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भारतीय प्रौद्योगिकी संस्थान रूड़की

Indian Institute of Technology Roorkee

RECRUITMENT EXAMINATION FOR JUNIOR TECHNICAL SUPERINTENDENT (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. How to split a column in MS Excel in to 2 or more columns?
   MS Excel में एक कॉलम को 2 या अधिक कॉलम में कैसे विभाजित करें? **[5 Marks]**

2. Explain the difference between transitions and animations in MS PowerPoint. Provide examples of when to use each.

MS PowerPoint में ट्रांज़िशन और एनिमेशन के बीच अंतर स्पष्ट करें। प्रत्येक का उपयोग कब करना है इसके उदाहरण प्रदान करें। **[5 Marks]**

3. What is the presenter view in MS PowerPoint and how it can benefit the presenter's experience during a Slideshow. How to start presenter's view?
MS PowerPoint में presenter view क्या है और यह स्लाइड शो के दौरान प्रस्तुतकर्ता के अनुभव को कैसे लाभ पहुंचा सकता है। Presenter view कैसे प्रारंभ करें? **[5 Marks]**

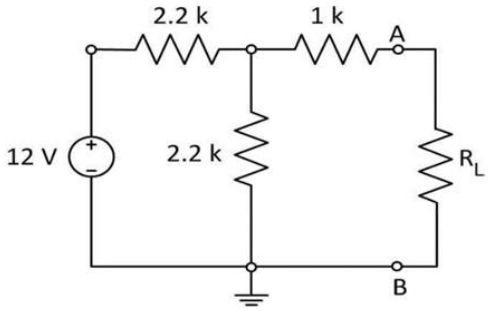
4. You are asked to prepare dry tetrahydrofuran from commercially available tetrahydrofuran. Write down the step-wise procedure.

OR

Explain the difference between internal fragmentation and external fragmentation in context of memory allocation. Which one occurs in paging systems and why? Which one occurs in memory systems with pure segmentation and why?

OR

Consider that you have assembled the following circuit in the lab:



If you remove the load resistance R_L and measure the open circuit voltage across terminals A-B (VOC) with the help of a digital multimeter, ideally what should be the value displayed on the multimeter (Take resistances in Ohm and k in the diagram means kilo)?

OR

A physical quantity is given by the relation

$$X = \frac{A^2 B^3}{C\sqrt{D}}$$

If the percentage errors of the measurement in *A*, *B*, *C*, and *D* are 4%, 2%, 3%, and 1%, respectively, then calculate the maximum possible percentage error in the calculation of *X*.

[5 Marks]

5. a) How the calomel electrode is represented?
b) A cell consists of Zn electrode immersed in a 0.001 M Zn^{2+} solution and Cu electrode immersed in a 0.1 M Cu^{2+} solution. If a voltmeter is connected between them, what will be the value in the voltmeter's display? Use the following cell potential values.

$Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s) + 0.34\ V$

$Zn^{2+}(aq) + 2e^{-} \rightarrow Zn(s) - 0.76\ V$

OR

Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is

86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for the disk-scheduling algorithms (i) SSTF and (ii) SCAN?

OR

On checking the output of a circuit, you found that it has a high frequency noise component. You have a resistor and a capacitor with you. Build a circuit using these components that might help you get rid of the noise in the output.

OR

A water drop of radius *R* is split into *n* smaller drops of each radius *r*. If *T* is the surface tension of water, then calculate the work done in this process.

[5 Marks]

6. a) What will be the colour of phenolphthalein indicator under the following pH:
i) pH 2.0; ii) pH 6.0; iii) pH 9.0; iv) pH 12.0

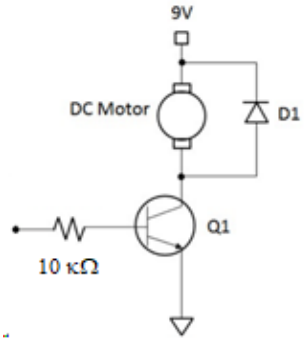
b) Consider the situation where you are assigned to titrate a strongly coloured basic solution and being restricted from using any suitable indicator. In such a scenario, how would you proceed with titrating the provided solution?

OR

Write a C program that uses character pointers to reverse a string taken as input in a character array and prints the reversed string.

OR

In order to run a 9V-100 rpm DC motor, a transistor-based circuit has been made as shown in the figure below:



The data sheet of the transistor is given below:

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-Base Voltage	80	V
V_{CEO}	Collector-Emitter Voltage	65	V
V_{EBO}	Emitter-Base Voltage	6	V
I_C	Collector Current (DC)	100	mA
P_C	Collector Power Dissipation	500	mW
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature Range	-65 to +150	°C

Electrical Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector Cut-Off Current	V_{CB} = 30 V, I_E = 0			15	nA
h_{FE}	DC Current Gain	V_{CE} = 5 V, I_C = 2 mA	110		800	
V_{CE}(sat)	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA		90	250	mV
		I_C = 100 mA, I_B = 5 mA		250	600	
V_{BE}(sat)	Collector-Base Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA		700		mV
		I_C = 100 mA, I_B = 5 mA		900		
V_{BE}(on)	Base-Emitter On Voltage	V_{CE} = 5 V, I_C = 2 mA	580	660	700	mV
		V_{CE} = 5 V, I_C = 10 mA			720	

At 9V-100 rpm, the motor has a power rating of 9W. Justify if the given circuit can be used to rotate the motor at 100 rpm.

OR

A Newton ring arrangement is used with a light source of wavelength $\lambda_1 = 6000\ A°\ and\ \lambda_2 = 5000\ A°$. It was found that the n^{th} dark ring due to λ_1 coincide with the $n + 1^{th}$ dark ring due to λ_2. If the radius of curvature of curved surface of the lens is 90 cm, find the ring number 'n' of the wavelength λ_1.

[5 Marks]

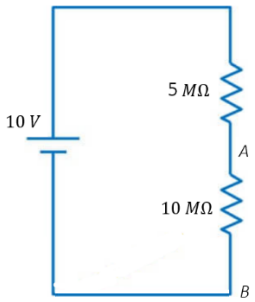
7. a) What do you measure in the high-resolution mass spectrometry (HRMS)?
b) How do HRMS and MALDI-ToF methods of mass analysis differ in terms of the principle of ionization, mass accuracy/resolution, and application?

OR

Consider an array *A* with 200 elements in sorted order. Suppose a given element *x* appears with the same probability in any place in *A.* Find the worst-case running time *f(n)* and the average-case running time *g(n)* to find *x* in *A* using the binary search algorithm.

OR

Consider the following circuit:



The reading on a multimeter on measuring the voltage across node A and B is 5 V. Theoretically, the voltage across A-B is $\frac{20}{3}$ V. What is the problem with the measurement, considering the multimeter is not-faulty?

OR

A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which $R = 3\ \Omega$, L =25.48 mH, and $C = 796\ \mu$F . Calculate the dissipated power in the circuit at the resonant condition.

[5 Marks]

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RECRUITMENT EXAMINATION FOR JUNIOR TECHNICAL SUPERINTENDENT (TIER-II)

PART -B

(COMPUTER-BASED TEST)

इस पुस्तिका में 4 पृष्ठ शामिल हैं।
This booklet consists of 4 pages.

अधिकतम अंक: 15 समय: 15 मिनट
Maximum Marks: 15 **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): I have learned that whatever I think of myself, God thinks better of me. No matter how much you have messed up your life, God still cares about you. God loves us despite all our failings. We have to go out and love ourselves and love our families despite their failings the way God loves us. I know there is part of me that is not physical, a part that I call my soul, or spirit. It is everything about me that is non-physical: my identity, my values, my memories, my sense of humor. Now, because it is not physical, it is not subject to death. My soul cannot die. That is not a religious dogma, that is a scientific fact. It can't be argued with. A soul is immortal because a soul is nonphysical and not subject to death. Hell is the understanding that if I am sarcastic to my daughter, she will be sarcastic to my grandchildren, and it will be my fault. Hell is realizing that every time I tell a lie because the truth is embarrassing, I am voting to make this a more deceitful world for my family to live in. Heaven is the awareness that every time I do something good, even if nobody thanks me for it, and every time I resist temptation, the world is permanently better for the good that I do. If there is no God, who is there to inspire us? **[5 Marks]**
2.	Type the following in English (निम्नलिखित को अंग्रेजी में टाइप करें): I have found that one thing disrupts forward progress more than anything- the ego. My own experience of the ego is that it wants a good life. The ego does not like pain, but demands instant gratification. There are three things that differentiate living from the soul versus living from the ego only: the ability to sense and learn new ways, the tenacity to ride a rough road and the patience to learn deep love over time. When I want a quick fix, I am operating out of my ego. When I cannot walk the talk, but can dictate it to others, I am being ego-centered. And when I want a lasting solution, I am not going to find one, as long as I am stuck in my ego. The greatest thing a person can do is to continually assess his or her own performance and make continual improvement. In other words, walk the talk. Don't ask that of me that you are unwilling to do yourself. If you are a pot, don't call the kettle black. Show me how to grow through your own growth. Guide me through the maze, but don't try to change me. Because, anytime we try to control another human being, we will always find ourselves dealing with rebellion. Hold a mirror up to yourself every day and say, "What do I need to look at today? Am I doing the things that I have committed to doing? And if not, why not?" **[5 Marks]**

3.	Type the following in English (निम्नलिखित को अंग्रेजी में टाइप करें): Hundreds of Olympic athletes have not only lived their dreams, they have spiked our dreams too with their courage and accomplishments. The Olympic Games are perhaps the world's greatest and most dramatic stage for those in pursuit of lifelong goals and dreams. The Olympics are as much as artistic as an athletic event, for the pursuit of dreams is the art of living life as it should be lived fully, enthusiastically with every breath you take. We take great inspiration from our Olympians, not just from the strength of their bodies, but from the strength of their characters. The strength of characters that enabled, for example, Jesse Owens, Jackie Joyner-Kersee and Dan Jansen to endure incredible sacrifices, pain, and labor before and during their actual Olympic events is even more awesome than their incredibly tuned athletic skills and powerful physiques. We often fail to consider how many defeats these athletes had to endure before the victories began to come. How much pain preceded victory? How much sacrifice paved the way for success? It is not the Olympics that makes these individuals champions. It is the determination that brought them here that sets them apart. Everybody should have a dream, said Jesse Owens, the grandson of a slave and son of an Arkansas sharecropper. Everybody should work towards that dream. And if we believe hard enough, whether it be in the Olympic Games, the business world, the music world, or the educational world, it all comes down to one thing. **[5 Marks]**

SPACE FOR ROUGH WORK