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भारतीय प्रौद्योगिकी संस्थान रूड़की

Indian Institute of Technology Roorkee

RECRUITMENT EXAMINATION FOR JUNIOR LAB ASSISTANT (TIER-II)

PART -A

(PEN-PAPER TEST)

इस पुस्तिका में 16 पृष्ठ शामिल हैं।
This booklet consists of 16 pages.

अधिकतम अंक: 35 समय: 45 मिनट
Maximum Marks: 35 **Time: 45 Minutes**

Roll Number:_____
अनुक्रमांक

Date of Examination:_____
परीक्षा की तिथि

अनुदेश / **Instructions**

इस प्रश्न पत्र में कुल 7 प्रश्न हैं, जिनके उत्तर इस प्रश्न पत्र पुस्तिका में दिए गए स्थान पर लिखे जाएंगे। प्रश्न (4)-(7) में विकल्प हैं जिनमें से केवल एक भाग का उत्तर देना है। प्रश्न (4) - (7) में उन विकल्पों को स्पष्ट रूप से काट दें जिन्हें आपने हल नहीं किया है। उम्मीदवार व्यक्तिपरक प्रकार के प्रश्नों का उत्तर हिंदी या अंग्रेजी में दे सकते हैं। सभी प्रश्न अनिवार्य हैं। व्यक्तिपरक प्रकार के प्रश्नों के अधिकतम अंक उनके सामने दर्शाये गये हैं। प्रत्येक पृष्ठ के शीर्ष पर अपना रोल नंबर लिखें।

This question paper contains a total of 7 questions, answer for which shall be written in the space provided in this question paper booklet. Questions (4) – (7) are having choices out of which only one portion is to be answered. Strike out the choices clearly which you have not attempted in Questions (4) – (7). Candidates can answer subjective type questions either in Hindi or English. All the questions are compulsory. Maximum marks for subjective type questions are shown against them. Write your roll number at the header of each page.

_____

Signature of the Candidate

1. What are the differences between workbook and worksheet in MS EXCEL?
   MS EXCEL में वर्कबुक और वर्कशीट के बीच क्या अंतर हैं? **[5 Marks]**

2. What are the differences between layout and slide master in MS PowerPoint?
MS PowerPoint में लेआउट और स्लाइड मास्टर के बीच क्या अंतर हैं? **[5 Marks]**

3. What is “Picture Effects” in MS Power point? What are the options available under the Picture Effects?
MS Power point में “Picture Effects” क्या है? Picture Effects के अंतर्गत कौन से विकल्प उपलब्ध हैं? **[5 Marks]**

4. Explain the principle and procedure of SDS-PAGE. How will you visualise the proteins on a gel after electrophoresis?

OR

If a horizontal venturi-meter is to be used to measure the flow of water through a tube, then derive the expression for theoretical flow-rate.

What is the coefficient of discharge? What are the typical values or range for coefficient of discharge observed in the venturi-meter.

OR

In chemistry laboratory you can find 98 % H_2SO_4 bottle. Calculate the molarity of the H_2SO_4 solution. Density of 98% H_2SO_4 is 1.8 g/cm^3. What will be the normality of the solution?

OR

The readings of weight retained on various sieves on sieve analysis of a sample of 1 kg of sand are as follows:

IS Sieve Designation	10 mm	4.75 mm	2.36 mm	1.18 mm	600 µm	300 µm	150 µm
Weight Retained (kg)	0.0265	0.0305	0.121	0.238	0.367	0.153	0.0265

What is the fineness modulus of the sand?

OR

Five batch jobs A through E, arrive at a computer nearly at the same time. They have estimated running times of 10, 6, 2, 4, and 8 minutes, respectively. Compute the average turnaround time for the five jobs with round-robin scheduling algorithm.

OR

Consider a continuous-time system with input-output relation given by

$$y(t) = 4x(-t),$$

where $x(t)$ and $y(t)$ are the input and output of the system, respectively. Is the system linear? Is the system time-invariant? Answer with justification.

OR

Explain the working principle of a thermocouple with a small sketch.

If you are asked to calibrate a thermocouple in the laboratory, how will you do it? Explain briefly.

OR

Discuss the principle of the scanning electron microscopy in brief. Mention various steps involved in the sample preparation for the scanning electron microscopy.

OR

Graphically explain the variation of charge carrier concentration in intrinsic semiconductors with temperature.

OR

Consider a 4-band resistor having colour code (Green, Blue, Orange, Gold). Explain how will you find the nominal value of the resistance of the resistor along with tolerance.

[5 Marks]

5. Define enzyme activity. How will you determine the V_m and K_m values using Michaelis Menten plot? Add a note on the effect of pH and temperature on enzyme kinetics.

OR

Reynolds number is the ratio of which forces? Write the formula for Reynolds number. To show the laminar flow profile to the students, an experiment needs to be performed. Draw the experimental setup and explain the step-by-step procedure.

OR

How will you prepare Fehling solution in laboratory? Write down one of its uses in the context of organic functional group detection.

OR

The length of a survey line was measured with a 20 m chain and was found to be equal to 1200 m. As a check, the length was again measured with a 25 m chain and was found to be 1212 m. On comparing the 20 m chain with the test gauge, it was found to be 1 decimetre longer than 20 m. What is the actual length of the 25 m chain used?

OR

Mention the two types of random access memory (RAM) used in a computer. Differentiate between the two types of RAM, in terms of access speed, memory density, cost, and usage.

OR

A message signal of bandwidth B (i.e. spectrum is in the range – B to B) is modulated with a carrier signal of frequency f_c. What will be the bandwidths of the modulated signals in cases of amplitude modulation, double sideband suppressed carrier modulation, single sideband modulation? For which of these modulation techniques can an envelope detector be used directly for demodulation?

OR

What is the purpose of UTM? What kind of fracture will occur in a tensile specimen? Describe the difference between static and dynamic balancing in a rotating mass system.

OR

Discuss the principle of the transmission electron microscopy in brief. Mention various steps involved in the sample preparation for the transmission electron microscopy.

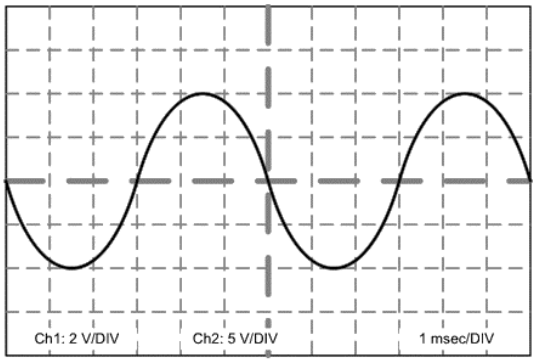
OR

A student measures mass *m* with a 0.5% error, height *h* with a 1% error, and radius *r* with a 0.25% error. Acceleration due to gravity *g* is known to be 9.8 m/s^2 with 1.5% error. Calculate the maximum percentage error in the estimate of the moment of inertia,

$$I = \left(\frac{n_2}{n_1 + n_2}\right) m \left(\frac{2gh}{\omega^2} - r^2\right)$$

Here n_1, n_2, and ω can be treated constant parameters.

OR



The output on channel-1 of an oscilloscope is as shown in the figure above.
What is the peak-to-peak voltage and time-period of the sinusoidal waveform on the oscilloscope?

[5 Marks]

6. How will you study the batch growth kinetics of a bacterial culture in a bioreactor?

OR

Write step-by-step experimental procedure (without sample calculations) for the sedimentation experiment (batch settling of solids in a slurry).
Assuming that solid concentration is very low, which forces are acting on a solid particle in a batch settling experiment? Give names and mathematical expressions for each of them.

OR

Write down the detailed protocol to prepare diazonium salt in a chemistry laboratory with an example.

OR

The readings from the laboratory test for determination of Aggregate Impact Value are as follows:

Sl. No.	Detail	Trial 1	Trial 2
1	Total weight of aggregates sample filling the cylindrical measure, kg	0.614	0.616
2	Weight of aggregate passing 2.36 mm sieve after the test, kg	0.054	0.040
3	Weight of aggregate retained on 2.36 mm sieve after the test, kg	0.558	0.570

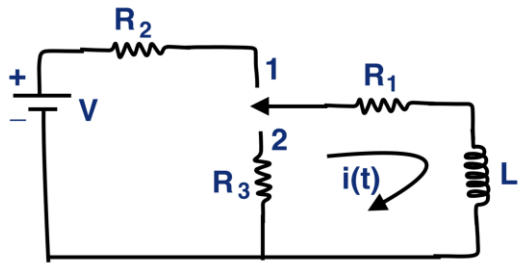
Report the result on the Aggregate Impact Value of this sample as per IS 2386 (Part IV) – 1963 (Reaffirmed 2002). Comment on the validity of this test as per IS 2386 (Part IV) – 1963 (Reaffirmed 2002).

OR

Write a bash shell script to print first 100 prime numbers.

OR

In the circuit shown in the figure below, the switch is changed from position 1 to position 2 at t = 0, a steady-state current having previously been established in the RL circuit. Find the expression of the current $i(t)$ in the circuit.



OR

When a measuring instrument is bought from a market, certain uncertainty value is mentioned. Explain briefly what does it mean?
What are the two different measurement uncertainties? Explain them briefly.
What is least count of an instrument?

OR

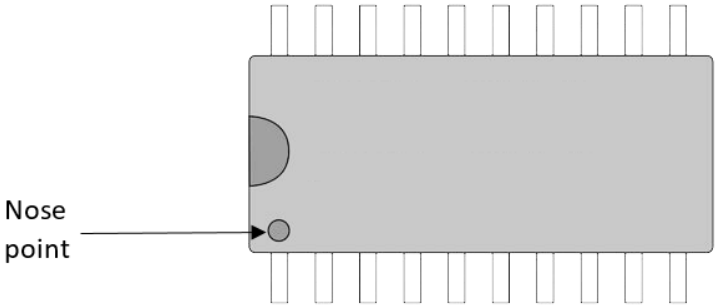
Draw a flowchart and briefly explain the general processes involved in the extraction of any metal from its ore.

OR

In the first excited state, sodium decays to the ground state by emitting a photon of wavelength 590 nm. If sodium vapour is used for the Frank-Hertz experiment, calculate the voltage at which the first current drop will be recorded.

OR

What does the nose point on an integrated circuit (IC) indicate?



[5 Marks]

7. How will you isolate plasmids from bacteria? Add a note on visualization of the plasmid in gel.

OR

To illustrate the basic concepts of chemical reaction engineering, the following saponification reaction between sodium hydroxide and ethyl acetate is conducted in an isothermal batch reactor:

$$NaOH + CH_3COOC_2H_5 \rightarrow CH_3COONa + C_2H_5OH$$

The above reaction can be approximated as

$$A + B \rightarrow C + D$$

What data (measurements at various times) will you be collecting? Describe the procedure/step you will take for this measurement.
From the collected data, you have to find the order (n) and rate constant (k), if the rate of this reaction is given as $dC_A/dt = -k(C_A)^n$. Describe the procedure.

OR

Write down the basic difference between UV-Vis spectroscopy and Fluorescence spectroscopy. Which one is more sensitive?

OR

The readings from an experiment to determine the specific gravity of soil solids are as follows:

Item	Test No.		
	1	2	3
Mass of flask + water filled to mark, gm	666.0	674.0	652.0
Mass of flask + soil + water filled to mark, gm	728.0	738.30	709.93
Mass of dry soil, gm	99.0	103.0	92.0

What is the specific gravity of the soil solids?

OR

Given the information that a host has an IP address of 192.168.130.199 with a subnet mask of 255.255.255.224. Provide the network address, starting address and ending address of the usable host IP addresses. How many subnets are being used in the network and what is the number of usable IP addresses in each subnet?

OR

A digital communication system uses a binary modulation scheme such that the receiver detects each message bit incorrectly with a probability p. Suppose 8 bits are transmitted. What is the probability that more than two bits out of the 8 bits will be detected incorrectly by the receiver?

OR

Explain two different types of taper turning methods with neat sketch.
What is the difference between drilling and reaming?

OR

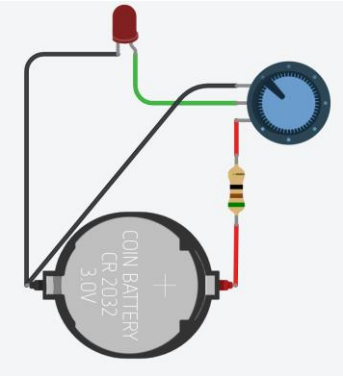
Write a short technical note on X-ray photoelectron spectroscopy that includes basics, application and sample preparation.

OR

What is the ESR experiment and what is the main purpose of this experiment? Why the Helmholtz coil is used in the ESR experiment instead of a bar magnet?

OR

Consider the following circuit assembled using a LED, resistor, potentiometer and a battery. What will be the change in the state of the LED, if the potentiometer is rotated in the direction shown in the figure below?



[5 Marks]

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RECRUITMENT EXAMINATION FOR JUNIOR LAB ASSISTANT (TIER-II)

PART -B

(COMPUTER-BASED TEST)

इस पुस्तिका में 2 पृष्ठ शामिल हैं।
This booklet consists of 2 pages.

अधिकतम अंक: 15
Maximum Marks: 15

समय: 15 मिनट
Time: 15 Minutes

अनुदेश / **Instructions**

इस प्रश्न पत्र में कुल 4 प्रश्न हैं। सभी प्रश्न अनिवार्य हैं। व्यक्तिपरक प्रकार के प्रश्नों के अधिकतम अंक उनके सामने दर्शाये गये हैं। अपने कंप्यूटर में उत्तर-स्क्रिप्ट फ़ाइल के एक नए पृष्ठ में प्रत्येक प्रश्न का उत्तर दें। उपयोग किए गए प्रत्येक पृष्ठ के शीर्षलेख पर अपना रोल नंबर लिखें। फाइल को कंप्यूटर के डेस्कटॉप पर अपने रोल नंबर के नाम से पीडीएफ के रूप में सेव करें। Page X of Y प्रारूप में फ़ाइल के पाद लेख पर पृष्ठ संख्या का उल्लेख करें। केवल निर्धारित परीक्षा समय के भीतर वर्ड से पीडीएफ फ़ाइल रूपांतरण और फ़ाइल के शीर्षलेख और पाद लेख में जानकारी डालने का कार्य पूरा करें। इन कार्यों के लिए कोई अतिरिक्त समय नहीं दिया जाएगा।

This question paper contains a total of 4 questions. All the questions are compulsory. Maximum marks for subjective type questions are shown against them. Attempt each question in a new page of the answer-script file in your computer. Write your roll number at the header of each page used. Save the file as PDF in the name of your roll number at the desktop of the computer. Mention page number at the footer of the file in Page X of Y format. Complete Word to PDF file conversion and inserting information at header and footer of the file within the stipulated exam time only. No extra time will be given for these operations.

1.	Type the following in English (निम्नलिखित को अंग्रेजी में टाइप करें): There are a million excuses for not paying the price: "If only I was given a particular opportunity," "If only the boss liked me better, I could accomplish this or that." Nothing but excuses. That's not to say there aren't obstacles or distractions. If you are trying to achieve, there will be roadblocks. But obstacles don't have to stop you. If you run into a wall, don't give up. Figure out how to climb it, go through it, or work around it. You have to stick to your plan. A lot of people try to pull you down to their level because they can't achieve certain things. But very few people get anywhere by taking shortcuts. More people gain success the honest way, by setting their goals and committing themselves to achieving those goals. Our society tends to glamorize individual success without considering the entire process. What if you have a CEO with a great idea, but he doesn't have the people to make it happen? If you don't have all the pieces in place, particularly at the front lines, that idea doesn't mean a thing. **[5 Marks]**
2.	Type the following in English (निम्नलिखित को अंग्रेजी में टाइप करें): Fear sometimes comes from a lack of focus or concentration. If you know you are doing the right things, just relax and perform. Forget about the outcome. When you make a presentation in business, you may do all the things necessary, but then it's out of your hands. Either the clients like the presentation, or they don't. It's up to the client or the buyer. I can accept failure. Everyone fails at something. But I can't accept not trying. It doesn't matter if you win as long as you give everything in your heart and work at it 110 percent. If you put in the work, the results will come. I can't do things halfheartedly, because I know if I do, then I can expect halfhearted results. That's why I approach practices the same way I approach games. I can't dodge it during practice and then, when I need that extra push late in the game, expect it to be there. But that's how a lot of people approach things. And that's why they fail. **[5 Marks]**
3.	Type the following in English (निम्नलिखित को अंग्रेजी में टाइप करें): I never look at the consequences of failing, because when you think about the consequences, you always think of a negative result. If I'm jumping into any situation, I'm thinking I'm going to be successful- not about what happens if I fail. Some people get frozen by fear of failure by thinking about the possibility of a negative result. They might be afraid of looking bad or being embarrassed. I realized that if I was going to achieve in life, I had to be aggressive. I had to get out there and go for it. I know fear is an obstacle for some people, but to me it's an illusion. Any fear is an illusion. You think something is standing in your way, but nothing is there- only an opportunity to do your best and gain some success. If it turns out my best isn't good enough, then at least I'll never be able to look back and say I was too afraid to try. Maybe I just didn't have it. Maybe I just wasn't good enough. **[5 Marks]**