ROLL NO

PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION FOR RECRUITMENT TO THE POSTS OF PROVINCIAL MANAGEMENT SERVICE, ETC -2023 CASE NO. 1C2024

SUBJECT: PRINCIPLE OF ENGINEERING (PAPER-I)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE:

i. All the parts (if any) of each Question must be attempted at one place instead of at different places.
ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
iv. Extra attempt of any question or any part of the question will not be considered.

NOTE: **Attempt any FIVE questions in all. Non-Programmable calculator is allowed. Draw clear diagrams where necessary.**

Q.No.1 **a)** Discuss in detail "Free electron model". Explain electron hole with the help of diagram.

b) What do you understand by the following terms?
i) Spherical and chromatic aberration ii) Dispersion and scattering

(10+10=20 Marks)

Q.No.2 **a)** Differentiate between Miscibility and Interactions.

b) A 21g sample of HCl is dissolved in 750 mL of a solvent (density= 1.3 g/mL and molecular weight= 180 g/mol). Assume the volume of HCl is 21 mL. Calculate the solution's molarity, molality, molar fraction, and mass percentage.

(10+10=20 Marks)

Q.No.3 **a)** An alternating voltage is triangular in shape, rising at a constant rate to a maximum of 300V in 8 ms and then falling to zero at a constant rate in 4 ms. The negative half cycle is identical in shape to the positive half cycle. Calculate (a) the mean voltage over half a cycle, and (b) the rms voltage.

b) If the supply to a circuit is 25 sin 628.3t volts and the voltage drop across one of the components is 18 sin (628.3t −0.52) volts, calculate (a) the voltage drop across the remainder of the circuit, (b) the supply frequency, and (c) the periodic time of the supply.

(10+10=20 Marks)

Q.No.4 **a)** What is a P-N junction diode? Explain working of a diode in forward and reversed biased mode.

b) Write notes on the following:
i) AM ii) FM iii) Delta iv) ASK v) PWM

(10+10=20 Marks)

Q.No.5 **a)** Keeping in view Pakistan, discuss different types of Transmission Lines in use and the reasons of heavy transmission line losses.

b) Describe power network analysis. What is polyphase system of distributing alternating -current (A.C) ?

(10+10=20 Marks)

Q.No.6 **a)** Some of the engine experts have the opinion that two stroke petrol engines are noisy & dirty, and it is a dying technology. What is your opinion? Give reasons to support your thoughts.

b) Describe Drilling and Gear cutting manufacturing processes.

c) What is Gibbs free energy concept? **(10+5+5=20 Marks)**

P.T.O

Q.No.7 **a)** Compare the electrical properties and mechanical properties of engineering ceramics.

b) What are the basic differences between general purpose plastic and engineering thermo-plastics?

(10+10=20 Marks)

Q.No.8 **a)** Write detailed notes on the following terms:
i) Diffusion in Ceramics ii) Creep Resistant Materials

b) The Young's moduli of alkali metals are given below in units of GN m–2:
Li (11.5), Na (9.0), K (3.5), Rb (2.7), Cs (1.8) and Fr (1.7). Compare this with the corresponding values of the melting points. Give a reason for this sequence.

(10+10=20 Marks)

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COMBINED COMPETITIVE EXAMINATION FOR RECRUITMENT TO THE POSTS OF PROVINCIAL MANAGEMENT SERVICE, ETC -2023 CASE NO. 1C2024

SUBJECT: PRINCIPLE OF ENGINEERING (PAPER-II)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE:
i. All the parts (if any) of each Question must be attempted at one place instead of at different places.
ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
iv. Extra attempt of any question or any part of the question will not be considered.

NOTE: Attempt any FIVE questions in all, including question No. 8 which is compulsory. Calculator is allowed. (Not Programmable).

Q.No.1 **(a)** Briefly explain the concepts namely:
(i) Inflation (ii) Consumer Price index
(iii) Marginal cost (iv) Differential revenue

(b) Elaborate on the Cost-volume-profit analysis. Also explain as to how we can express profit function in the context of this analysis. **(12+8=20 Marks)**

Q.No.2 **(a)** Bank provides loan to a customer, an amount of $25,000 with interest compounded at a rate of 8% per year. How much will the customer owe to the Bank if he repays it at the end of 5 years. Alternatively, also determine the annual equal installments if bank provides provision to have it returned over a period of five years instead of having it repaid at the end of year five.

(b) An Organization is interested in determining "book value" of its certain asset after 5 years whose current worth is $500,000. An assessment of its salvage value stands at $ 50,000 after a useful life of around 15 years. Apply straight line depreciation method to determine its book value after 5 years. **(10+10=20 Marks)**

Q.No.3 Write a comprehensive note on the "Non-destructive" testing techniques used to assess the internal defects within materials/products. Elaborate on the methodologies involved and draw schematics while giving your explanations for following cases:

(i) Magnetic Particle Inspection
(ii) Dye Penetrant Testing **(20 Marks)**

Q.No.4 **(a)** A project based organization is interested in determining important timelines pertaining to the project being undertaken by it. Consider the data given in the table below and i) construct the network diagram, ii) identify the critical path and iii) determine the project completion time.

Explain the testing spectrum specifying the person who will do any specific testing along with general scope.

Activity	Activity Predecessor	Activity Duration (Weeks)
A	-	4
B	-	6
C	A, B	7
D	B	8
E	B	5
F	C	5
G	D	7
H	D,E	8
I	F,G,H	4

(b) In the context of resource loading, differentiate and explain *"time-limited resource scheduling"* and *"resource-limited resource scheduling"*. Please state possible scenarios/examples as to where each situation may occur.

(10+10=20 Marks)

Q.No.5 **(a)** In the context of "quantity discount model", discuss how in certain situations, a non-optimal point of the total cost curve, pertaining to a particular discount value of the inventory item, may still result into the most economical proposition from among other available discount alternates.

(b) Elaborate on the differences of "basic economic order quantity model" and "production order quantity model". Please represent both the models graphically and use these to better explain your answer. **(10+10=20 Marks)**

Q.No.6 **(a)** Write a short note on "Forced Field Analysis", for its use for facilitating decision making. Make use of an example to better explain the technique.

(b) Discuss "Why-Why" analysis as to how it may be used to explore the cause and effect relationships underlying a particular problem. Use example while explaining.

(10+10=20 Marks)

P.T.O

Q.No.7 A manufacturing organization intends to evaluate various strategies to plan their production so as to meet the expected customer demand. Following strategies are being considered by the organization:

(i) Maintain a constant workforce throughout six months period

(ii) Maintain a constant workforce at a level necessary to meet the lowest daily demand for a month and meet the rest of the demand by subcontracting.

Using the following data sets as gathered by the company, evaluate as to which strategy would be more cost effective.

Month	Expected Demand	Production Days
Jan	800	22
Feb	700	18
Mar	850	21
Apr	1,100	21
May	1,600	23
Jun	1,200	20

Inventory carrying cost	$ 8 per unit per month
Subcontracting cost per unit	$ 25 per unit
Average pay rate	$ 11 per hour ($ 88 per day)
Labor-hours to produce a unit	1.6 hours per unit

(20 Marks)

Q.No.8 **Choose the best option: (Compulsory)** **(20 Marks)**

1) Pick up the correct statement from the following:

(A) The capital required to get a project started is the first cost

(B) The first cost is a single cash flow or a series of cash flows that are made in the beginning of the activity's life span

(C) The first cost of purchasing a car is the sum of the down payment, taxes and dealers charges

(D) All of these

2) In a cash flow series:

(A) Uniform gradient signifies that an income or disbursement changes by the same amount in each interest period

(B) Either an increase or decrease in the amount of a cash flow is called the gradient

(C) The gradient in the cash flow may be positive or negative

(D) All of these

3) Imputed cost is a_____.

(A) Notional cost (B) Real cost (C) Normal cost (D) Variable cost

4) Indirect material used in production is classified as.

(A) Office overhead (B) Selling overhead

(C) Distribution overhead (D) Production overhead

5) Exhaustive testing is:

(A) Always possible (B) Practically possible

(C) Impractical but possible (D) Impractical and impossible

6) Analysis of Boundary value belong to?

(A) White Box Testing (B) Black Box Testing

(C) White Box & Black Box Testing (D) None of the mentioned

7) The statistical tool that depicts a project's tasks and the relationships between those tasks is known as

(A) Milestone (B) Goal (C) Gantt chart (D) PERT chart

8) Which of the following is NOT a part of project management?

(A) Initiating (B) Monitoring
(C) Closing (D) All of these are parts

9) Which of the following is the simplest page replacement algorithm?

(A) FIFO (B) Optimal page replacement
(C) LRU replacement (D) Counting based replacement

10) Effective inventory management minimizes the investment in inventory by effectively meeting the;

(A) Functional requirement (B) Customer requirement
(C) Process reliability (D) Sales forecasting of a firm

11) Which of the following option is correct regarding QA and QC?

(A) QC is an integral part of QA
(B) QA is an integral part of QC
(C) QA and QC are independent to each other
(D) QC may or may not depend on QA

12) Which among the following is not a contribution made by Crosby?

(A) Quality is Free
(B) Quality without Tears
(C) Let's Talk Quality and Leading: The Art of Becoming an Executive
(D) Quality Planning and Analysis

13) Which of the following device is mostly associated with automation?

(A) NC machine (B) Flexible manufacturing
(C) Computer graphics workstation (D) Robots

14) The formula for free float is _____.

(A) Total float – slack of tail event (B) Total float – LFT of head event
(C) Total float – EFT of head event (D) Total float – Slack of head event

15) Which of the following are the pros of Decision Trees?

(A) Possible Scenarios can be added
(B) Use a white-box model, if a particular result is provided by a model
(C) Best, worst and expected values can be determined for different scenarios
(D) All of these

16) Which of these does not come into the general model of a process?

(A) Input (B) Controllable input factors
(C) Uncontrollable inputs factors (D) Acceptance sampling

17) Customers come and stay because of this factor.

(A) Quality (B) Time (C) Flexibility (D) All of these

18) ___ deals with the conversion of the logical model into the relational model.

(A) Business model (B) Business process
(C) Physical modeling (D) None of these

19) In an information system which one is not a technology driver for an information system?

(A) Knowledge asset management (B) Networks and the Internet
(C) Object technologies (D) Enterprise applications

20) Which of the following is responsible for the systems development, budget, on-time development and with acceptable quality

(A) Systems owner (B) Systems designer
(C) Project manager (D) User systems builder