness of a measurement scale. **[4]**

b) Explain the differences between collection of data through questionnaire and schedules. **[5]**

OR

**Q4) a)** Discuss in brief various sampling techniques. **[4]**

b) Why the data collected for research should be checked for reliability suitability and adequacy. Explain. **[5]**

**P.T.O.**



- Q5)** a) Write a note on the usage of ANOVA in linear regression analysis. Why do we use t-test in linear regression analysis? [8]
- b) Explain the centroid method of factor analysis and merits demerits of factor analysis. [8]

OR

- Q6)** a) Explain the significance of research report and explain the various steps involved in writing such report. [8]
- b) Differentiate descriptive statistics and inferential statistics. [8]

- Q7)** a) Explain the significance of research report and explain the various steps involved in writing such report. [8]
- b) Explain the various important points while preparing the research report. [8]

OR

- Q8)** Write a research proposal for suitable research problem (preferably from civil engineering field) with reference to following terms. Title, Introduction, Origin of problem, Expected Outcome, literature review, significance of study, objectives and methodology year wise plan. [16]



Total No. of Questions : 12]

SEAT No. :

PD-5103

[Total No. of Pages : 2

[6405]-242

M.E. (Civil)(Environmental)

**ENVIRONMENTAL LEGISLATION AND MANAGEMENT  
SYSTEM**

**(2017 Pattern) (Semester - I) (501061)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full Marks.*
- 3) *Assume suitable data if necessary.*
- 4) *Question 09 and Question 10 are compulsory.*

**Q1)** Discuss the principles of "Precautionary Principle" and "Polluter Pays Principle" and their significance in environmental protection. **[5]**

OR

**Q2)** Explain in detail: Concept of absolute liability. **[5]**

**Q3)** Analyze the role of regulatory agencies under the Water (Prevention & Control of Pollution) Act, 1974 in mitigating water pollution. **[5]**

OR

**Q4)** What are the powers of State Pollution Control Boards and Central Pollution Control Board in controlling air pollution? Support your answer in detail with suitable example. **[5]**

**Q5)** Trace the genesis of the Environment (Protection) Act, 1986, and analyze the delegation of powers to regulatory authorities. **[5]**

OR

**Q6)** Explain in detail: Public Interest Litigation. Support your answer with suitable example. **[5]**

**Q7)** Discuss the key powers and functions of the Maharashtra Pollution Control Board (MPCB) under the Water and Air Acts. **[5]**

OR

**P.T.O.**

- Q8)** Explain international and national efforts at environmental protection in detail. Support your answer with suitable example. [5]
- Q9)** a) Explain in detail, the important powers and functions of the MPC board under both the water and air acts. [8]  
b) Discuss the role of NGOs in nature conservation with reference to successful case studies in India. [7]
- Q10)** a) Explain in detail: Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier. [8]  
b) Analyze the responsibilities of waste generators and Pollution Control Boards in hazardous waste management, emphasizing authorization procedures. [7]



Total No. of Questions : 12]

SEAT No. :

**PD5104**

[Total No. of Pages : 2

**[6405]-243**

**First Year M.E. (Civil-Environmental Engineering)  
ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY  
(2017 Pattern) (Semester - I) (501062)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.
- 2) Figures to the right indicate full marks.
- 3) Your answers will be valued as a whole.
- 4) Assume suitable data, if necessary.
- 5) Use of electronic pocket calculator and steam table is allowed.

**Q1)** How is Gibbs free energy applied to assess the feasibility of a chemical reaction? **[5]**

OR

**Q2)** Explain hydrocarbons and classify them with suitable examples. **[5]**

**Q3)** Describe the role of hydroxyl radicals (OH) in the breakdown of air pollutants. **[5]**

OR

**Q4)** In what way does solar radiation impact the acidic properties of sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>)? **[5]**

**Q5)** How do nonionic detergents compare with anionic and cationic detergents in terms of properties and applications? **[5]**

OR

**Q6)** Explain the environmental pollution caused by pesticides with a relevant example. **[5]**

**Q7)** Discuss how photosensitizer additives influence the biodegradability of polymers? **[5]**

OR

**Q8)** What are the symptoms of acute aflatoxin poisoning? Explain in detail. **[5]**

**P.T.O.**

- Q9)** a) Describe the structure and function of a prokaryotic cell. How does it differ from a eukaryotic cell? [7]
- b) How are microorganisms classified based on their energy and carbon sources? Provide examples relevant to environmental processes. [7]

OR

- Q10)** a) Identify the major research areas in environmental microbiology and provide examples of their practical applications. [7]
- b) What are enzymes? Discuss their significance in metabolic reactions and environmental biodegradation. [7]
- Q11)** a) Explain the process of microbial enumeration using a hemocytometer. [8]
- b) Discuss in detail the role of microorganisms in biofilm formation in water systems. [8]

OR

- Q12)** a) Elaborate on the role of *Saccharomyces cerevisiae* in industrial microbiology. [8]
- b) Differentiate between aerobic and anaerobic biological treatment processes. Discuss the role of microorganisms in the activated sludge process. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5105**

**[6405]-244**

[Total No. of Pages : 3

**M. E.-I (Civil - Environmental)**

**PHYSICO-CHEMICAL PROCESS FOR WATER AND WASTE  
WATER TREATMENT**

**(2017 Credit Pattern) (Semester - I) (501063)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q.5 or Q. 6 and Q. 7 or Q. 8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator is allowed.*

- Q1)** a) Discuss completely mixed batch reactor for treatment of waste water.[4]  
b) Explain in detail unit operations and unit processes in water and wastewater treatment. [5]

OR

- Q2)** a) Design a mechanical clariflocculator to treat water for a town having population 1 lakh and rate of water supply 160 lpcd. Detention period is 30 minutes and paddle speed is 3 rpm. Use depth of basin = 3.0m, horizontal velocity = 1m/min, Assume  $C_D = 1.8$  for planks, kinematic viscosity =  $0.8039 \times 10^{-6} \text{ m}^2/\text{sec}$  and center to center distance between the shaft and paddle = 3.0m, Horizontal velocity in basin = 1m/min, Paddle area=45% Vertical c/s area of Basin. [5]  
b) What are the objectives of aeration in wastewater treatment? [4]

- Q3)** a) Explain Break Point Chlorination. [4]  
b) Design of high rate single stage trickling filter for treating domestic sewage flow of 6 MLD using N.R.C. use following data. [5]  
i)  $\text{BOD}_5$  of raw sewage=250mg/l  
ii) BOD removed during primary treatment = 30%  
iii) Organic loading rate =  $0.8 \text{ Kg/m}^3/\text{d}$   
iv) Hydraulic loading rate= $15 \text{ m}^3/\text{m}^2/\text{d}$   
v) Recirculation ratio = 2

Determine volume of filter media, Dimensions of trickling filter, Efficiency of trickling filter.

OR

**P.T.O.**

- Q4)** a) Explain with a neat sketch: Working principle of tube settler. [5]  
b) Draw and discuss the generalised biological process reaction in the Activated Sludge Process. [4]

- Q5)** a) Draw and discuss the schematic diagram of typical UASB. [8]  
b) Estimate size of digester required to treat the sludge from primary treatment plant designed to treat 38000 m<sup>3</sup>/d of wastewater. Check the volumetric loading and estimate the percent stabilization and the amount of gas produced per capita for the wastewater to be treated it has been found that the quantity of dry volatile solids and biodegradable COD removed is 0.15 kg/m<sup>3</sup> and 0.14 kg/m<sup>3</sup>, respectively. Assume that the sludge contains about 95 % moisture and has specific gravity of 1.02. Also use following data (i) Complete mix reactor (ii) SRT 10 days (iii) Efficiency of waste utilization = 0.70 (iv)  $Y = 0.08 \text{ kg VSS/kg bCOD}$  utilized and  $k_d = 0.03 \text{ d}^{-1}$  (v) Constants are for a temperature of 35°C (vi) Digester gas is 65 percent methane. [8]

OR

- Q6)** a) Design an aerobic digester to treat the waste sludge produced by the activated sludge treatment plant. Assume that the following conditions apply: [8]  
i) Quantity of sludge to be digested = 2057 kg TSS/d  
ii) Min Temp for Winter and Max Temp for summer operation = 15°C and 25°C  
iii) Volatile solid reduction in winter = 40%  
iv) Minimum SRT for winter condition = 60 d  
v) Waste sludge concentrated to 3%  
vi) Specific gravity of Waste sludge = 1.03  
vii) Sludge Concentration in the digester = 70%  
viii)  $k_d$  at 15 °C = 0.06 d<sup>-1</sup>  
ix) Volatile fraction of digester TSS = 0.80  
x) Air temperature in diffused air system = 20°C  
b) Design an UASBR for an average flow of 8 MLD of wastewater. Use following additional data: [8]  
COD of wastewater = 400 mg/l; HRT = 6 hrs; Design COD loading: 1.5 kg COD/Cu M/d; Rising velocity permissible: 0.7 m/hr; Velocity of wastewater in settling chamber < 1.5 m/hr; Flow area covered by each inlet: 2 sq. M.

**Q7) a)** Determine the carbon requirements to treat a flow of 1000L/min and the bed life of A fixed-bed granular activated carbon absorber using following data. [8]

- i) Compound=trichloroethylene(TCE)
- ii) Initial Concentration=1.0 mg/l
- iii) Final Concentration=0.005mg/l
- iv) GAC density=450g/l
- v) Freundlich Capacity factor  $K_f = 128(\text{mg/g})(\text{L/mg})^{1/n}$
- vi) Freundlich intensity parameter,  $1/n=0.62$
- vii) Empty-bed contact time = 10min

**b)** Explain in detail: [8]

- i) Nano-Filtration
- ii) Micro Filtration.

OR

**Q8) a)** Explain in detail limitation of oxidative processes and oxidizing agents in water and wastewater treatment. [8]

- b)** Estimate quantity and quality of the waste stream and the total quantity of water that must be processed, from a reverse osmosis facility that is to produce 4000m<sup>3</sup>/d of water to be used for industrial cooling operations. Assume that both the recovery and rejection rates are equal to 90% and that the concentration of bed stream is 400g/m<sup>3</sup>. [8]





Total No. of Questions : 12]

SEAT No. :

**PD5106**

[Total No. of Pages : 2

**[6405]-245**

**First Year M.E. (Civil/Environmental Engineering)**

**ENVIRONMENTAL SANITATION**

**(2017 Pattern) (Semester - I) (501064)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.
- 2) Figures to the right indicate full marks.
- 3) Your answers will be valued as a whole.
- 4) Assume suitable data, if necessary.

**Q1)** Differentiate between direct and indirect methods of disease communication. **[5]**

OR

**Q2)** Define epidemiology and its significance in public health. **[5]**

**Q3)** Discuss the mosquito-borne disease transmission and the methods of control. **[5]**

OR

**Q4)** What are the preventive measures for fly breeding in urban areas? **[5]**

**Q5)** Explain the role of proper plumbing fixtures in ensuring sanitation in public buildings. **[5]**

OR

**Q6)** Define industrial sanitation and its importance in public buildings. **[5]**

**Q7)** Discuss the role of community participation in improving rural sanitation. **[5]**

OR

**Q8)** What are the key features of low-cost excreta disposal systems? **[5]**

**P.T.O.**

- Q9) a)** What are the different types of storage tanks used in building water supply systems? [7]
- b) Compare and contrast domestic storage tanks and flushing storage tanks in terms of purpose, design, and installation. [7]

OR

- Q10)a)** Describe the components of a typical water supply system in buildings, including the water connection, storage, and distribution. [7]
- b) Explain the role of flushing storage tanks in building water supply systems. Discuss their design and operational requirements. [7]
- Q11)a)** Enlist and discuss the sanitary fittings, give the function, and materials used for water closets and wash basins. [8]
- b) Compare the single stack system and one-pipe system with their advantages and disadvantages. [8]

OR

- Q12)a)** Provide a detailed explanation of different types of flushing cisterns and their working. [8]
- b) Compare and contrast gully traps, intercepting traps, and other types of traps commonly used in building drainage systems. Provide examples of where each type would be applicable. [8]

\* \* \*

Total No. of Questions : 12]

SEAT No. :

**PD5107**

[Total No. of Pages : 2

**[6405]-246**

**First Year M.E. (Civil -Environmental Engineering)  
INDUSTRIAL WASTE WATER MANAGEMENT  
(2017 Pattern) (Semester - II) (501067)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12
- 2) Figures to the right indicate full marks.
- 3) Your answers will be valued as a whole.
- 4) Assume suitable data, if necessary.
- 5) Use of electronic pocket calculator and steam table is allowed.

**Q1)** What are the main environmental impacts of industrial wastewater? **[5]**

OR

**Q2)** Discuss the various source reduction techniques used in industrial pollution prevention. **[5]**

**Q3)** What is the significance of phosphorous removal in wastewater treatment?**[5]**

OR

**Q4)** What is ion exchange, and how is it used in wastewater treatment? **[5]**

**Q5)** How does effluent from dairy industries impact the environment? **[5]**

OR

**Q6)** Briefly explain the concept of biological treatment of effluent. **[5]**

**Q7)** Discuss any one biological treatment method suitable for pharmaceutical waste. **[5]**

**[5]**

OR

**Q8)** What is the importance of oil-water separators in refineries? **[5]**

**Q9) a)** What are the common operation and maintenance problems faced by Common Effluent Treatment Plants (CETPs)? **[7]**

- b) Enlist the economic benefits of establishing CETPs in industrial clusters. Discuss with examples how CETPs can mitigate pollution while fostering economic growth. **[7]**

OR

**P.T.O.**

- Q10)a)** What role does advanced technology play in improving the efficiency of CETPs? Discuss the innovations made in CETP management. **[7]**
- b) Discuss the regulatory framework governing CETPs in India. How do current policies encourage or hinder the growth and effectiveness of CETPs? **[7]**

**Q11)a)** Explain the principle and mechanism of adsorption as a treatment method. **[8]**

- b) Discuss the process of polymer dosing, mixing, and flocculation. **[8]**

OR

**Q12)a)** How can digital tools aid in creating detailed drawings and cost estimations for wastewater treatment plants? **[8]**

- b) How are sludge management and disposal handled in industrial wastewater treatment? **[8]**



Total No. of Questions : 8]

SEAT No. :

PD-5108

[Total No. of Pages : 2

[6405]-247

**M.E. (Civil - Environmental Engineering)**

**AIR POLLUTION AND CONTROL**

**(2017 Pattern) (Semester - II) (501068)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q. 5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) What are the types of air quality models? [4]  
b) What do you understand by stability conditions? Explain its significance in air quality study. [5]

OR

- Q2)** a) Explain plume behaviour with the help of neat sketches. [4]  
b) A power plant is emitting SO<sub>2</sub> with exhaust rate of 127 g/s through a stack that has effective height of 75m. The atmospheric conditions are moderately to slightly stable. The wind velocity at the top of the stack is 6m/s. Determine the ground level concentration at a distance of 3km downwind at the centreline of the plume  $\sigma_y = 280\text{m}$  and  $\sigma_z = 170\text{m}$ . [5]

- Q3)** a) Explain in brief about the control of pollution by process modification and change of raw materials. [4]  
b) What are the requirements of electrostatic precipitation process? Also enlist the operational issues related to ESP. [5]

OR

- Q4)** a) Differentiate between bag house filter and ESP. [4]  
b) What are the various NO<sub>x</sub> control technologies? [5]

**P.T.O.**

- Q5)** a) Explain in brief National Air Quality Monitoring Programme. [8]  
b) What are the tabular columns mentioned in national ambient air quality standards (NAAQS) What are the current NAAQS for ozone, lead, carbon monoxide and benzene? [8]

OR

- Q6)** a) Explain with neat sketch the determination of ambient  $PM_{10}$  and  $PM_{2.5}$  using particulate dust sampler. [8]  
b) What is the purpose of stack sampling? Explain in detail essential parts of sampling train. [8]

- Q7)** a) What are the various control strategies adopted for automobile pollution? [8]  
b) What are the major air pollutants emitted from vehicular sources? What are the measures taken to control it in Delhi? [8]

OR

- Q8)** a) What do you mean by odour pollution? Explain any one method to control odour pollution. [8]  
b) What are the causes of indoor air pollution? Explain the method of mechanical ventilation system used for control of indoor air pollution. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5109**

[Total No. of Pages : 2

**[6405]-248**

**First Year M.E. (Civil-Environmental Engineering)**  
**SOLID WASTE AND HAZARDOUS WASTE MANAGEMENT**  
**(2017 Pattern) (Semester - II) (501069)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Use of Calculator is allowed.
- 4) Assume suitable data, if necessary.

- Q1) a)** Explain the functional elements of Solid Waste Management in detail. **[4]**  
b) Explain in detail the direct load and discharge load Transfer station. **[5]**

OR

- Q2) a)** Determine the field capacity of a landfill site for the following conditions, after 1 year of operation, and compute the amount of water that can be held in the waste: Density of compacted solid waste = 600 kg/m<sup>3</sup>, moisture content = 25% by volume, lift after one-year 6m and net annual rainfall=400mm **[5]**  
b) Explain in detail any 2 types of collection system. **[4]**

- Q3) a)** Describe the design and operation of a sanitary landfill with a neat sketch. **[4]**  
b) Explain in detail the Pyrolysis and Incineration. **[5]**

OR

- Q4) a)** Describe in detail any 04 factors which affect Composting? **[4]**  
b) Explain in detail area method of landfilling. **[5]**

- Q5) a)** Write a detailed note on material recovery facility. **[8]**  
b) Explain in detail about drop off center and buy back center. **[8]**

OR

**P.T.O.**

- Q6)** a) What is biomedical waste? Explain in detail any 02 methods of collection and treatment. **[2+6]**
- b) Define in detail recycling of solid waste. Discuss the purposes of recycling of municipal solid waste. **[2+6]**
- Q7)** a) Write a detailed note on TCLP test. **[8]**
- b) What are the key legislations at the national and international levels governing the management and handling of hazardous waste? Explain in detail **[8]**

OR

- Q8)** a) Explain in detail the labeling and handling of hazardous waste. **[8]**
- b) What strategies and technologies are effective in reducing hazardous waste at its source? Explain any 02 in detail **[2+6]**





Total No. of Questions : 12]

SEAT No. :

PD-5110

[Total No. of Pages : 2

[6405]-249

**M.E. (Civil) (Environmental Engineering)**  
**ENVIRONMENTAL IMPACT ASSESSMENT**  
**(2017 Pattern) (Semester - III) (601073)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12
- 2) Figures to the right indicate full marks.
- 3) Your answers will be valued as a whole.
- 4) Assume suitable data, if necessary.
- 5) Use of electronic pocket calculator and steam table is allowed.

Q1) What are the key stages of the EIA process? [5]

OR

Q2) What are project thresholds in the context of EIA? [5]

Q3) What are environmental indices and indicators? Discuss their roles. [5]

OR

Q4) Discuss about interaction matrix methodologies. [5]

Q5) Discuss the impact of noise pollution on human health and the environment.[5]

OR

Q6) How is the type and quantity of air pollutants identified during an environmental impact assessment? [5]

Q7) What are the potential impacts of soil contamination of groundwater? [5]

OR

Q8) What role does mitigation play in environmental impact assessment? [5]

*P.T.O.*

- Q9) a)** Discuss the mitigation strategies for addressing adverse impacts on the socioeconomic environment. **[7]**
- b)** Explain how stakeholder engagement contributes to the evaluation of alternatives in the EIA process. **[7]**

OR

- Q10)a)** How can verbal communication techniques improve the quality and effectiveness of public participation in EIA studies? **[7]**
- b)** Explain the methods used to predict and assess the impact of developmental projects on cultural resources. **[7]**
- Q11)a)** Compare and contrast Rapid EIA and Comprehensive EIA, highlighting their applications and limitations. **[8]**
- b)** Enlist and discuss the steps involved in obtaining environmental clearance for construction projects. **[8]**

OR

- Q12)a)** Describe the process and significance of post-environmental monitoring in ensuring compliance with environmental standards. **[8]**
- b)** Explain the procedure for conducting a public hearing as part of the EIA process, and discuss its importance for stakeholder engagement. **[8]**



Total No. of Questions : 8]

SEAT No. :

**PD5111**

**[6405]-250**

[Total No. of Pages : 2

**S.Y.M.E. (Civil- Environmental)**  
**RESEARCH METHODOLOGY**  
**(2017 Pattern) (Semester - III) (601074)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) Neat diagram must be drawn wherever necessary.*
- 3) Figure to the right indicates full marks.*
- 4) Assume suitable data, if necessary and clearly state.*
- 5) Use of cell phone is prohibited in the examination hall.*
- 6) Use of electronic pocket calculator is allowed.*

- Q1)** a) What is meaning of the research objectives and research outcomes? [4]
- b) State the elements and objectives of literature survey. [5]

OR

- Q2)** a) What are generic elements to be included in Research Proposal? [5]
- b) Discuss the merits and limitations of internet as source of literature review. [4]

- Q3)** a) Describe the various factors affecting choice of data collection methods. [4]
- b) Explain the meaning of analysis of variance. Describe briefly the technique of analysis of variance. [5]

OR

- Q4)** a) What are the merits and demerits of collection of data through questionnaires? [5]
- b) Why data collected for research should be checked for reliability, suitability and adequacy? [4]

**P.T.O.**

- Q5)** a) Write note on correlation and regression analysis. [8]
- b) How many discriminant functions would you obtain in a 4 group discriminant analysis and why? What do you mean by misclassification in discriminant analysis? [8]

OR

- Q6)** a) How factor analysis and discriminant analysis used in data analysis? [8]
- b) How multidimensional scaling is carried out in data set? [8]
- Q7)** a) What are the techniques of writing report? What are the characteristics of a good research report? [8]
- b) What are the elements of effective presentation? [8]

OR

- Q8)** a) Describe in brief, the structure of report. What do you mean by plagiarism? [8]
- b) Discuss the important points to be considered during presenting a research idea. And write a note on patenting a research idea. [8]



Total No. of Questions : 8]

SEAT No. :

PD-5112

[Total No. of Pages : 2

[6405]-251

M.E. (Civil - Geotechnical)

ADVANCE SOIL MECHANICS

(2017 Pattern) (Semester - I) (501121) (Credit)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q. 5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of electronic pocket calculator is allowed in the examination.*
- 5) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Write a note on stresses and displacements in elastic soil mass. [5]  
b) Discuss effective stress principle. [4]

OR

- Q2)** a) Explain limiting equilibrium for analysis of slope stability. [5]  
b) Write a note on plane strain problem. [4]

- Q3)** a) Enlist various earth pressure theories and explain any one in detail. [5]  
b) Write a note on free strain consolidation with no smear. [4]

OR

- Q4)** a) Write a note on consolidation by vertical sand drains and its design aspect.[5]  
b) Write a note on lateral earth pressure in cuts. [4]

- Q5)** a) Explain how to determine mass spring constant and damping factor for vibrating system. [8]  
b) Discuss linear elastic weightless spring method for machine foundation.[8]

OR

*P.T.O.*

- Q6)** a) Write a note on dynamic response of embedded block foundation. [8]  
b) Explain types and general requirement of machine foundation. [8]

- Q7)** a) Write down design criteria for foundation of rotary machine. [8]  
b) Explain isolating materials and their properties. [8]

OR

- Q8)** a) Write a note on construction details of machine foundation. [8]  
b) Explain the two Dimensional analysis of a foundation of a rotary machine by amplitude method. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5113**

[Total No. of Pages : 1

**[6405]-252**

**First Year M.E. (Civil-Geotechnical Engineering)**

**GROUND IMPROVEMENT TECHNIQUES**

**(2017 Pattern) (Semester - I) (501122)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right indicate full marks..

**Q1) a)** Which are the different clay minerals? Explain characteristics of any one. **[5]**

**b)** Write a short note on electrical effects in clay minerals. **[4]**

OR

**Q2) a)** State the different methods of soil stabilization and explain any one. **[5]**

**b)** Describe the behaviour of chemically stabilized soils. **[4]**

**Q3) a)** Explain electro-osmosis. **[5]**

**b)** Describe process of dynamic consolidation. **[4]**

OR

**Q4) a)** Write a short note on stone column. **[5]**

**b)** Write a note on mechanism of bituminous stabilization. **[4]**

**Q5) a)** Discuss granular trench stabilization. **[8]**

**b)** Discuss the design consideration of sand drains. **[8]**

OR

**Q6) a)** Discuss the importance of total and differential settlement giving examples. **[8]**

**b)** Discuss the design criteria for lime column foundations. **[8]**

**Q7) a)** Explain Permeation Grouting and Jet Grouting. **[8]**

**b)** State and explain various types of grout. **[8]**

OR

**Q8) a)** Explain hydro-fracture grouting and compaction grouting. **[8]**

**b)** Draw and explain the grouting equipments. **[8]**



Total No. of Questions : 8]

SEAT No. :

**PD5114**

**[6405]-253**

[Total No. of Pages : 2

**First Year M. E. (Civil)(Geotechnical Engineering)**

**ROCK MECHANICS**

**(2017 Pattern) (Semester - I) (501123)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt any 5 questions from the 8 questions.*
- 2) Figure to the right indicates full marks.*
- 3) Use of logarithmic tables, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) Assume suitable data, if necessary.*
- 5) Neat diagram must be drawn wherever necessary.*

**Q1) a)** What is creep in rock? Explain the influence of time on rock deformation. **[5]**

b) Discuss Modes of failure of rocks. **[5]**

**Q2) a)** Explain Rock failure in compression. **[5]**

b) Explain Factors affecting Rupture behavior of rock. **[5]**

**Q3) a)** Explain Flat Jack method of rock stress determination. **[4]**

b) What are the different index properties of rock mechanics? Explain any one in detail. **[6]**

**Q4) a)** Write a note on structural discontinuities in rock masses. **[5]**

b) Explain approximate methods for two dimensional limit equilibrium analysis. **[5]**

**P.T.O.**



**Q5)** a) Write a note on stress and deflection in rock under footing. [5]

b) Explain Failure propagation in rock masses. [5]

**Q6)** a) Explain foundation anchoring. [4]

b) Explain principal of limit equilibrium method for the analysis of rock structure. [6]

**Q7)** a) Write a note on shotcreting. [4]

b) Explain the kinematic analysis of rock mechanics. [6]

**Q8)** a) Write a note on rock slopes. [4]

b) Explain plastic behavior around tunnels. [6]



Total No. of Questions : 8]

SEAT No. :

**PD5115**

[Total No. of Pages : 2

**[6405]-254**

**First Year M.E. (Civil/Geotechnical Engg.)  
GEO-ENVIRONMENTAL ENGINEERING  
(2017 Pattern) (Semester - I) (501125)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator is allowed.*

**Q1) a)** State the chemical and biological characteristics of solid waste. **[4]**

b) Enlist different sources of solid waste. Explain any two. **[5]**

OR

**Q2) a)** Define solid waste and State the classification. **[4]**

b) Explain the defects of pollutants on soil properties. **[5]**

**Q3) a)** Explain principle of composting of solid waste. **[5]**

b) State any four advantages and disadvantages of landfill method. **[4]**

OR

**Q4) a)** State factors affecting selection of site for land filling of solid waste. **[4]**

b) Discuss on detection, control and remedies of sub-surface containment. **[5]**

**Q5) a)** Explain uses of waste in geotechnical engineering. **[8]**

b) Discuss in detail landfill reclamation process. **[8]**

OR

**P.T.O.**

- Q6)** a) Explain in detail the reclaimed waste. [8]  
b) Describe in detail, “Reclamation of old solid waste dumps”. [8]

- Q7)** a) Discuss advantages and disadvantages of landfill? [8]  
b) Describe in detail types and application of clay liners. [8]

OR

- Q8)** a) Explain in detail which waste materials are used for landfill liner. [8]  
b) Discuss the application of Geosynthetics in waste disposal design. [8]

\* \* \*

Total No. of Questions : 8]

SEAT No. :

**PD5116**

[Total No. of Pages : 2

**[6405]-256**

**First Year M.E. (Civil-Geotechnical Engineering)**

**ADVANCE FOUNDATION ENGINEERING**

**(2017 Pattern) (Semester - II) (501127)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator is allowed.*

- Q1)** a) Discuss IS Criteria for depth of bore holes in subsurface investigations.[5]  
b) A thin walled sampler was used in soft clay having. [4]  
i) Inside and outside diameter 78 mm & 70mm,  
ii) Length of sampler is 650 mm,  
iii) Sample recovered is 490 mm. Determine the recovery ratio and area ratio.
- Q2)** a) 1.5m-wide strip footing is founded at a depth of 0.75m below ground level on a sand layer having unit weight of  $1.8\text{t/m}^3$ . The water table is well below the foundation level. Shear strength properties are:  $c = 0$ ,  $\phi = 38^\circ$ . The strip footing transfers to the soil a load of  $50\text{ t/m}^2$ . [5]  
Determine the factor of safety against shear failure if the load is vertical.  
b) Explain 'Split Spoon Sampler'. [4]
- Q3)** a) Explain in short 'Modulus of subgrade reaction' and its determination.[4]  
b) How the counter fort retaining wall differs from the cantilever retaining walls? [5]
- Q4)** a) Determine the net ultimate bearing capacity of a mat foundation of  $14\text{ m} \times 9\text{ m}$  on a saturated clay with  $C_u = 78\text{ kN/m}^2$ ,  $\phi = 0^\circ$ ,  $D_f = 2.5\text{m}$  [5]  
b) State types of retaining wall. Differentiate between diaphragm wall and sheet pile wall. [4]

**P.T.O.**

**Q5) a)** A group of 9 piles arranged in square pattern with diameter and length of each pile as 30 cm and 7 m respectively, is used as a foundation in soft clay deposit. Taking UCS of clay as  $65 \text{ kN/m}^2$  and pile spacing as 100 cm c/c. Find load capacity of group. Assume bearing capacity factor  $N_c = 9$ , Adhesion factor = 0.75, FOS = 2.5 [8]

b) Explain Negative skin friction. Discuss IRC 78 considerations for Piles socketing and termination depth. [8]

OR

**Q6) a)** Discuss 'Vertical piles subjected to lateral loads'. [8]

b) 20 piles are arranged in four rows and five columns. Calculate the efficiency of the pile group by Feld's rule. [8]

**Q7) a)** Enlist the types of coffer dams and explain any one in detail. [8]

b) Discuss components of well foundation with its function. [8]

OR

**Q8) a)** Describe the construction procedure of open caissons (well foundation), giving neat sketch. In which situations they are used? [8]

b) Explain IRC method to lateral stability of well foundation. [8]



Total No. of Questions : 8]

SEAT No. :

PD-5117

[Total No. of Pages : 2

**[6405]-257**

**M.E. (CIVIL - Geotechnical)**

**CONSTRUCTION METHODS IN GEOTECHNICAL  
(2017 Pattern) (Credit) (Semester - II) (501128)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume Suitable data, if necessary.*
- 4) *Use of electronic pocket calculator is allowed in the examination.*
- 5) *Neat diagrams must be drawn wherever necessary.*

**Q1) a)** Write a note on selection of site for raft foundation. **[5]**

b) Explain setting and driving of sheet pile. **[4]**

OR

**Q2) a)** Explain in detail what is micro pilling. **[4]**

b) Explain in detail rectangular cofferdam. **[5]**

**Q3) a)** Explain Tremic method for construction of seal of cofferdam. **[5]**

b) State the site selection criteria for caissons. **[4]**

OR

**Q4) a)** Write a note on buckling of long struts. **[4]**

b) Explain sinking of open caisson. **[5]**

**P.T.O.**

**Q5) a)** State various drilling equipment's and explain any one in detail. **[8]**

b) What is trim blasting? State merits and demerits. **[8]**

OR

**Q6) a)** State importance of blasting round design. **[8]**

b) Explain pre splitting for rock excavation. **[8]**

**Q7) a)** Explain what shield tunnelling method is. **[8]**

b) Write down types of TBM & explain any one in detail. **[8]**

OR

**Q8) a)** Explain single stage mining method. **[8]**

b) Explain sinking caisson method & write down its merits and demerits. **[8]**



Total No. of Questions : 8]

SEAT No. :

**PD5118**

[Total No. of Pages : 2

**[6405]-258**

**First Year M.E. (Civil) (Geotechnical Engineering)**

**STABILITY OF SLOPES AND EARTH DAMS**

**(2017 Pattern) (Semester - II) (501129)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Use of Calculator is allowed.
- 4) Assume suitable data, if necessary.

- Q1) a)** Explain Prishops method of stability analysis for finite height slopes [5]
- b) Explain the following parameters that affects design of an earthen dam [5]
- i) Optimum moisture content
  - ii) C-d value

OR

- Q2) a)** Explain the term 'Limiting equilibrium'. Discuss in short various methods of stability analysis of finite slopes. [5]
- b) Explain various design considerations in seismic region for an earthen dam. [5]
- Q3) a)** Explain the construction of flow net under a weir considering anisotropy with respect to permeability of material. [5]
- b) Explain the measures to control seepage through the foundations of an earthen dam with sketches. [5]

OR

- Q4) a)** Derive an equation to estimate the seepage discharge by a typical flow net in an earth dam. [5]
- b) Explain terms [5]
- i) Seepage force
  - ii) Critical hydraulic gradient Giving suitable equations & their significance.

**P.T.O.**



- Q5) a)** Briefly discuss the checks that are required to be made to investigate the sterility of an earth dam [5]
- b) What are the Derivable features of good Instrumentation it an earth dam. Explain the various types of pyrometers & their suitability for pore pressure measurement in an earth dam. [10]

OR

- Q6) a)** Explain how settlement of an earth dam is measured with vibrating wire settlement cell and settlement gauge. [8]
- b) Write a short note on [7]
- i) Joint meter
  - ii) Inclinator

- Q7) a)** Explain the functions of geosynthetics as [8]
- i) Separator
  - ii) Reinforcements
  - iii) Unstable slopes
  - iv) Road Pavements with suitable sketches
- b) Draw a typical layout of Road embankment of National highway Also, explain the functions of various component parts. [7]

OR

- Q8) a)** Explain the typical technical specification of railway ballast as per Indian railway codes provisions. [7]
- b) Why steep slope embankments are reinforced? What are the techniques of reinforcing of steep slope embankments. [8]



Total No. of Questions : 8]

SEAT No. :

PD-5119

[Total No. of Pages : 2

[6405]-259

**M.E. (Civil - Geotechnical Engineering)**  
**GEOTECHNICAL EARTH QUAKE ENGINEERING**  
**(2017 Pattern) (Semester - III) (601133)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator is allowed.*

- Q1) a)** What is continental drift and how does it relate to plate tectonics? [6]  
**b)** Explain two lab tests, for measurement of Dynamic soil properties. [7]

OR

- Q2) a)** Explain the steps for strong motion recording with the help of seismographs. [6]  
**b)** Explain 1-d ground response analysis. [7]

- Q3) a)** What are the local site effects on the earthquake ground motion? [6]  
**b)** What areas are susceptible to liquefaction? [6]

OR

- Q4) a)** Discuss 'Development of design parameters' for ground motion. [6]  
**b)** What are the three major earthquake-induced landslides? [6]

- Q5) a)** Discuss Ground Response Analysis. [6]  
**b)** What is seismic stability and Why slope stability analysis is required?[6]

OR

- Q6) a)** Explain Development of deformation analysis by Goodman. [6]  
**b)** Describe types of earthquake which induced landslides. [6]

*P.T.O.*

- Q7)** a) Explain Seismic pressure on retaining walls, with the help diagram. [7]  
b) Discuss 'Seismic Design of Retaining wall'. [6]

OR

- Q8)** a) What are the factors affecting stability of the dam? [6]  
b) Explain Development of deformation analysis by Seed Approach. [7]



Total No. of Questions : 8]

SEAT No. :

**PD5120**

**[6405]-260**

[Total No. of Pages : 2

**Second Year M.E. (Civil-Geotechnical Engineering)**

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - III) (601134)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary and mention it clearly.*

**Q1)** a) Explain various steps in research process. [5]

b) What do you mean by literature survey? Explain its need. [4]

OR

**Q2)** a) Write short notes on styles of literature survey and strategies of literature survey. [5]

b) Explain clearly with examples the difference between applied and fundamental research. [4]

**Q3)** a) Write a note on “Rating scales as a Sampling technique” with examples. [5]

b) What are the methods of data collection? Explain. [4]

OR

**Q4)** a) Discuss the condition in which analysis of variance techniques is used in research with a suitable example. [5]

b) Differentiate collection of data through questionnaire’s and schedules. [4]

**P.T.O.**

- Q5)** a) Explain in detail “Multi-collinearity and Regression”. [8]
- b) Write a note on “Two group Discriminant Analysis” and “Multiple Discriminant Analysis”. [8]

OR

- Q6)** a) Explain “Descriptive Statistics: Measures of Central Tendency, Measures of Dispersions, Measures of Skewness and Measures of Relationships”. [8]
- b) Explain the centroid method of factor analysis. [8]

- Q7)** a) Write a research proposal for a suitable research problem (related to Geotechnical Engg.) to a funding agency with reference to the following terms- “Title, Introduction, origin of the problem, expected outcome, literature review, significance of study in context of current status, objectives, methodology year wise plan. [8]
- b) Discuss the important points to be considered during presenting a research idea. Also write a note on patenting a research idea. [8]

OR

- Q8)** a) Explain in detail mechanics of writing research report with suitable example. [8]
- b) Write short notes on the following : [8]
- i) Bibliography and its importance in context of research report
- ii) Rewriting and polishing of report



Total No. of Questions : 8]

SEAT No. :

**PD5121**

[Total No. of Pages : 3

**[6405]-265**

**First Year M.E. (Civil-Hydraulics)  
OPEN CHANNEL HYDRAULICS  
(2017 Pattern) (Semester - II) (501047)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q. 2, Q.3 Q. 4, Q.5 or Q. 6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figure to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of calculator is allowed.*

**Q1) a)** A rectangular channel 3 m wide carries 3 m<sup>3</sup>/s of water at a depth of 1.0 m. If the width is to be reduced to 2.0 m and bed raised by 10 cm what would be the depth of flow in the contracted section? Neglect the loss of energy in transition. What maximum rise in the bed level of the contracted section is possible without affecting the depth of flow upstream of the channel? **[5]**

b) An overflow spillway has its crest at elevation 125.40 m and horizontal apron at an elevation of 95.00 m on the downstream side. Find the tailwater elevation required to form a hydraulic jump when the elevation of the energy line is 127.90 m. The  $C_d$  for the flow can be assumed as 0.735. The energy loss for the flow over the spillway face can be neglected.**[4]**

**OR**

**Q2) a)** A rectangular channel is 2.5 m wide and conveys a discharge of 2.75 m<sup>3</sup>/s at a depth of 0.9 m. A contraction of width is proposed at section in this canal. Calculate the water surface elevations in the contracted section as well as in an upstream 2.5 m wide section when the width of proposed contraction is 2.0 m. Neglect energy losses in the transition.**[4]**

b) A rectangular channel carrying a supercritical stream is to be provided with a hydraulic jump type of energy dissipator. If it is desired to have an energy loss of 5 m in the jump when the inlet Froude number is 8.5, determine the sequent depths. **[5]**

**P.T.O.**

- Q3) a)** Explain characteristics of M1, M2 and M3 profiles. [5]
- b) A rectangular channel 3.0 m wide can carry a discharge of 3.6 m<sup>3</sup>/s at a normal depth of 1.2 m. Design a side weir so that it will pass all the flow in the canal when the discharge is 2.00 m<sup>3</sup>/s and will divert 0.6 m<sup>3</sup>/s when the canal discharge is 3.6 m<sup>3</sup>/s. [4]

OR

- Q4) a)** A river 50 m wide has an average bed slope of 1 in 10000. Compute the approximate length of the backwater curve produced by a weir which raises the water surface immediately behind it by 3.0 m. What will be the rise in water level at a point 9.0 km upstream of the weir? The discharge in the river can be taken as 62.5 m<sup>3</sup>/s. Assume Chezy's constant  $C = 45$ . Use direct step method and take 2 steps only. [5]
- b) Derive differential equation for spatially varied flow. [4]
- Q5) a)** A rectangular channel carries a flow with a velocity of 0.65 m/s and depth of 1.4 m. If the discharge is abruptly increased threefold by a sudden lifting of a gate on the upstream, estimate the velocity and the height of the resulting surge. [8]
- b) Show that the continuity equation for a GVUF in a non-prismatic channel with no lateral in flow is [8]

$$A \frac{\partial V}{\partial x} + VT \frac{\partial y}{\partial x} + \epsilon yV \frac{\partial T}{\partial x} + T \frac{\partial y}{\partial t} = 0$$

where  $\epsilon =$  a coefficient which depends on the nature of the non-prismaticity of the channel with  $\epsilon = 0.5$  and 1.0 for triangular and rectangular channels.

OR

- Q6) a)** A 2.0 m wide rectangular channel, 2 km long carries a steady flow of 4.6 m<sup>3</sup>/s at a depth of 1.15 m. The sides of the channel are 2.0 m high. If the flow is suddenly stopped by the closure of a gate at the downstream end, will the water spill over the sides of the channel? If there is no spillage, what minimum time interval must elapse before the arrival of the surge at the upstream end? [8]
- b) Show that by using the Chezy's formula with  $C =$  constant, the ration  $(V_w)_m/V_n$  of a monoclinal wave is 1.50 and 1.25 for wide rectangular and triangular channels respectively. [8]

**Q7) a)** The storage, elevation and outflow data of a reservoir are given below:[10]

| Elevation (m) | Storage $10^6 \text{ m}^3$ | Outflow discharge ( $\text{m}^3/\text{s}$ ) |
|---------------|----------------------------|---------------------------------------------|
| 299.50        | 4.8                        | 0                                           |
| 300.20        | 5.5                        | 0                                           |
| 300.70        | 6.0                        | 15                                          |
| 301.20        | 6.6                        | 40                                          |
| 301.70        | 7.2                        | 75                                          |
| 302.20        | 7.9                        | 115                                         |
| 302.70        | 8.8                        | 160                                         |

The spillway crest is at elevation 300.20 m. the following flood flow is expected into the reservoir.

| Time (h)                            | 0  | 3  | 6  | 9  | 12 | 15 | 18 | 21 | 24 | 27 |
|-------------------------------------|----|----|----|----|----|----|----|----|----|----|
| Discharge ( $\text{m}^3/\text{s}$ ) | 10 | 20 | 52 | 60 | 53 | 43 | 32 | 22 | 16 | 10 |

If the reservoir surface is at elevation 300.00 m at the commencement of the inflow, route the flood to obtain

- i) the outflow hydrograph and
  - ii) the reservoir elevation vs time curve
- b) Describe the Muskingum method of routing an inflow hydrograph through a channel reach. Assume the values of the coefficients  $K$  and  $x$  for the reach are known. [6]

OR

**Q8) a)** Define the problem of level pool routing. Describe a commonly used method of reservoir routing. [7]

- b) The storage in the reach of a stream has been studied. The values of  $x$  and  $K$  in Muskingum equation have been identified as 0.28 and 1.6 days. If the inflow hydrograph to the reach is as given below, compute the outflow hydrograph. Assume the outflow from the reach at  $t = 0$  as  $3.5 \text{ m}^3/\text{s}$ . [9]

| Time (h)                         | 0  | 6  | 12 | 18  | 24  | 30  |
|----------------------------------|----|----|----|-----|-----|-----|
| Inflow ( $\text{m}^3/\text{s}$ ) | 35 | 55 | 92 | 130 | 160 | 140 |





[6405]-270

M.E. (Civil-Structures)

**THEORY OF ELASTICITY AND PLASTICITY**

**(2017 Pattern) (Semester-I) (501001)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right bracket indicate full marks.
- 4) Assume suitable data, if necessary and clearly state.

**Q1)** a) The state of stress at a point is given by  $\sigma_x = 20$  MPa,  $\sigma_y = -10$  MPa,  $\sigma_z = 5$  MPa,  $\tau_{xy} = 4$  MPa,  $\tau_{yz} = 5$  MPa,  $\tau_{xz} = 6$  MPa. If  $E = 2 \times 10^5$  N/mm<sup>2</sup>,  $G = 0.84 \times 10^5$  N/mm<sup>2</sup>. Determine the strain components. **[5]**

b) Write a short note on Airy's Stress Function Method. **[4]**

OR

**Q2)** a) Derive an expression for maximum shearing strain for a state of strain at a point on an element. **[5]**

b) Obtain the Navier's-Lame's equation of equilibrium. **[4]**

**Q3)** a) If inner radius  $a=200$ mm, outer radius  $b=250$ mm and pressure  $p=50$  N/mm<sup>2</sup> acting externally, find  $\sigma_r$  and  $\sigma_\theta$  at inner and outer faces of cylindrical vessel. **[5]**

b) Obtain the expression for torsion of equilateral triangular cross sectional bar. **[4]**

OR

**Q4)** a) Obtain the differential analogous methods used for solving torsion problems. Explain Prandtl's Theory of solid sections. **[5]**

b) Explain with examples the axisymmetric problems. Hence write down the corresponding basic equations of equilibrium, compatibility and strain displacement relations. **[4]**

*P.T.O.*

**Q5) a)** Write a short note on Tresca's yield theory and Von-Mises yield criteria. [8]

b) State the uniqueness theorem for small plastic-elastic deformations. [8]

OR

**Q6) a)** Explain in brief Tresca's and Von-Mises-Henky's yield criteria. [8]

b) When plasticity model is said to be isotropic hardening? Explain with example. [8]

**Q7) a)** Show that for this walled prismatic tube subjected to torsion, the angle of twist  $\theta = \frac{q}{2AG} \oint \frac{ds}{t}$ , Where, t = thickness, ds = shear stress differential element circumferential length, q = shear stress, A = Area of tube, and G = shear modulus. [8]

b) Derive the expression for solid cylindrical bar under torsion as per Nadia's Sand Heap analogy. [8]

OR

**Q8) a)** State the behavior of ideally plastic thick walled cylinders under internal pressure alone. [8]

b) Write a short note on ideally plastic solids of ductile and brittle materials with an suitable diagram. [8]



[6405]-271

First Year M.E. (Civil)/(Structural Engineering)

STRUCTURAL DYNAMICS

(2017 Pattern) (Semester - I) (501002)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer Q.1 or Q.2; Q.3 or Q.4; Q.5 or Q.6; and Q.7 or Q.8
- 2) Figures in bold to the right, indicate full marks
- 3) Neat diagrams should be drawn where ever necessary

**Q1) a)** Find the equivalent stiffness for the structure shown in Fig. 1 **[4]**

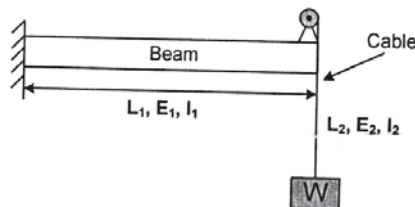


Fig. 1

- b) For a single degree of freedom system if  $m = 2.5 \text{ kg}$ ,  $k = 10 \text{ N/m}$  and the initial conditions are  $x_0 = 0.05 \text{ m}$  and  $\dot{x}_0 = 0$ . Find the response of system for following cases. **[5]**

- i) If  $c = 5 \text{ N.s/m}$ ;
- ii) If  $c = 10 \text{ N.s/m}$  and;
- iii) If  $c = 12 \text{ N.s/m}$ .

OR

- Q2) a)** An elevated reinforced concrete water tank is idealized as a single degree of freedom system as shown in Fig. 2 is 100 m high. It has a tubular cross section of inner diameter 2.5 m and outer diameter 3 m. The tank has a mass of 275,000 kg when filled with water. The Young's modulus of reinforced concrete as 30 GPa, determine the following: **[5]**

- i) The vibration response of the water tank due to an initial transverse displacement of 250 mm.
- ii) The maximum values of the velocity and acceleration experienced by the water tank.

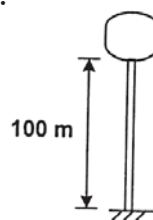


Fig. 2

P.T.O.

- b) Find the total response of a single degree of freedom system with the given data:  $m = 10 \text{ kg}$ ,  $c = 20 \text{ N.s/m}$ ,  $k = 4000 \text{ N/m}$ ,  $x_0 = 0.01 \text{ m}$  and  $\dot{x}_0 = 0$ ,  $F(t) = F_0 \cos \omega t$  where  $F_0 = 100 \text{ N}$  and  $\omega = 10 \text{ rad/s}$ . [4]

- Q3)** During an earthquake the structure shown in Fig. 3 is subject to a ground acceleration of amplitude  $50 \text{ mm/s}^2$  at a frequency of  $88 \text{ rad/s}$ . Determine the acceleration amplitude of the structure. Assume the girder is rigid and the structure has a damping ratio of  $0.03$ . Consider the mass of the girder as  $2000 \text{ kg}$ , stiffness of each column is  $k/2$  where  $k = 1.8 \times 10^6 \text{ N/m}$ . [9]

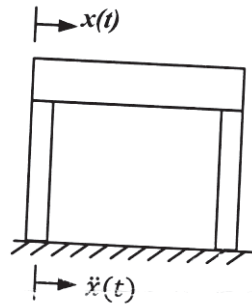


**Fig. 3**

OR

- Q4)** Derive the solution for a system subjected to pulse loading. [9]

- Q5) a)** For the system shown in Fig. 4, determine the natural frequencies of oscillation about equilibrium and the respective modal ratios. Assume the following parameter values:  $m_1 = 10 \text{ kg}$ ,  $m_2 = 14 \text{ kg}$ ,  $k_1 = 4 \text{ N/m}$ ,  $k_2 = 5 \text{ N/m}$ , and  $k_3 = 6 \text{ N/m}$ . [10]

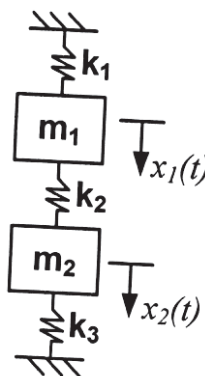


**Fig. 4**

- b) Explain mass coupling, velocity coupling and, elastic coupling with suitable examples. [6]

OR

- Q6) a)** The two storey building shown in Fig. 5 is subjected to a ground displacement of  $y(t) = 0.20 \sin(\pi t)m$ . The equivalent stiffness of the lower and upper columns are 800 N/m and 600 N/m respectively and  $m_1 = m_2 = 50$  kg. Calculate the response  $x_1(t)$  and  $x_2(t)$ . **[10]**

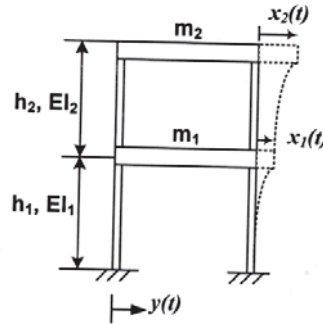


**Fig. 5**

- b)** Explain with an example why are the mass, damping, and stiffness matrices are symmetrical. **[6]**
- Q7) a)** Derive the equation for the fundamental frequency using the Rayleigh's method. **[8]**
- b)** Derive the general equation of motion for the lateral vibrations of beams from fundamental concepts. **[8]**
- OR**
- Q8) a)** Determine the natural frequencies of vibration of a beam fixed at one end and simply supported at the other end. **[8]**
- b)** Derive the frequency equation of a uniform beam fixed at both ends. **[8]**



Total No. of Questions : 8]

SEAT No. :

PD-5124

[Total No. of Pages : 2

[6405]-272

**M.E. (Civil) (Structural Engineering)**  
**ADVANCED DESIGN OF STEEL STRUCTURES**  
**(2017 Pattern) (Semester - I) (501003)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 Or Q.2,Q.3, or Q.4, Q.5 or Q.6,Q.7,orQ.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume Suitable data if necessary.*
- 4) *The figures on right side indicates the marks.*
- 5) *Use of Electronic pocket calculators is allowed.*
- 6) *Use IS : 875, IS: 800-2007, Is:800-1984, IS:801, IS:802, IS:811, SP-34 are allowed.*

- Q1)** a) Explain the process of designing hoarding structures under dead load, live load, and wind load as per IS 875. [3]
- b) Design a tubular column as per IS 806 for a height of 8m in a multi-story building subjected to an axial load of 1000 kN. The column is fixed at the base and pinned at the top. [6]

OR

- Q2)** What is the concept behind use of castellated beams. Describe the fabrication process of a castellated beam from a rolled steel section. [9]

- Q3)** Two C-sections of size 200 mm × 60 mm × 2.5 mm are welded together with their webs connected to act as a beam. The effective span of the beam is 5 m. Determine the maximum uniformly distributed load, including self-weight, that the beam can carry. Use properties from IS 811-1961. [9]

OR

- Q4)** a) Describe the bracing systems commonly used in transmission towers with proper sketches. What are their roles in ensuring stability? [3]
- b) Explain the concept of flat-width ratio and its significance in the design of light gauge compression members. [6]

**P.T.O.**

- Q5) a)** What are the different types of linings used in steel chimneys? Explain their purpose and material selection criteria. [8]
- b) A steel chimney of 50 m height and the diameter of cylindrical shell is 2.5 m. The moment at the base of chimney is 8830kNm and the weight of chimney shell is 756kN. It has a 100mm thick lining brick lining. Design base plate and anchor bolt. [8]

OR

- Q6) a)** What forces act on the base plate of steel chimney? Explain the design procedure of base plate. [8]
- b) What are the key factors to consider in the stability analysis of steel chimneys? [8]
- Q7) a)** Design a steel chimney with the following specifications:
- Height: 50m
- Diameter: 2.5m
- Wind load: As per IS 875 (Part 3):2015 (Basic wind speed: 39 m/s, Terrain Category III). Calculate the thickness of steel plates. [8]
- b) Discuss the design of ladders and access platforms for steel chimneys, focusing on safety and functional requirements. [8]

OR

- Q8)** Design a steel chimney with the following specifications:

Height: 60m

Diameter: 3 m

Wind load: As per IS 875 (Part 3):2015 (Basic wind speed: 39 m/s, Terrain Category III). Calculate the thickness of steel plates, design the base plate, and detail the anchor bolts. Check the overall stability of the chimney. [16]



[6405]-273

M.E. (Civil - Structural)

NUMERICAL METHODS IN STRUCTURAL  
ENGINEERING

(2017 Pattern) (Semester-I) (501004)

Time : 3 Hours]

[Max. Marks : 50

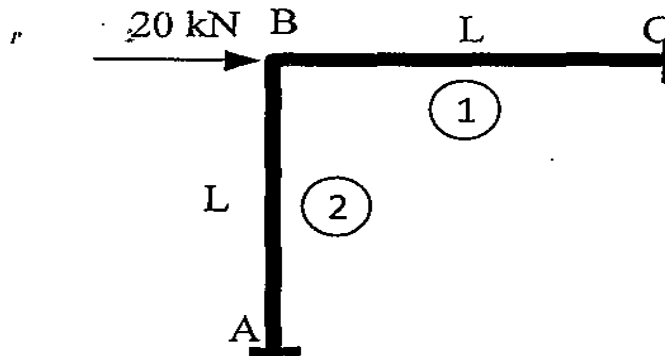
Instructions to the candidates :

- 1) Answer Q.1 or Q.2; Q.3 or Q.4; Q.5 or Q.6; and Q. 7 or Q.8
- 2) Figures to the right indicate full marks
- 3) If necessary, assume suitable data and indicate clearly
- 4) Use of electronic pocket calculator is allowed.

**Q1) a)** Explain the significance of transformation matrix. For the frame shown in the figure, determine the member stiffness matrix  $[S_m]_G$  in global coordinates for element 1 and the transformation matrix  $[R]$  of element 2 of the frame shown in Figure 1.

Take  $E = 200 \text{ GPa}$ ,  $A = 0.04 \text{ m}^2$ ,  $I = 0.0004 \text{ m}^4$ ,  $L = 3.5 \text{ m}$ .

[5]



b) Explain the Choleski's factorization method with an example.

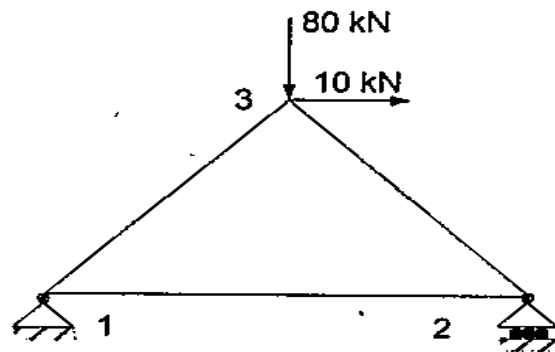
[4]

OR

P.T.O.



- Q2) a)** For the given truss having equilateral triangular shape, derive the global stiffness matrix using Direct stiffness matrix. [5]



- b) Comment if the following matrix is hermitian positive definite. Also find

its Cholesky factorization if possible  $[A] = \begin{bmatrix} 2 & 2 & 1 \\ 2 & 3 & 3 \\ 1 & 3 & 2 \end{bmatrix}$  [4]

- Q3) a)** Use power method to approximate a dominant eigenvalue and the corresponding eigenvector of  $\begin{bmatrix} 4 & -5 \\ 2 & 3 \end{bmatrix}$  correct to 3-significant figures,

after 5 iterations. Begin with an initial nonzero approximation of  $[X_0] = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$  [5]

- b) Write a short note on Trapezoidal rule,  $\frac{3^{th}}{8}$  Simpson's rule and Gauss Quadrature method for numerical integration. Specify the advantages of Gauss Quadrature method. [4]

OR

- Q4) a)** Solve the following initial value problem using fourth order Runge Kutta

method  $\frac{d^2y}{dx^2} + 0.5\left(\frac{dy}{dx}\right) + 7y = 0$  with initial conditions  $y(0) = 4$  and

$\frac{dy}{dx} = 0$ . Start at  $x = 0$  and find  $y(2)$ . [5]

- b) Explain the Gauss Quadrature rule of Integration. Integrate  $f(x) = 2x^3 - 3x^2 + 4x - 5$  from  $-2$  to  $4$  using Gauss Quadrature formula. [4]

- Q5) a)** A propped cantilever beam has a span of 4 m and is loaded with a couple of 1kNm at the propped end. Second moment of area of its cross section is '2I' for left half portion towards the fixed end and 'I' for right half portion. Using nodes at 1 m interval, calculate the deflection and bending moment at the center using finite difference method. [8]
- b)** Using finite difference method, estimate the deflection at the nodal points of the grid, using grid interval of  $h=0.5$  for a simply supported uniform plate of length 2 m and width 1 m. The plate supports a central point load of 10 kN along with uniformly distributed load  $2 \text{ kN/m}^2$  over the entire plate. [8]

OR

- Q6) a)** Estimate the buckling load of a pin ended column of length L and uniform cross section. Consider four subinterval and compare the approximate value obtained with the exact value given by Euler's critical load theory. [8]
- b)** A simply supported square plate of size 1.1 m supports a uniformly distributed load of intensity  $2.5 \text{ kN/m}^2$ . Divide the plate into nine equivalent squares and find deflection at the four interior nodal points using finite difference method. [8]

- Q7) a)** Fit an saturation growth model ( $y=a*x/(b+x)$ ) to the data given below.[8]

|   |     |     |     |     |
|---|-----|-----|-----|-----|
| X | 2   | 4   | 6   | 8   |
| Y | 1.4 | 2.0 | 2.4 | 2.6 |

- b)** Using cubic spline interpolation technique, interpolate  $f(x) = x^4$  on the interval  $-1 \leq x \leq 1$  by the cubic spline  $g(x)$  corresponding to the nodes  $x_0 = -1, x_1 = 0, x_2 = 1$  and satisfying the clamped conditions  $g'(-1) = f'(-1), g'(1) = f'(1)$ . [8]

OR

- Q8) a)** Fit a curve using least square method and find the functional value at  $x = 0.6$ . [8]

|   |         |         |         |         |          |
|---|---------|---------|---------|---------|----------|
| X | 3       | 5       | 7       | 9       | 11       |
| Y | 5.39943 | 6.59468 | 8.05501 | 9.83841 | 12.01666 |

- b)** Write a short note on Spline Fit technique and point out the conceptual difference between interpolating technique and regression technique for a set of data. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5126**

[Total No. of Pages : 2

**[6405]-274**

**First Year M.E. (Civil-Structural Engg.)**

**FINITE ELEMENT METHOD**

**(2017 Pattern) (Semester - II) (501007)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q. 2, Q.3 or Q. 4, Q.5 or Q. 6 and Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figure to the right indicates full marks.
- 4) Assume suitable data, if necessary and clearly state.
- 5) Use of cell phone is prohibited in the examination hall.
- 6) Use of electronic pocket calculator is allowed.

**Q1)** Solve using collocation method, the differential equation governing a physical phenomenon as **[9]**

$$\frac{d^2y}{dx^2} + y = x, x \in [0, 2]$$

boundary conditions are  $y(0)=0$ ;  $y(2)=5$

Assume trial function:  $y = \frac{3}{\sin^2} \sin x + x$ . Over interval  $[0, 2]$

OR

**Q2)** a) Write a note on significance of strong and weak formulation in Finite element analysis. **[4]**

b) Write a short note on node numbering. **[5]**

**Q3)** a) What is Lagrangian Polynomial? Using this, determine and plot the shape functions of four noded rectangular elements in natural coordinate system. **[4]**

b) Write the properties of shape functions. **[5]**

OR

**Q4)** a) A four noded element has coordinates (1,1), (3,0) (3.5, 2.5) (2,3) Determine the Jacobian matrix and its value at (1.3, 1.5). **[5]**

b) For a plane elasticity problem, derive the strain displacement matrix for the rectangular 2D-6 noded serendipity element. **[4]**

**P.T.O.**

- Q5) a)** State the salient features shear deformation theory with reference to finite element analysis. Explain shear locking phenomenon. **[8]**
- b)** Explain the Mindlin's plate element and briefly explain the formulation of stiffness matrix. **[8]**

OR

- Q6) a)** Explain the convergence requirements of displacement functions. Write a note on conforming and non-conforming elements with reference to plate elements. **[8]**
- b)** Derive the stiffness matrix for ACM. **[8]**
- Q7) a)** For axisymmetric element, write constitutive relations and hence obtain the element stiffness matrix for a typical triangular element for its application in solving a problem of cylinder subjected to internal pressure. **[8]**
- b)** How will you differentiate shell element in comparison with plate element. Write the strain displacement matrix for the curved shaped element. **[8]**

OR

- Q8) a)** Explain how axi-symmetric problems can be analyzed using axi-symmetric elements in Finite element method. **[8]**
- b) i)** Explain in detail 'Flat elements' in Finite element analysis. **[8]**
- ii)** Write the displacement field for 4 noded degenerated shell elements.



Total No. of Questions : 8]

SEAT No. :

PD-5127

[Total No. of Pages : 2

[6405]-275

M.E. (Civil - Structures)

**THEORY OF PLATES AND SHELLS**  
**(2017 Pattern) (Semester - II) (501008)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q. 5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary and clearly state.*

**Q1)** a) Derive the relations between bending moments and curvature in pure bending of plates? [5]

b) Differentiate Navier's and Levy's method for the analysis of thin plate. [4]

OR

**Q2)** a) Distinguish between thin plate with small deflection and thin plate with large deflection. [5]

b) Explain small deflection theory of thin plates also states their assumptions. [4]

**Q3)** a) A uniform loaded solid circular plate with radius 'a' has its edges simply supported obtain the expressions for the maximum deflections and obtain bending moments. [5]

b) Explain the bending and membrane theories for analysis of shells. [4]

OR

**Q4)** a) Explain about the various types of shells with neat sketches? [5]

b) Develop from first principles, governing differential equation for circular plate under axisymmetric loading. [4]

*P.T.O.*

- Q5)** a) A horizontal cylindrical shell with closed ends is filled with liquid of density  $\gamma$  and is simply supported at ends. Derive expressions for stress resultants  $N_x$ ,  $N_\phi$  and  $N_{x\phi}$  for a meridional angle  $\phi$  in the shell. [8]
- b) Find the membrane forces in a circular cylindrical shells subjected to a sinusoidal load. [8]

OR

- Q6)** a) Sketch cylindrical shell. Show the stress resultants for small element on the shell surface. Derive equation of equilibrium for this element. [8]
- b) Find the membrane stresses in a circular cylindrical shell subjected to snow load. [8]

- Q7)** a) Explain stress analysis of cylindrical roof shells. [8]
- b) Briefly explain Lundgreen's beam theory for the analysis of a shell with edge beam giving necessary equations for beam action. Arch action may be explained qualitatively. [8]

OR

- Q8)** a) Explain the beam method of analysis of cylindrical shells with advantages and limitation of this method. [8]
- b) Draw a typical cylindrical shell element and indicate various member forces, transverse shears and moments. Give the relations among forces and moments on positive faces and negative faces. [8]



Total No. of Questions : 8]

SEAT No. :

PD-5128

[Total No. of Pages : 3

[6405]-276

**M.E. (Civil) (Structural Engineering)**

**ADVANCED DESIGN OF CONCRETE STRUCTURES**

**(2017 Pattern) (Semester - II) (501009)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q. 7or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Use of IS 456-2000, IS 1343, IS 1893, IS 3370 and Non-programmable calculator is allowed
- 4) Neat diagrams must be drawn wherever necessary.
- 5) Mere reproduction from IS Code as answer, will not be given full credit
- 6) Assume any other data, if necessary.

- Q1) a)** Explain guidelines for establishing axes of rotations and yield lines. **[4]**
- b) Design a grid slab for a floor of hall  $12\text{m} \times 16\text{m}$  c/c having square grid of  $1.5\text{m}$ . Use M20 Fe 500 take live load  $4\text{kN/m}^2$  and floor finish load  $1.5\text{kN/m}^2$ . Design for flexure only. **[5]**

OR

- Q2) a)** Draw yield line pattern for: A rectangular slab with fixed support on three sides with shorter side free. **[4]**
- b) Design a grid slab for a floor of hall  $12\text{m} \times 14\text{m}$  having a square grid of  $2\text{m}$ . Take live load  $6\text{kN/m}^2$  and floor finish load  $1.4\text{kN/m}^2$  Use M20 and Fe415 steel. **[5]**
- Q3) a)** Explain different types of flat slab and list the advantages of flat slab.**[4]**
- b) An open circular tank  $12\text{m}$  diameter and  $3\text{m}$  deep and supported  $7\text{m}$  above the ground level on beams and columns. Design the tank, beam and columns. Use M25 concrete and Fe 415 steel. **[5]**

OR

*P.T.O.*

- Q4) a)** Design an interior panel of a flat slab  $6\text{m} \times 6\text{m}$  for a live load of  $4\text{ kN/m}^2$  and F.F. of  $1.3\text{ kN/m}^2$ . Use M25 and Fe 415. Design for flexure. [5]
- b) Explain in detail wind load analysis of columns for water tank supported on four identical columns with their lower end fixed to the base and braced at intermediate levels. [4]
- Q5) a)** Design a square bunker to store 300 kN furnace slag. Unit weight of slag is  $8000\text{N/m}^3$ . Angle of repose is  $24^\circ$ . Use M25 and Fe500. Draw reinforcement details. [8]
- b) A concrete bin is  $3.8\text{m} \times 3.8\text{m}$  and contains wheat weighing  $8.75\text{kN/m}^3$ . The coefficient of friction between grain and grain is 0.45. The coefficient of friction between grain and concrete is 0.42. If the depth of wheat is 4m, determine the lateral pressure per meter run of the bin wall. [8]

OR

- Q6) a)** Design a circular bunker to store 100 KN of coal take density of coal as  $8.5\text{kN/m}^3$ , angle of repose is  $25^\circ$ . Use M25 and Fe500 steel. Draw the details of reinforcement in side wall and hopper. [8]
- b) A concrete silo of diameter 8m with height of cylindrical portion of 15m and contains and contains cement weighing  $15\text{kN/m}^3$ . The coefficient of friction between grain and grain is 0.31, the coefficient of friction between grain and concrete is 0.45 and angle of repose is  $17.5^\circ$ . Determine the lateral pressure at 5m interval on the walls of silo. [8]
- Q7) a)** A group of 25 piles is arranged with 5 rows and 5 piles each. The piles are 350mm diameter and spaced 1.2 m centers each pile can carry 370kN working load, if it can act independently. Determine the carrying capacity of the pile group. [8]
- b) Design the formwork for slab  $4\text{m} \times 4\text{m}$  having thickness of 180mm. It is proposed to deposit concrete in one stage. [8]

OR



- Q8) a)** In a group of 16 piles of diameter 450mm and center to center spacing of pile being 1.5m. The piles are arranged in square area. Each pile is 10m long and taking  $m = 0.7$  and  $c = 50\text{kN/m}^2$ . Ascertain whether the failure will occur with the piles acting individually or as a group. Also specify the failure load. **[8]**
- b)** Design raft foundation for center-to-center distance of columns in both directions is 3.4 m, column size 400mm  $\times$  400mm, working axial load on each column is 650kN. The depth of strata is 2m. Use M20 and Fe500. The safe bearing capacity of strata is  $120\text{kN/m}^2$ . Draw reinforcement details. **[8]**



Total No. of Questions : 8]

SEAT No. :

PD-5129

[Total No. of Pages : 2

[6405]-277

**M.E. (Civil) (Structural Engineering)**  
**RESEARCH METHODOLOGY**  
**(2017 Pattern) (Semester - III) (601013)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Define the term Research Methodology. Explain in brief its significance. **[4]**  
b) Enlist the various funding agencies for engineering research grants. Explain any one in detail. **[5]**

OR

- Q2)** a) What are the criteria or characteristics of good research problem? **[4]**  
b) What is meant by research design? Explain the different types of research designs and formulate a research design for your research problem. **[5]**

- Q3)** a) Explain the purpose of literature survey. Explain with example the purpose and use of three different literature sources. **[5]**  
b) What is mean by literature review? State and explain the different sources of literature. **[4]**

OR

- Q4)** a) Explain the importance of good literature review. **[5]**  
b) How to write literature review to develop conceptual framework for research? **[4]**

**P.T.O.**

- Q5) a)** Explain in detail : **[8]**
- i) Correlations and regression analysis.
  - ii) Multidimensional scaling and measurement.
- b) What is mean by sampling design? Critically examine the various types of sampling design techniques. **[8]**

OR

- Q6) a)** Explain the characteristics of good sample design with suitable example. **[8]**
- b) What is hypothesis testing? Define Null hypothesis and Alternative hypothesis. Explain type 1 and type 2 error with suitable example. **[8]**
- Q7) a)** Write a format of a good report indicating, different parts and their positioning in the report. **[8]**
- b) Write a research proposal for a suitable research problem (Any problem related to Structural Engineering can be considered) to a funding agency with reference to the following terms: Title, Introduction, origin of the problem, expected outcome, literature review, Significance of the study in the context of current status, objectives, methodology, year wise plan. **[8]**

OR

- Q8) a)** Describe in writing the steps involved in filing a patent in India. **[8]**
- b) Write a research proposal for a suitable research problem (Any problem related to Civil Engineering can be considered) to a funding agency with reference to the following terms: Title, Introduction, origin of the problem, expected outcome, literature review, Significance of the study in the context of current status, objectives, methodology, year wise plan. **[8]**



Total No. of Questions : 8]

SEAT No. :

**PD5130**

**[6405]-278**

[Total No. of Pages : 2

**S.Y.M.E. (Civil - Structural Engineering)**  
**ANALYSIS AND DESIGN OF EARTHQUAKE RESISTANT**  
**STRUCTURES**  
**(2017 Pattern) (Semester - III) (601014)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q. 7or Q.8.*
- 2) Neat diagram must be drawn wherever necessary.*
- 3) Figure to the right indicates full marks.*
- 4) Assume suitable data, if necessary and clearly state.*
- 5) Use of cell phone is prohibited in the examination hall.*
- 6) Use of electronic pocket calculator is allowed.*
- 7) IS 1893 is allowed.*

- Q1)** a) Describe about the characteristics of earthquake. [5]
- b) Write short note on P- $\Delta$  effect. [4]

OR

- Q2)** a) Explain elastic rebound theory. [5]
- b) Explain the importance of orientation of building in earthquake resistant design. [4]

- Q3)** a) Explain center of mass of a structure. [5]
- b) How will you develop an Isoseismal map? [4]

OR

- Q4)** a) Explain the types of geological faults. [5]
- b) Define concept of Stiffness, flexibility and ductility. [4]

**P.T.O.**

- Q5) a)** Write about principle of earthquake resistant design. [4]
- b) Design a rectangular beam for 8m span to support a DL of 08 kN/m and a LL of 10 kNm inclusive of its own weight. Moment due to earthquake load is 1500kNm and shear force is 70 kN. Use M20 grade concrete and Fe415 steel. [12]

OR

- Q6) a)** Explain capacity based design and detailing for RC building with example. [8]
- b) Discuss a R.C.C building frame procedure as per IS 1893:2016. [8]
- Q7) a)** Examine types of shear wall and what do you prefer for high rise building? Explain it. [8]
- b) Design a shear wall for 14 stored reinforced building with reinforced concrete building as per the design requirement of IS 13920. Assume relevant data if any needed. [8]

OR

- Q8) a)** Calculate time period of water tank whose mass is 2,50,000 kg and stiffness is  $2.3 \times 10^8 \text{ N/m}$ . [8]
- b) Explain about the design procedure of shear wall in detail. [8]



Total No. of Questions : 8]

SEAT No. :

PD-5131

[Total No. of Pages : 2

**[6405]-279**

**M. E. (Civil)**

**WATER RESOURCE AND ENVIRONMENTAL ENGG**

**Planning and Management of Water Resources**

**(501081) (2017 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary*

- Q1)** a) Explain environmental aspects of planning and management of water resources. [5]
- b) Comment on spatial and temporal characteristics of water resources. [4]

OR

- Q2)** a) Explain constraints like reversibility for development of water resources. [5]
- b) Explain objectives of water resources planning. [4]
- Q3)** a) Explain how conjunctive use of water play important role in water management. [4]
- b) Explain latest technique to measured sedimentation in a reservoir. [5]

OR

- Q4)** a) How groundwater content can be improved. [4]
- b) Explain role of water doctrines to resolve disputes. [5]

**P.T.O.**

- Q5)** a) Comment on causes of floods, effects of flood and methods to control floods. [8]
- b) Discuss central government central water policy with regards to water allocation. [8]

OR

- Q6)** a) Explain essential data necessary for water power studies for storage project. [8]
- b) Explain repayment of cost and allocation of cost for multipurpose project. [8]
- Q7)** a) Explain financial performance analysis to check economic viability of long term sustainable projects. [8]
- b) Explain in detail basin planning (principles & procedures). [8]

OR

- Q8)** a) Explain with an example Inter Basin Water Transfer. [8]
- b) Explain discounting techniques for financial analysis of large dams. [8]



Total No. of Questions : 8]

SEAT No. :

**PD5132**

[Total No. of Pages : 2

**[6405]-283**

**First Year M.E. (Civil/WREE)**

**HYDROLOGY**

**(2017 Pattern) (Semester - II) (501087)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume Suitable data if necessary.

**Q1) a)** Explain hydrologic cycle. State various rain-gauges Explain in detail modern method. **[5]**

b) Explain Stanford Watershed Model. **[4]**

OR

**Q2) a)** Draw a flow chart for mathematical methods in hydrology and explain stochastic hydrology applications. **[6]**

b) Explain log-normal distribution (statistical). **[3]**

**Q3) a)** What is design flood? How it is finalized while designing hydraulic structure. **[4]**

b) Explain Pearson Type-III method. **[5]**

OR

**Q4) a)** Write note on method of images for ground water management. **[5]**

b) Explain the Goodrich method of flood routing. **[4]**

**Q5) a)** Explain step by step design of tube well & also explain types and construction methods for tube wells. **[8]**

b) What are causes of ground water pollution? State effects of ground water pollution. What are the methods to treat polluted ground water. **[8]**

OR

**P.T.O.**



- Q6)** a) What affects the quality of ground water in India. [8]  
b) Explain digital computer models. [8]

- Q7)** a) Explain any one widely used method of ground water recharge. [8]  
b) State various methods to conserve ground water and explain any two and also explain how it helps in management of water resources. [8]

OR

- Q8)** a) Explain electric analog model for ground water modeling with neat sketches. [8]  
b) Explain sand tank model and transparent model for ground water modeling with neat sketches. [8]



Total No. of Questions : 8]

SEAT No. :

PD-5133

[Total No. of Pages : 2

**[6405]-288**  
**M.E. (AI & DS)**  
**ARTIFICIAL INTELLIGENCE**  
**(2017 Pattern) (Semester - I) (510501)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat Diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume Suitable data if necessary.

**Q1)** What are the different types of environments encountered in AI? **[9]**

OR

**Q2)** What is probabilistic reasoning in the context of artificial intelligence? **[9]**

**Q3)** How do uninformed search strategies explore the search space compared to informed search strategies? **[9]**

OR

**Q4)** How does reinforcement learning involve the interaction between an agent and its environment? **[9]**

**Q5) a)** Explain the elements of First Order Logic. **[8]**

b) How planning algorithm is applied in moving cargo on aeroplane from one airport to another airport. **[8]**

OR

**Q6) a)** What are the common techniques used in AI-based credit card fraud detection systems? **[8]**

b) How do collaborative filtering algorithms generate recommendations based on user preferences and interactions? **[8]**

**P.T.O.**

- Q7)** a) What is classical planning, and how does it differ from other types of planning approaches in AI? **[8]**
- b) What role does perception play in the planning and acting process for AI systems operating in the real world? **[8]**

**OR**

- Q8)** a) How do local search algorithms handle constraints and constraints satisfaction problems in optimization? **[8]**
- b) Can you provide examples of real-world applications where online search agents are used to navigate and explore unknown environments? **[8]**



Total No. of Questions : 12]

SEAT No. :

**PD5134**

[Total No. of Pages : 2

**[6405]-289**

**F.Y. M.E. (Artificial Intelligence)  
DATA PREPARATION AND ANALYSIS  
(2017 Pattern) (Semester - I) (510502F)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.

**Q1)** Compare different data formats such as CSV, JSON, XML, and Parquet. How does the choice of format impact data storage and processing? **[8]**

OR

**Q2)** Why is feature selection important in machine learning? Explain different feature selection techniques like filter, wrapper, and embedded methods with examples. **[8]**

**Q3)** What is data integration? Discuss different challenges in integrating data from multiple sources and how schema matching can help. **[8]**

OR

**Q4)** Explain Min-Max Normalization with a mathematical formula. Provide an example showing its application. **[8]**

**Q5)** Explain linear transformations in data preprocessing. How do they help in feature scaling? Provide examples. **[8]**

OR

**Q6)** Explain the Box-Cox transformation. When is it applied, and how does it help in normalizing data? Provide a step-by-step example. **[8]**

**Q7)** What is data exploration? Explain how summary statistics such as mean, median, variance, skewness, and kurtosis help in understanding data. **[9]**

OR

**Q8)** What is dimensionality reduction? Discuss its significance in handling high-dimensional datasets. **[9]**

**P.T.O.**

**Q9)** Describe various types of plots such as bar charts, line charts, histograms, scatter plots, and box plots. Provide use cases for each. **[8]**

OR

**Q10)** What is time series data? Explain different visualization techniques used for time series analysis with examples. **[8]**

**Q11)** What are the common challenges faced in web scraping? Discuss issues like CAPTCHA, dynamic content, and anti-scraping mechanisms. **[9]**

OR

**Q12)** How can OpenRefine be used for data cleaning and transformation? Explain with an example. **[9]**



Total No. of Questions : 12]

SEAT No. :

PD-5135

[Total No. of Pages : 2

[6405]-290

**M.E. (Artificial Intelligence)**

**DATA MODELING AND VISUALIZATION**

**(2017 Pattern) (Semester-I) (610303G)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Attempt: Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6. Q.No. 7 or Q.No.8, Q.No.9 or Q.No.10, Q.No.11 or Q.No.12.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** Explain the need for data visualization and discuss the different types of data with suitable examples. **[8]**

OR

**Q2)** Define Fitts' Law and its significance in human-computer interaction. Discuss human visual perception and its role in data visualization. **[8]**

**Q3)** Explain the advanced visualization techniques for numerical data. Discuss streamline visualization and statistical measures used in data visualization. **[8]**

OR

**Q4)** Explain the importance of scatter plots and histograms in numerical data visualization. Discuss their uses with suitable examples. **[8]**

**Q5)** Explain the importance of visualizing non-numeric data. Discuss symbol maps and shaded maps as techniques for non-numeric data visualization with suitable examples. **[9]**

OR

*P.T.O.*

**Q6)** Explain the role of graphs and networks in numerical data visualization. Discuss their types and applications with example. [9]

**Q7)** Explain the challenges of visualizing high-dimensional data. Discuss the role of Principal Component Analysis (PCA) in reducing dimensionality and mapping high-dimensional data into a suitable visualization method. [8]

OR

**Q8)** Explain clustering techniques for high-dimensional data. Discuss methods for visualizing high-dimensional clustering results in R and Python. [8]

**Q9)** Discuss the role of texture theory and data mapping in static and moving data visualization. Explain how perception of transparency is used in data visualization to enhance interpretability. [8]

OR

**Q10)** Explain the concept of static and moving data patterns in motion visualization. Discuss different techniques. [8]

**Q11)** Explain the Desktop Workspace in Tableau and describe its key components. How do different sections of the Tableau workspace help in data visualization and analysis? [9]

OR

**Q12)** Explain the key stages of Data Analytics and their importance in decision making. Discuss different types of data analytics with real-world applications. [9]



Total No. of Questions : 8]

SEAT No. :

**PD5136**

[Total No. of Pages : 2

**[6405]-291**

**F.Y.M.E. (Artificial Intelligence/Computer Engg./Computer (AIDS))**

**BIO-INSPIRED OPTIMIZATION ALGORITHM**

**(2017 & 2020 Pattern) (Semester - II) (510102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Discuss the advantages and disadvantages of self-organization over its alternatives. [4]  
b) Write a short note on Hill-climbing search technique. [4]  
c) State three main concepts involved in problem solving. [2]
- Q2)** a) Explain with example roulette wheel selection in Genetic Algorithm. [4]  
b) Define [4]  
i) Evolution  
ii) Phenotype  
iii) Mendelian Factor  
iv) Genotype  
c) Define crossover and mutation in genetic algorithm. [2]
- Q3)** a) Define swarm intelligence. Mention the basic principles of swarm intelligence system. [4]  
b) Explain Ant Colony Optimization (ACO) algorithm with suitable example. [4]  
c) Define Stigmergy in ant colony. [2]
- Q4)** a) Write pseudo code of flower pollination algorithm and discuss idealized rules of flower pollination algorithm. [4]  
b) Describe how attractiveness and distance is calculated in firefly algorithm. [4]  
c) What is levy flight in cuckoo search algorithm? [2]

**P.T.O.**



- Q5)** a) Explain the Bone Marrow algorithm. [4]  
b) Illustrate procedure to generate antibodies from gene libraries. [4]  
c) List out the applications of Artificial Immune System. [2]
- Q6)** a) Illustrate boid flocking. [4]  
b) Explain the AIBO robot. [4]  
c) What are the two forms of ALife? [2]
- Q7)** a) What is artificial life? What are the goals of artificial life. [5]  
b) Illustrate any one application of Genetic Algorithm. [5]
- Q8)** a) Write pseudo code of Bat algorithm and discuss idealized rules of Bat algorithm. [5]  
b) Explain genetic programming with example. [5]



Total No. of Questions : 6]

SEAT No. :

PD-5137

[Total No. of Pages : 2

[6405]-299

**M.E. (Electrical) (Power Electronics and Drives)**

**POWER SYSTEM MODELLING**

**(2024 Pattern) (Semester - I) (503401)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1. or Q.2. Q.3. or Q.4. Q.5. or Q.6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of electronic calculator is allowed.*

**Q1) a) Explain power system modelling for following components. [10]**

- i) Hydro turbine & governor system
- ii) Tap changing transformer

**b) Explain Steady state analysis for synchronous machine. [8]**

OR

**Q2) a) Explain power system modelling for following components. [10]**

- i) Boiler
- ii) phase shifting Transformer

**b) Explain the concept of excitation control in power systems. What is the effect of a change in excitation on system parameters? [8]**

**Q3) Model the excitation control system using a DC generator exciter. Discuss the self-excited and separately excited DC generator systems. and their role in the excitation system. [16]**

OR

**Q4) Explain the AC excitation system modeling. Discuss the field-controlled alternator rectifier system, brushless excitation system, and static excitation system with necessary diagrams. [16]**

**P.T.O.**

**Q5)** Explain the transmission line modeling techniques using Clark's and Kron's transformation. Discuss their importance in power system stability and analysis. **[16]**

OR

**Q6)** Discuss the static VAR compensators (SVC) and their role in enhancing the stability of a power system. Additionally, explain static load modelling and the modelling of induction motors using the synchronous machine model. **[16]**



Total No. of Questions : 6]

SEAT No. :

**PD5138**

[Total No. of Pages : 2

**[6405]-300**

**F.Y. M.E. (Electrical Engineering)  
ADVANCED POWER ELECTRONICS  
(2024 Pattern) (Semester - I) (503402)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6.
- 2) Figures to the right indicate full marks.
- 3) Use of electronic calculator is allowed.
- 4) Assume suitable data, if necessary.

- Q1)** a) Explain about Generalized technique of harmonic elimination and voltage control with neat circuit diagrams and wave forms. **[10]**
- b) What are the key advantages and disadvantages of a matrix converter compared to a multipulse converter in terms of efficiency, complexity, and harmonic distortion? **[8]**

OR

- Q2)** a) Explain about the following with neat circuit diagrams. **[10]**
- i) Diode clamped multilevel inverter
  - ii) Cascaded multilevel inverter
- b) Explain the concept and principle of operation of Flywheel energy storage system with neat circuit diagram. **[8]**

- Q3)** a) With neat circuit diagram explain about How does the frequency response of a series resonant inverter affect its efficiency and output waveform, particularly near the resonant frequency? **[8]**
- b) Explain about Parallel resonant inverters with neat circuit diagrams and output waveforms. **[8]**

OR

- Q4)** a) Explain about Class E Resonant inverter with neat circuit diagrams and output waveforms. **[8]**
- b) What are the key differences in performance between Zero Voltage Switching (ZVS) and Zero Current Switching (ZCS) resonant converters in terms of switching losses, complexity and applications? **[8]**

**P.T.O.**

- Q5)** a) With a neat circuit diagram and relevant waveform explain about active and reactive powers in three phase circuits. **[8]**
- b) How does the presence of non-linear loads affect the power equation of a system with a sinusoidal voltage source and what role do harmonic currents play in this analysis? **[8]**

OR

- Q6)** a) With a neat diagram and relevant waveform explain about Akagi's instantaneous power (pq) theory. **[8]**
- b) Explain the necessity of compensation in power circuits and describe the application of PQ theory for reactive and harmonic power compensation in simple circuits. **[8]**



Total No. of Questions : 5]

SEAT No. :

PD-5139

[Total No. of Pages : 2

[6405]-301

M.E. (Electrical)

**COMPUTER APPLICATION IN POWER SYSTEM  
(2024 Pattern) (Semester - I) (503403)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Q.1 is compulsory, Solve Q2 or Q3 and Q4 or Q5.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary

**Q1) Attempt any three**

**[18]**

- a) What are the theorems used in optimizing multivariable functions?
- b) Explain Fibonacci for unconstrained optimization technique
- c) Derive equations of Newton Raphson load flow analysis in rectangular ordinates.
- d) Derive the equation used in AC DC load flow analysis.

**Q2) a) Explain solution economic load dispatch problem using NR method. [6]**

- b) The incremental production costs of both the units are
- $$\frac{dF_1}{dP_1} = 0.4P_1 + 40 \text{ Rs/MWh and } \frac{dF_2}{dP_2} = 0.5P_2 + 30 \text{ Rs/MWh. Determine}$$
- economical schedule for the sharing of 180MW demand considering generation limit on each unit as 25MW and 100MW. Determine the saving obtained by economical loading over equal load sharing. **[10]**

OR

*P.T.O.*

**Q3) a)** Define economical load dispatch problem without considering and with considering losses. [6]

b) Two units of the system have following cost curves [10]

$$f(P_{G1}) = 0.00889P_{G1}^2 + 10.333P_{G1} + 200 \text{ Rs / h}$$

$$f(P_{G2}) = 0.00741P_{G2}^2 + 10.833P_{G2} + 240 \text{ Rs / h}$$

The transmission loss are given by

$$P_L = 0.001P_{G1}^2 + 0.002P_{G2}^2 - 0.0004P_{G1}P_{G2}$$

where  $P_G$  is in MW. Determine the economic operating schedule to meet the demand of 150 MW using classical method perform one iteration.

**Q4) a)** Show that transmission loss formula is a function of generation and load. [6]

b) The transmission loss coefficients  $B_{mn}$  expressed in  $pu$  on the base of 100MVA of a power system network having three plants are given by

$$B = \begin{bmatrix} 0.01 & -0.001 & -0.002 \\ -0.001 & 0.02 & -0.003 \\ -0.002 & -0.003 & 0.03 \end{bmatrix}$$

Three plants supply power of 100MW, 200MW and 300MW respectively into the network. Calculate the transmission loss and incremental transmission losses of the plant in MW [10]

OR

**Q5) a)** Derive general formula of fault current and fault voltage for LG type fault. [8]

b) Explain economic load dispatch for active and reactive power balance. [8]



Total No. of Questions : 6]

SEAT No. :

PD-5140

[Total No. of Pages : 2

**[6405]-302**  
**M.E. (Electrical)**  
**RESEARCH METHODOLOGY**  
**(2024 Pattern) (Semester - I) (503404)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt any three questions from question 1 to 4.*
- 2) Questions 5 and 6 are compulsory.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Use of logarithmic table, slide rule and non-programmable calculator is allowed.*
- 6) Assume suitable data, if necessary.*

*Q1)* What is the need of research and write different components of research paper. **[6]**

*Q2)* Explain the structure of a research proposal and what care must be taken in selecting the research problem. **[6]**

*Q3)* Describe the process of drafting and filing the patent along with the legal procedure. **[6]**

*Q4)* Explain the Jacobi's method of solving linear simultaneous equations with example. **[6]**

*Q5)* Solve any two :

- a) Write a short note on finite difference approximations of partial derivatives with example. **[8]**
- b) Explain in detail the convex programming problem. **[8]**
- c) Explain the penalty function method of constrained nonlinear programming with algorithm and example. **[8]**

**P.T.O.**



**Q6)** Write short note on the following with applicable example in Electrical Engineering(Attempt any two) :

- a) Genetic Algorithm [8]
- b) Ant Colony Method [8]
- c) Particle Swarm Optimization [8]



Total No. of Questions : 8]

SEAT No. :

PD-5327

[Total No. of Pages : 2

**[6405]-303**

**M.E. Electrical (Power Electronics and Drivers)**

**AC AND DC DRIVES**

**(2024 Pattern) (Semester - II) (503407)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right side indicates full marks.
- 4) Assume suitable data, if necessary.

**Q1)** What are the main criteria to consider when selecting drive components for a specific application? **[10]**

OR

**Q2)** Explain multi quadrant operation of a motor driving a hoist load. **[10]**

**Q3)** Explain about Steady state analysis of separately excited DC motor fed by chopper. **[10]**

OR

**Q4)** Explain the concept of field weakening in DC motors. How is it implemented? **[10]**

**Q5)** Draw and explain the block diagram representation of a closed-loop drive system. **[15]**

OR

**Q6)** Describe the speed control strategy of a separately excited DC motor using inner current and outer speed loops. **[15]**

**P.T.O.**

**Q7)** Compare VSI-fed and CSI-fed induction motor drives with suitable examples.  
**[15]**

OR

**Q8)** Describe the working of a slip power recovery scheme and its impact on power factor.  
**[15]**



Total No. of Questions : 3]

SEAT No. :

PD-5270

[Total No. of Pages : 2

**[6405]-304**

**M.E. (Electrical Engineering)**

**ADVANCE POWER SYSTEM PROTECTION**

**(2024 Pattern) (Semester-II) (503408)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data wherever necessary.*
- 5) *Use of non-programmable scientific calculator is allowed.*

**Q1) Attempt any three :**

- a) Explain causes of different faults in synchronous generator. Explain principle of microprocessor based unit protection scheme. **[6]**
- b) What are the assumptions made for conducting short circuit studies of a power system network? **[6]**
- c) State sampling theorem and explain the importance of sampling theorem in digital protection of power system. **[6]**
- d) What is the function of a tuning inductor & ferro resonance suppression circuit in CCVT? **[6]**
- e) A 1200/5, C400 with secondary resistance  $0.61\Omega$  and a  $2.0\Omega$  is the relay burden. Based on the accuracy classification, what is the maximum symmetrical fault current that may be applied to this CT without exceeding a 10% ratio error? **[6]**

**P.T.O.**

**Q2) Attempt any two :**

- a) Explain the problem of over-reach in distance relay? Describe use of three - stepped distance protection to overcome this problem? [8]
- b) Explain distance protection of transmission line using reactance relay.[8]
- c) Explain phase comparison travelling wave relay scheme for protection of transmission line. [8]

**Q3) Attempt any two :**

- a) Why overcurrent relays are replaced by digital distance relays for protection of transmission lines. [8]
- b) Describe under reach and over reach phenomenon in over current protection of transmission line. [8]
- c) Elaborate the applications of computer graphics in electrical protection system. [8]



Total No. of Questions : 6]

SEAT No. :

PD-5235

[Total No. of Page : 1

[6405]-305

**M.E. (Electrical Engineering)**  
**POWER SYSTEM DYNAMICS**  
**(2024 Pattern) (Semester - II) (503409)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Solve Total Three questions. Answer 1 question from Q1 or Q2, Q3 or Q4, and Q5 or Q6 each.*
- 2) Assume suitable data, if necessary.*
- 3) Write down all the assumptions made.*

**Q1)** Derive an expression for power flow for a system consists of 'm' machines. Also state mechanical power equation prior to disturbance. **[18]**

OR

**Q2)** Classify and discuss the various states of operations and the security of the system as per Dy Liacco, and Fink and Carlson. **[18]**

**Q3)** Draw the diagram representing synchronous generator by model 2.1 and derive stator voltage equations for it. **[16]**

OR

**Q4)** Derive an expression for calculation of initial conditions for the analysis of dynamics of synchronous generator connected to infinite bus system. **[16]**

**Q5)** Draw the block diagram of single machine system. Derive the characteristic equation for single machine system. **[16]**

OR

**Q6)** Derive the rotor mechanical and electrical torque equations for the small signal analysis of single machine model with field circuit only. Write down assumptions involve in it. **[16]**



Total No. of Questions : 8]

SEAT No. :

PD-5328

[Total No. of Pages : 2

[6405]-306

M.E. (Internet of Things)

Edge Artificial Intelligence for IoT  
(2024 Pattern) (Semester - II) (504816)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Answer any five questions out of eight questions.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data if necessary.
- 4) Use of scientific calculator is allowed.

- Q1) a) What is the significance of Edge AI. [5]  
b) Explain use of the machine learning. [5]

OR

- Q2) a) Explain Pros and Cons of embedded machine learning. [5]  
b) What are AI compliant hardware platforms. [5]

- Q3) a) Design considerations with Edge Artificial Intelligence. [5]  
b) Write short note on Model optimization. [5]

OR

- Q4) a) Describe the use of Edge AI with Arduino. [5]  
b) Explain 3Vs (Vision, Voice and Vibration) in detail. [5]

- Q5) a) Explain hardware and software features of Raspberry Pi SBC. [5]  
b) What are the challenges and opportunities in Edge Computing. [5]

OR

- Q6) a) Explain RPi ecosystem. [5]  
b) Explain object classification using Raspberry Pi. [5]

P.T.O.

- Q7)** a) Describe the use of Edge AI with STM 32. [5]  
b) Explain low power predictive maintenance (IoT scenario). [5]

OR

- Q8)** a) Explain Vision AI application with Jetson Nano. [5]  
b) Write short note on STM32H7(Dual Core). [5]





**[6405]-307****M.E. (Mechanical) (Robotics & Automation)****ADVANCED MATHEMATICS AND NUMERICAL METHODS****(2017 Pattern) (Semester - I) (MERA 501)****Time : 3 Hours]****[Max. Marks : 50****Instructions to the candidates :**

- 1) Answer any five questions from the following.
- 2) Figures to the right side indicate full marks.
- 3) Use of electronic pocket calculator is allowed.
- 4) Assume suitable data if necessary.

- Q1) a)** Describe Mid-point Method **[4]**  
**b)** Fit a polynomial of the second – degree to the data points given in the following table **[6]**

|   |     |     |      |
|---|-----|-----|------|
| x | 0.0 | 1.0 | 2.0  |
| y | 1.0 | 6.0 | 17.0 |

- Q2) Solve the following using Gauss Seidal method** **[10]**

$$\begin{aligned}
 10x_1 - 2x_2 - x_3 - x_4 &= 3 \\
 -2x_1 + 10x_2 - x_3 - x_4 &= 15 \\
 -x_1 - x_2 + 10x_3 - 2x_4 &= 27 \\
 -x_1 - x_2 - 2x_3 + 10x_4 &= -9
 \end{aligned}$$

- Q3) Given the equation  $y'(x) = 2y/x$  with  $y(1) = 2$ , estimate  $y(2)$  using** **[10]**

- a) Euler's method,
- b) Heun's method and compare the results with exact solution.  
Take  $h = 0.25$

- Q4) a)** Given  $\frac{dy}{dx} = x^2(1+y)$  and  $y(1) = 1$ ,  $y(1,1) = 1.233$ ,  $y(1,2) = 1.548$ ,  
 $y(1,3) = 1.979$ , evaluate  $y(1,4)$  by Adams - Bashforth method. **[5]**  
**b)** Use fourth order Runge - Kutta method to estimate  $y(0,4)$  when  
 $y'(x) = x^2 + y^2$  with  $y(0) = 0$  Assume  $h = 0.2$ . **[5]**

**P.T.O.**

**Q5) a)** Use Romberg's method to compare  $\int_0^1 \frac{dx}{1+x^2}$  correct to 4 decimal places. [5]

**b)** The following data given the velocity of a particle for 20 seconds at an interval of 5 seconds. Find the initial acceleration using the entire data:[5]

|                    |   |   |    |    |     |
|--------------------|---|---|----|----|-----|
| Time t (sec)       | 0 | 5 | 10 | 15 | 20  |
| Velocity v (m/sec) | 0 | 3 | 14 | 69 | 228 |

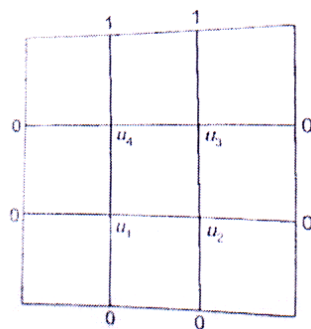
**Q6) a)** Find by Newton Raphson method the real root of equation. [5]

$3x = \cos x + 1$ , correct to 4 decimal places.

**b)** Using Given's Method, reduce the following matrix to the tri-diagonal

form  $A = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 2 \\ 3 & 2 & 3 \end{bmatrix}$  [5]

**Q7)** Solve the equation  $u_{xx} + u_{yy} = 0$ , in the domain of figure shown below by Jacobi's method [10]



Total No. of Questions : 7]

SEAT No. :

**PD5142**

[Total No. of Pages : 1

**[6405]-308**

**F.Y.M.E. (Mechanical Engineering)/(Robotics & Automation)**

**MERA-502: MACHINE VISION SYSTEM**

**(2021&2017 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** What is Machine vision? Write about types and Selection process for Machine Vision Lenses and Optical Filters. **[10]**

**Q2)** What is Image Acquisition? Explain Image Processing in Spatial and Frequency Domain? **[10]**

**Q3)** What is Image processing? Explain in detail Point Operation and Thresholding. **[10]**

**Q4)** Write Machine vision applications in metrology and gauging, Vision guided robotics, Field and Service Applications, and Bio medical field. **[10]**

**Q5)** Explain how Industrial machine vision is used in production and services. Explain with an example. **[10]**

**Q6)** Define Object Detection. Explain in detail Silhouette-Based Method for Object Classification and Viola Jones object detection framework. **[10]**

**Q7)** Explain the terms **[10]**

- a) Template based activity recognition
- b) Human Recognition Using Gait



Total No. of Questions : 7]

SEAT No. :

PD-5143

[Total No. of Pages : 1

**[6405]-309**

**M.E. (Mechanical Engineering) (Robotics & Automation)**

**TOTAL INTEGRATED AUTOMATION INDUSTRY 4.0**

**(2017- 2021 Pattern) (Semester-I) (MERA503)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Answer any five questions from the following.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*

**Q1)** Discuss Methods of Evaluating Investment Alternatives of Automation in Industry 4.0. **[10]**

**Q2)** Explain following terms, **[10]**

- a) Analysis of Transfer Lines Without Storage
- b) Automated Flow Lines with Storage Buffers
- c) Computer Simulation of Automated Flow Lines

**Q3)** Explain Product identification in Material handling and Identification Technologies. **[10]**

**Q4)** Write difference between Process Industries Verses Discrete Manufacturing Industries, **[10]**

**Q5)** Discuss various contact inspection methods. **[10]**

**Q6)** Write a PLC Program for any industrial application. **[10]**

**Q7)** Explain the sequential steps of working PLC system. **[10]**



Total No. of Questions : 7]

SEAT No. :

**PD5144**

[Total No. of Pages : 1

**[6405]-310**

**F.Y.M.E. (Mechanical Engineering/Robotics & Automation)**  
**MEERA 504 : ENGINEERING RESEARCH METHODOLOGY**  
**(2017/2021 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions from the following.*
- 2) Neat diagram must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1)** Explain conceptual and empirical research with example. **[10]**

**Q2)** Write a note on Assessment of Quality of Journals and Articles. **[10]**

**Q3)** Explain the use of Standards and Codes in research Design. **[10]**

**Q4)** Discuss the role of Data organization and data grouping in data collection.**[10]**

**Q5)** Discuss the role of Regression modelling in data analysis. **[10]**

**Q6)** Explain the steps involve in writing a research proposal. **[10]**

**Q7)** Differentiate between Synopsis and Dissertation writing. **[10]**

\* \* \*

Total No. of Questions : 7]

SEAT No. :

PD-5236

[Total No. of Pages : 1

**[6405]-311**

**M.E. Mechanical (Robotics and Automation)**  
**MERA 507 : ARTIFICIAL INTELLIGENCE AND**  
**MACHINE LEARNING FOR ROBOTICS**  
**(2017/2021 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

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

**Q1)** Explain the difference between uninformed (blind) search and informed (heuristic) search strategies. Illustrate your answer with examples of algorithms and discuss their relative advantages and limitations. **[10]**

**Q2)** Explain the inference mechanism in first-order logic, emphasizing the role of unification and resolution. Illustrate with an example how a query is resolved using these techniques. **[10]**

**Q3)** What is a Bayesian Network? Explain its semantics with a simple example. **[10]**

**Q4)** What is a Partially Observable Markov Decision Process (POMDP)? How is it different from a standard MDP. **[10]**

**Q5)** Explain how logistic regression works for binary classification. **[10]**

**Q6)** What is model selection and why is feature selection important in machine learning? **[10]**

**Q7)** How does the K-means clustering algorithm work? Explain its steps. **[10]**



Total No. of Questions : 7]

SEAT No. :

PD-5271

[Total No. of Page : 1

[6405]-312

**M.E. Mechanical (Robotics & Automation)**

**MERA508 : DIGITAL SIGNAL & VIDEO PROCESSING**

**(2017/2021 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** Explain the classification of signals with examples. Discuss the operations that can be performed on signals. **[10]**
- Q2)** Define Z-transform and derive its properties. Explain how it is used in the analysis of discrete-time systems. **[10]**
- Q3)** Describe the basic steps involved in digital image processing. Explain the concepts of sampling and quantization of images. **[10]**
- Q4)** Compare Lossy and Lossless image compression techniques with examples. Describe Huffman and Arithmetic coding. **[10]**
- Q5)** Explain the differences between analog and digital video. Describe the basic steps involved in video processing. **[10]**
- Q6)** Explain the application of motion estimation in video coding. Discuss predictive and transform coding techniques. **[10]**
- Q7)** Describe waveform-based coding and block-based transform coding. Compare their advantages and use cases in modern video compression standards. **[10]**



Total No. of Questions : 7]

SEAT No. :

PD-5272

[Total No. of Pages : 1

[6405]-313

**M.E. (Mechanical Engineering)(R & A)**  
**ROBOTIC OPERATING SYSTEM**  
**(2017 Pattern) (Semester - II) (MERA509)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** Explain the role of sensors and actuators in a robot. How do they contribute to robot autonomy? **[10]**
- Q2)** What are the advantages and limitations of simulating robots using ROS and Gazebo before deploying them in the real world? **[10]**
- Q3)** Discuss the functionality and features of Dynamixel actuators. Why are they suitable for advanced robotic systems like ChefBot? **[10]**
- Q4)** How does sensor fusion improve robot localization? Illustrate your answer with a case using IMU and encoders. **[10]**
- Q5)** Explain the process of acquiring and processing point cloud data from Kinect using ROS, OpenNI, and PCL in a Python environment. **[10]**
- Q6)** How do you design and test a Python node in ROS to perform autonomous navigation in ChefBot? **[10]**
- Q7)** Describe how ROS launch files are structured. How can they be used to automate the initialization and calibration of ChefBot? **[10]**

