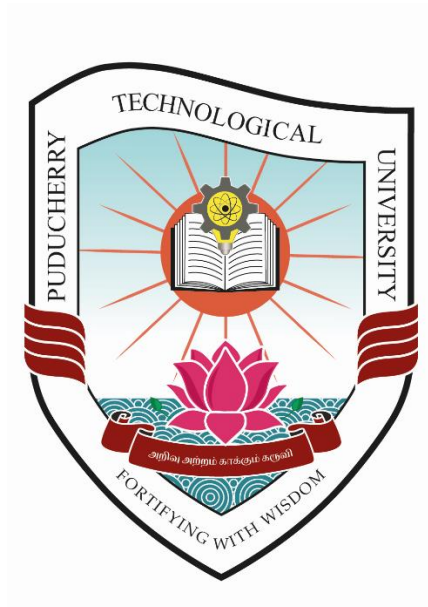


PUDUCHERRY TECHNOLOGICAL UNIVERSITY

(Erstwhile Pondicherry Engineering College)

Puducherry – 605014



PH.D ADMISSIONS 2021-22

SYLLABUS & MODEL QUESTIONS

FOR

ENTRANCE EXAMINATION

To be held on

8th & 9th January, 2022

Chemical Engineering

Engineering Mathematics: Linear algebra, calculus, differential equations, complex variables, probability and statistics, numerical Methods.

Graduate Aptitude Test in Engineering (GATE) level questions from the following core Chemical Engineering subjects

Process Calculations and Chemical Engineering Thermodynamics, Fluid Mechanics and Mechanical Operations, Heat Transfer, Mass Transfer, Instrumentation and Process Control, Plant Design and Economics, Chemical Technology, Chemical Reaction Engineering, Energy Technology.

Model Questions

1. In a binary distillation column if the feed contains 50 mol% vapour, the q-line will have a slope of

- a) 0.5 b) -0.5 c) 1 d) -1

2. At three given temperatures K_1 , K_2 , K_3 are equilibrium constants, for the following reversible equilibrium reactions



Then K_1 , K_2 and K_3 are related as

- a) $K_1 = K_3/K_2$ b) $2K_3 = K_1 + K_2$ c) $K_3 = (K_1K_2)^{0.5}$ d) none

3. Applying a pressure drop across capillary results in a volumetric flow rate Q under laminar flow conditions. The flow rate, for the same pressure drop, in a capillary of the same length but twice the radius is

- a) Q b) $2Q$ c) $4Q$ d) $16Q$

4. Match the following Compound Process

P NaOH I Solvay Process

Q NH₃ II Haber Process

R H₂SO₄ III Contact Process

- a) P-I, Q-II, R-III b) P-II, Q-I, R-III c) P-III, Q-I, R-II d) P-III, Q-II, R-I

5. For net sales of a company amount to Rs. 600,000 annually, when the fixed costs are Rs. 350,000/- and the direct costs are 35% of the net sales. What is the gross profit?

- a) Rs.40,000/- b) Rs.60,000/- c) Rs.250,000/- d) none of these

Mechanical Engineering

Subjects for Entrance Exam for Ph.D admission 2021-22

1. Engineering Mechanics
 2. Mechanics of Materials
 3. Theory of Machines
 4. Vibrations
 5. Machine Design
 6. Fluid Mechanics
 7. Heat-Transfer
 8. Thermodynamics
 9. Power Engineering, IC engines, Refrigeration & Air Conditioning, Turbomachines
 10. Engineering Materials
 11. Casting, Forming and Joining Processes
 12. Machining and Machine Tool Operations
 13. Metrology and Inspection
 14. Computer Integrated Manufacturing
 15. Production Planning and Control
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Model Questions

1. In metal cutting operation, the work done against friction is equal to
 - a) Shear force x Shear velocity
 - b) Frictional force x Cutting velocity
 - c) Frictional force x Chip flow velocity
 - d) Frictional force x Feed velocity

2. According to Taylor's Principle, No Go gauge checks
 - a) only one feature at a time
 - b) only the related dimensions at a time
 - c) only important dimensions at a time
 - d) all the dimensions at a time

3. An engine working on Otto cycle is supplied with air. The compression ratio is 8. The cycle efficiency is equal to
 - a) 80.6 %
 - b) 56.5 %
 - c) 32.4 %
 - d) 28.5 %

4. A 100 W electric bulb has a filament temperature of 3001°C. Assuming the filament to be a black body and its length to be 250 mm, its diameter will be
 - a) 1 mm
 - b) 0.2 mm
 - c) 0.05 mm
 - d) 0.02 mm

Physics

Mathematical Physics, Classical and Statistical Physics, Quantum Mechanics, Electromagnetic Theory, Solid State Physics and Nuclear and Particle Physics at PG level

Model Questions

- The Laplace transform of second derivative of a function $f(t)$ is
 - $s^2 f(s) + sf(0) - f'(0)$
 - $s^2 f(s) - sf(0) + f'(0)$
 - $s^2 f(s) - sf(s) - f'(0)$
 - $s^2 f(s) + sf(s) + f'(0)$
- The quantized elastic vibration is known as
 - Phonon
 - photon
 - Polaron
 - Quanta
- The temperature of a black body is increased from 50 K to 2000 K. What is the increase in the amount of energy radiated by the black body?
 - 1.57×10^9
 - 4.52×10^7
 - 2.56×10^6
 - 3.14×10^8
- The drift velocity of the charge carrier is measured by
 - Joule-Thompson effect
 - Compton effect
 - Hall effect
 - Photo-electric effect
- Let ABCD be the rectangle with corners at $(0,0,0)$, $(1,0,0)$, $(1,1,0)$, $(0,1,0)$ and F be the vector $F = (2xy+y^2) i + (2yz+x^2) j + (2zx+z^2) k$. The value of the line integral $\int_{ABCD} F \cdot dl$ is
 - 0
 - 1/2
 - 1
 - 1/2

Electronics & Communication Engineering

List of subjects:

1. Network theory
2. Signals and Systems
3. Electronic Devices and circuits
4. Digital Circuits
5. Analog and Digital Communication
6. Control Systems
7. Electromagnetics
8. Microprocessor and Microcontrollers
9. Digital Signal and Image Processing
10. Microwave & Fiber Optic Communication
11. Transmission Lines & Waveguides
12. Antennas & Wave Propagation
13. Communication Networks
14. Wireless Communication
15. VLSI design

Model questions

1. The condition for which the voltage gain of the common collector amplifier remain constant irrespective of variations in emitter resistance.

- a) $I_C R_E \gg V_{CE}$
- b) $I_C R_E \gg V_T$
- c) $I_C R_E \ll V_T$
- d) $I_C R_E \ll V_{CE}$

2. Two scattering mechanisms are existing in a semiconductor and if only one mechanism is present the mobility will be $250 \text{ cm}^2/\text{Vs}$ and if other scattering mechanism only present then the mobility is $500 \text{ cm}^2/\text{Vs}$, find the resultant mobility

- a) $750 \text{ cm}^2/\text{Vs}$
- b) $500 \text{ cm}^2/\text{Vs}$
- c) $166.67 \text{ cm}^2/\text{Vs}$
- d) $187.53 \text{ cm}^2/\text{Vs}$

3. For implementing the function $F=A \oplus C$ using 4x1 MUX with A and B are to be used as selection bits with A being the most significant bit. Which one of the following statements correctly describes the choice of signals to be connected to the inputs?

a) $I_0= 1, I_1= 0, I_2= C, I_3=\underline{\underline{C}}$

b) $I_0=C, I_1=\underline{\underline{C}}, I_2=C, I_3=1$

c) $I_0=\underline{\underline{C}}, I_1=C, I_2=\underline{\underline{C}}, I_3=C$

d) $I_0=C, I_1=C, I_2=\underline{\underline{C}}, I_3=\underline{\underline{C}}$

4. The 8085-microprocessor interfaced with an 8Kx8 bits RAM and the starting address of the memory is 8500H. Then, its last byte address is

a) A3FFH

b) ACFFH

c) A5FFh

d) A4FFH

Electrical & Electronics Engineering

List of subjects:

1. Electric Circuits and Networks
 2. Signals and Systems
 3. Electromagnetic Circuits and Field Theory
 4. Electronic Devices and Circuits
 5. Digital Electronics Circuits and Systems
 6. Static Electrical Machines
 7. Rotating Electrical Machines
 8. Analog and Digital Integrated Circuits
 9. Microprocessors and Microcontrollers
 10. Linear Control Systems
 11. Power and Energy Systems
 12. Transmission and Distribution Systems
 13. Power Electronic Devices and Circuits
 14. Measurement and Instrumentation Systems
 15. Renewable Energy Systems
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Model Questions

1. If a sinusoidal voltage of $v(t) = V_m \sin(\omega t)$ is applied to a capacitor C, the expression for current $i(t)$ at steady state is given by
 - a. $\omega C V_m \cos(\omega t)$
 - b. $\omega C V_m \sin(\omega t)$
 - c. $V_m \cos(\omega t)$
 - d. $V_m \sin(\omega t)$
2. The linear time-invariant system described by the transfer function $G(s) = \frac{1}{s^2 + 4}$ is
 - a. Asymptotically stable
 - b. Marginally stable
 - c. Unstable
 - d. BIBO stable
3. Which one among the following statements is true?
 - a. $\sin(t)$ is an odd signal and $\cos(t)$ is an even signal
 - b. $\sin(t)$ is an even signal and $\cos(t)$ is an odd signal
 - c. Both $\sin(t)$ and $\cos(t)$ are odd signals
 - d. Both $\sin(t)$ and $\cos(t)$ are even signals

4. In a three phase semi-converter, for a firing angle of 90° under continuous conduction mode, the freewheeling diode conducts for
- 30°
 - 90°
 - 0°
 - 60°
5. A three phase 440V, 60Hz induction motor has a slip of 5%. The frequency of the rotor emf is given by
- 60Hz
 - 50Hz
 - 5Hz
 - 3Hz

Information Technology

List of subjects:

1. Mathematical Foundations of Information Technology
 2. Theory of Computation
 3. Advanced Data Structures
 4. Advanced Computer Organization
 5. Object Oriented Programming
 6. C, C++, Java, Python
 7. Computer Networks
 8. Systems Programming
 9. Operating Systems
 10. Machine Learning
 11. Artificial Intelligence
 12. Web Technologies
 13. Software Architecture & Testing
 14. Database Management Systems
 15. Cloud Computing
-

Model Questions

1. A layer-4 firewall (a device that can look at all protocol headers up to the transport layer) CANNOT
 - (A) block entire HTTP traffic during 9:00PM and 5 :00AM
 - (B) block all ICMP traffic
 - (C) stop incoming traffic from a specific IP address but allow outgoing traffic to the same IP address
 - (D) block TCP traffic from a specific user on a multi-user system during 9:00PM and 5:00AM

2. Consider different activities related to email.
 - m1: Send an email from a mail client to a mail server
 - m2: Download an email from mailbox server to a mail client
 - m3: Checking email in a web browserWhich is the application level protocol used in each activity?
 - (A) m1: HTTP m2: SMTP m3: POP
 - (B) m1: SMTP m2: FTP m3: HTTP
 - (C) m1: SMTP m2: POP m3: HTTP
 - (D) m1: POP m2: SMTP m3: IMAP

3. Which of the following pairs have DIFFERENT expressive power?
- (A) Deterministic finite automata (DFA) and Non—deterministic finite automata (NFA)
 - (B) Deterministic push down automata (DPDA) and Non-deterministic push down automata (NPDA)
 - (C) Deterministic single-tape Turing machine and Non-deterministic single-tape Turing machine
 - (D) Single-tape Turing machine and multi-tape Turing machine
4. The minimum number of D flip—flops needed to design a mod-258 counter is
- (A) 9
 - (B) 8
 - (C) 512
 - (D) 258
5. You are given a set of 'n' distinct elements and an unlabeled binary tree with 'n' nodes. In how many ways you can populate the tree with the given set so that it becomes a binary search tree?
- (A) 0
 - (B) 1
 - (C) n!
 - (D) $\frac{1}{n+1} \cdot 2^n \cdot C_n$

Computer Science & Engineering

List of Subjects:

1. Mathematical Foundations of Computer Science
 2. Theory of Computation
 3. Advanced Data Structures
 4. Advanced Computer Organization
 5. Object Oriented Programming
 6. C, C++, Java, Python
 7. Computer Networks
 8. Systems Programming
 9. Operating Systems
 10. Machine Learning
 11. Artificial Intelligence
 12. Web Technologies
 13. Software Architecture & Testing
 14. Database Management Systems
 15. Cloud Computing
-

Model Questions

1. Which one of the following is **NOT** logically equivalent to $\neg \exists x (\forall y (\alpha) \wedge \forall z (\beta))$?

- (A) $\forall x (\exists z (\neg \beta) \rightarrow \forall y (\alpha))$
- (B) $\forall x (\forall z (\beta) \rightarrow \exists y (\neg \alpha))$
- (C) $\forall x (\forall y (\alpha) \rightarrow \exists z (\neg \beta))$
- (D) $\forall x (\exists y (\neg \alpha) \rightarrow \exists z (\neg \beta))$

2. A RAM chip has a capacity of 1024 words of 8 bits each (1K X 8) . The number of 2: 4 decoders with enable line needed to construct a 16K X16 RAM from 1K X8 RAM is

- (A) 4 (B) 5 (C) 6 (D) 7

3. Consider the following operation along with Enqueue and Dequeue operations on queues, where k is a global parameter

```
MultiDequeue( Q )
{
    m = k
    while (Q is not empty and m > 0 )
    {
        Dequeue (Q)
        m =m -1
    }
}
```

What is the worst case time complexity of a sequence of n queue operations on an initially empty queue?

- (A) $\Theta(n)$ (B) $\Theta(n + k)$ (C) $\Theta(nk)$ (D) $\Theta(n^2)$

4. The preorder traversal sequence of a binary search tree is 30, 20, 10, 15, 25, 23, 39, 35, 42. Which one of the following is the postorder traversal sequence of the same tree?

- (A) 10,20,15,23,25,35,42,39,30
(B) 15,10,25,23,20,42,35,39,30
(C) 15,20,10,23,25,42,35,39,30
(D) 15,10,23,25,20,35,42,39,30

Note: Same syllabus and model questions for PhD in Computer Science (for MCA & MSc applicants)

Civil Engineering

List of Subjects:

1. Mechanics of solids
 2. Concrete technology
 3. Building Technology
 4. Structural analysis
 5. Reinforced concrete
 6. Environmental engineering
 7. Geotechnical Engineering
 8. Steel structures
 9. Transportation Engineering
 10. Surveying
-

Model Questions

Q1. A column of height h with a rectangular cross-section of size $a \times 2a$ has a buckling load of P . If the cross-section is changed to $0.5a \times 3a$ and its height changed to $1.5h$, the buckling load of the redesigned column will be

- (A) $P/12$ (B) $P/4$ (C) $P/2$ (D) $3P/4$

Q2. The deformation in concrete due to sustained loading is

- (A) creep (B) hydration (C) segregation (D) shrinkage

Q3. Two rectangular under-reinforced concrete beam sections X and Y are similar in all aspects except that the longitudinal compression reinforcement in section Y is 10% more. Which one of the following is the correct statement?

- (A) Section X has less flexural strength and is less ductile than section Y
(B) Section X has less flexural strength but is more ductile than section Y
(C) Sections X and Y have equal flexural strength but different ductility
(D) Sections X and Y have equal flexural strength and ductility.

Q4. The width of a square footing and the diameter of a circular footing are equal. If both the footings are placed on the surface of sandy soil, the ratio of the ultimate bearing capacity of circular footing to that of square footing will be

- (A) $4/3$ (B) 1 (C) $3/4$ (D) $2/3$

Q5. As per IS 10500:2012, for drinking water in the absence of alternate source of water, the permissible limits for chloride and sulphate, in mg/L, respectively are

- (A) 250 and 200 (B) 1000 and 400 (C) 200 and 250 (D) 500 and 1000

Mathematics

List of Subjects:

1. Algebra
 2. Analysis
 3. Differential Equations
 4. Fluid Dynamics
 5. Numerical Analysis
 6. Stochastic Processes
 7. Statistics
-

Model Questions

1. Consider the function $f(x, y) = \frac{x^2}{y^2}$, $(x, y) \in \left[\frac{1}{2}, \frac{3}{2}\right] \times \left[\frac{1}{2}, \frac{3}{2}\right]$. The derivative of the function at (1,1) along the direction (1,1) is:
 - a) 0
 - b) 1
 - c) 2
 - d) -2
2. If A is a 5×5 real matrix with trace 15 and if 2 and 3 are eigen values of A, each with algebraic multiplicity 2, then the determinant of A is equal to
 - a) 0
 - b) 24
 - c) 120
 - d) 180
3. What is the total number of positive integer solution to the equation
$$(x_1 + x_2 + x_3)(y_1 + y_2 + y_3 + y_4) = 15 ?$$
 - a) 1
 - b) 2
 - c) 3
 - d) 4
4. Consider two waves of same angular frequency ω , same angular wave number K, same amplitude a, travelling in the positive direction of X-axis with the same speed and with phase difference φ . Then the superposition principle yields a resultant wave with
 - a) Amplitude $2a$ and phase φ
 - b) Amplitude $2a$ and phase $\frac{\varphi}{2}$
 - c) Amplitude $2a \cos \frac{\varphi}{2}$ and phase $\frac{\varphi}{2}$
 - d) Amplitude $2a \cos \frac{\varphi}{2}$ and phase φ

5. Let $\{X_t\}$ and $\{Y_t\}$ be two independent pure birth processes with birth rates λ_1 and λ_2 respectively. Let $Z_t = X_t + Y_t$. Then
- a) $\{Z_t\}$ is not a pure birth process
 - b) $\{Z_t\}$ is a pure birth process with birth rate $\lambda_1 + \lambda_2$
 - c) $\{Z_t\}$ is a pure birth process with birth rate $\min\{\lambda_1, \lambda_2\}$
 - d) $\{Z_t\}$ is a pure birth process with birth rate $\lambda_1 \lambda_2$

Electronics & Instrumentation Engineering

List of subjects:

- 1) Process Control
- 2) Digital Signal Processing
- 3) Embedded System
- 4) VLSI
- 5) Microelectronics
- 6) Biomedical Instrumentation
- 7) Micro-Electro Mechanical Systems
- 8) Power electronics
- 9) Sensor and Transducer
- 10) Analog Electronics
- 11) Instrumentation
- 12) Digital Electronics
- 13) Measurements and Instrumentation
- 14) Control Systems

Model Questions

- 1) An alternate function of port pin P3.4 in the 8051 is
 - a) Timer 0
 - b) Timer 1
 - c) interrupt 0
 - d) interrupt 1
- 2) Which of the following instructions will load the value 35H into the high byte of timer 0?
 - a) MOV TH0, #35H
 - b) MOV TH0, 35H
 - c) MOV T0, #35H
 - d) MOV T0, 35H
- 3) Bit-addressable memory locations are
 - a) 10H through 1FH
 - b) 20H through 2FH
 - c) 30H through 3FH
 - d) 40H through 4FH
- 4) The 8-bit address bus allows access to an address range of
 - a) 0000 to FFFFH
 - b) 000 to FFFH
 - c) 00 to FFH
 - d) 0 to FH

- 5) Which of the following instructions will move the contents of register 3 to the accumulator?
- a) MOV 3R, A
 - b) MOV R3, A

Part B questions (50 numbers) are common to all the disciplines which will test the Reading comprehension, analytical ability and attitude towards research.