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) What is difference between wave mechanics and matrix mechanics? What is wave particle duality? Why does wave nature of matter is not more apparent in our everyday life?

b) What do you understand by the term "superconductivity'? Discuss low temperature and high temperature superconductors and their applications.   **(10+10=20 Marks)**

Q.No.2   a) What are effects of different Crystalline structure on same substance on its properties?

b) Discuss in detail heat capacity of solids and gases. What is the significance of gas constant?

c) Explain in detail Graham's Law of Diffusion and Roult's law.

(7+7+6=20 Marks)

Q.No.3   a) What do you understand by electromagnetic induction? Explain, how Lenz's law is helpful in determining the direction of induced current?

b) What must be the magnitude of an isolated positive charge for the electric potential of 120 V at 15 cm from the charge?

c) What do you understand by magnetic hysteresis?   **(10+5+5=20 Marks)**

Q.No.4   a) Discuss in detail AC Induction motor and synchronous motor and compare their Performance and Efficiency.

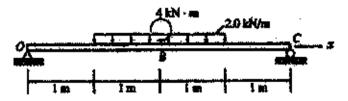b) Explain Copper & Iron Losses in step-up/step-down Transformers.

(10+10=20 Marks)

Q.No.5   a) In given Fig. assume that a 20-mm-diameter rivet joins the plates that are each 110 mm wide. The allowable stresses are 120 MPa for bearing in the plate material and 60 MPa for shearing of rivet. Determine (a) the minimum thickness of each plate; and (b) the largest average tensile stress in the plates.

b) For the beam, simply supported at the ends and loaded as shown, write equations for the shearing force and bending moment at any point along the length of the beam. Also, draw the shearing force and bending moment diagrams.

(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 Casting and Forging manufacturing processes.

c) Explain in detail Carnot cycle.

(10+5+5=20 Marks)

Q.No.7   **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)

Q.No.8   **a)** Differentiate between beams and columns.

b) What is the roll of traffic appraisal in highway administration and scheme preparation?

c) What kind of impacts have water resources projects on Environment in Pakistan?

d) What are the different kinds of pressure measuring devices used in engineering applications?

(5+5+5+5=20 Marks)

PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION
FOR RECRUITMENT TO THE POSTS OF
PROVINCIAL MANAGEMENT SERVICE, ETC -2022
CASE NO. 2C2023

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   An electronics company is considering the options of either (a) immediately proceeding with production of an innovative product which has just completed prototype testing or (b) having a value analysis team complete a study. If the company proceeds with option (a), the firm expects with a probability of 0.6, that sales would be 100,000 units at $550 each, also there exists a probability of 0.4 that sales may remain at 75,000 units at $550 each. If the company pursues option (b), the firm expects with a probability of 0.7, that sales would be 75,000 units at $750 each whereas there exists a probability of 0.3 for the sales to remain at 70,000 units at $750 each. Value analysis, at a cost of $100,000 is only used in option (b) whereas no further cost factor needs consideration for option (a) as it is ready to be launched.

Use decision tree analysis to recommend which option should be taken by the company.

(20 Marks)

Q.No.2   a) A project with the detail of its activities as shown below, was started on 20/1/2022. If the project has a delay of 02 weeks after 06 working weeks, what would be its new delivery date?

Activity	A	B	C	D	E	F	G	H	I	K
Duration (weeks)	3	4	4	2	3	3	4	4	5	6
Following Activity	B,D,E	C	I	F	G	H	I	—	K	—

b) What is Project Integration Management? Write Processes of Project Integration Management.   (10+10=20 Marks)

Q.No.3   (a) Write a short note on the benefits of international quality management system (e.g ISO) certification.

(b) What do you understand by "cost of quality"? Write a note on various categories of quality costs.   (10+10=20 Marks)

Q.No.4   a) Classify the software testing techniques commonly used in practice.

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

b) Describe and then differentiate the static and structural White Box testing techniques in detail.

(10+10=20 Marks)

Q.No.5   (a) In the context of independent demand models, what is the difference between "fixed-period (P) system" and "fixed-quantity (Q) system"?

(b) A hotel distributes a mean of 1000 bath towels per day to guests in their rooms. The demand is normally distributed with a standard deviation of 100 towels per day, based on the occupancy. The laundry firm that has the contract to supplies of these towels to the hotel, requires a 2-day lead time. The hotel targets 98% service level to satisfy customer (guest) expectations.

    a. What should be the safety stock?
    b. What is the re-order point (ROP)?
    c. To what extent (in %), the hotel would need to vary its safety stocks than those calculated in part (a) if the policy changes to the risking stock outs at 10%?

Table for areas under the Normal Curve is provided

(5+15=20 Marks)

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84850	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97784	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950

Q.No.6

(a) What is a flexible manufacturing system (FMS)? Write a short note on the various benefits associated with a FMS system if implemented successfully in an Organization.

(b) What is "Agile Manufacturing"? Provide an overview of the concept and some possible approaches as to how this may be achieved by Organizations.   (10+10=20 Marks)

Q.No.7

An organisation has done some estimation of the complexity of four of its current projects and has ranked them out of 10 against the headings shown in the following table:

	Organisational Complexity	Resource Complexity	Technical Complexity
Project 1	1	7	6
Project 2	4	4	5
Project 3	4	2	1
Project 4	2	9	4

In the absence of any further information, if the organisation wanted to apply the Prince 2 methodology to only one of the projects, which one would you recommend?   (20 Marks)

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

1) Keeping in view, the feasibility order of magnitude, the preliminary, conceptual or budget estimates, are prepared by:
(A) Architect/engineer   (B) Construction manager
(C) Owner himself/herself   (D) Construction manager

2) Which statement is correct?
(A) Ratio analysis is the procedure of determining and interpreting numerical relationship of various items of the financial statement
(B) All financial ratios are obtained by relating two sets of information contained in a single financial statement
(C) The relationship between two accounting figures expressed mathematically, is known as a financial ratio
(D) All of these

3) Basic objectives of cost accounting is_____.
(A) tax compliance.   (B) financial audit.   (C) cost ascertainment.   (D) profit analysis.

4) Wages paid to a labour who was engaged in production activities can be termed as.
(A) direct cost.   (B) indirect cost.   (C) sunk cost.   (D) imputed cost.

5) Which one of the following is not considered for preparation of cost sheet?
(A) Factory cost.   (B) Goodwill written off.   (C) Selling cost.   (D) Labour cost.

6) White Box Techniques are also classified as
(A) Design based testing   (B) Structural testing
(C) Error guessing technique   (D) None of the mentioned

7) Impact Analysis help to decide which of the following testing describe below:
(A) How much regression testing should be done?
(B) How many more test cases need to written?
(C) Exit Criteria
(D) Different Tools to perform Regression Testing

8) The PERT in project management means program evaluation and _____ technique.
(A) resource   (B) reconciliation   (C) reconsideration   (D) review

9) "Risk" is usually _____ as the project progresses.
(A) increased   (B) reduced   (C) remained same   (D) become negligible

10) The scope of the work is defined in which phase of the project management?
(A) Initiating   (B) Planning   (C) Executing   (D) Closing

11) Which of the following is a type of inventory system that is used to manage independent demand items?
(A) Order point system   (B) Material Requirements Planning
(C) Time Phased Order Point   (D) Enterprise Resource Planning

12) Arrange the steps of QA in ascending order?
(A) Customer needs, material control, design development, process control, marketing
(B) Material control, process control, customer need, design development, finished product
(C) Customer needs, design development, material control, process control, finished product
(D) Material control, servicing, process control, material control, design development

13) The maximum length of the data variable can hold is called
(A) size of file (B) length of a variable
(C) width of a variable (D) width of a variable

14) Strategies are formulated based on the ___ of the organization and the environment in which it is carrying on the business.
(A) Mission (B) Objectives (C) Vision (D) Goals

15) Who have concerns with tactical operational problems and decision making?
(A) supervisors (B) mobile managers (C) middle managers (D) executive managers

16) Which of the following is not a characteristic of labour?
(A) It is inseparable from laborer (B) It is immobile & passive
(C) It is human efforts. (D) It is rewarded with wages

17) Total Product, Marginal Product & Average Product for 1st unit of labor are
(A) Identical (B) Different
(C) Unable to be determined (D) None of above

18) Decision Tree is a display of an algorithm.
(A) True (B) False (C) Partially true (D) None of these

19) How to represent Decision Nodes?
(A) Disks (B) Squares (C) Circles (D) Triangles

20) Production Management starts with;
(A) Aggregate planning (B) Average planning
(C) Strategy formulation (D) None of the above