5863

Ph.D. ENTRANCE EXAMINATION, OCTOBER 2013

Name of Candidate	
Register Number	
Answer Booklet Code	
Signature of Candidate	
Signature of Invigilator	

Time : 140 Minutes Max. Marks : 160

Section – B & C

(This is to test the candidate's capability of defining concepts through short answers.)

***Note** :*

1) *Answer **any twelve** questions from Section **B** and **one** question from Section **C**.*
2) *In Section **B** **each** question carries **10** marks. Section **C** carries **40** marks.*
3) *In Section **B** an answer should not exceed **100** words. In Section **C** an answer should not exceed **500** words.*
4) *Candidates should **clearly** indicate the **Section**, **Question Number** and **Question Booklet code** in the answer paper.*
5) *The candidates are **permitted** to answer questions **only** from the subject that comes under the **faculty** in which he/she seeks registration as indicated in the **application** form.*

FACULTY OF ENGINEERING

Ph.D. Engineering	
1. Civil Engineering	
2. Eletronics and Communication	
M.Sc. Engg. By research	
3. Civil Engineering	
4. Electronics and Communication	
5. Mechanical Engineering	

FACULTY OF ENGINEERING

Ph.D. Engineering

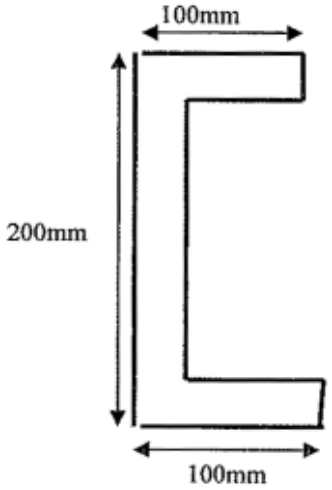
1. Civil Engineering

Section – B

1. The principal stresses at a point in a strained material are 90 N/mm^2 (tensile) and 60 N/mm^2 (compressive). Find the normal, shear and resultant stress intensities on a plane inclined at 600 to the plane of tensile principal stress. Also locate the plane on which the stress is wholly shear and find out the intensity of this shear stress.

2. Draw the shear stress distribution across a hollow circular shaft of external diameter 200 mm and wall thickness 20 mm subjected to a torque of 500 kN-m. Also find the relative rotation between the ends of the shaft if it is of 3 m length and the shear modulus is 1×105 N/mm^2.

3. Locate the shear centre of the channel section shown in figure. Flanges and web are 10 mm thick.



4. A train of 3 wheel loads (10 kN, 12.5 kN and 20 kN), with gaps of 2 m between two successive wheel loads can traverse over a simply supported beam AB of span 18 m in either direction. Using influence lines, find the maximum shear force and bending moment at a section located 7 m from the left end A. Also find the absolute maximum bending moment in the beam.

5. The maximum capacity of a 2-lane carriageway of a four lane dual carriageway is 2000 veh/hr. Due to pipe laying operations the width of two carriage way is reduced, restricting the maximum capacity to 1100 veh/hr. When the flow upstream beyond the influence of the bottleneck is reasonably steady and free-flowing at 1500 veh/hr. Find :
   i) The mean speed of traffic in the bottleneck.
   ii) The rate at which the queue of the congested conditions outside bottleneck grows. The mean space headway when the vehicles are stationary is 8 m. The relation between speed and concentration is linear.

6. a) Explain the term journey speed and running speed.
   b) The consolidated from speed and delay studies by floating car method on stretch of urban road of length 3.5 km, running North-South are given below. Determine the average values of volume, journey speed and running speed of the traffic stream along either direction.

Trip no. :	Direction of trip	Journey time Min. sec.	Total stopped delay Min. sec.	No. : of vehicles overtaking	No. : of vehicles overtaken	No. : of vehicles from opp. direction
1	N-S	6-32	1-40	4	7	268
2	S-N	7-14	1-50	5	3	186
3	N-S	6-50	1-30	5	3	280
4	S-N	7-40	2-00	2	1	200
5	N-S	6-10	1-10	3	5	250
6	S-N	8-00	2-22	2	2	170
7	N-S	6-28	1-40	2	5	290
8	S-N	7-30	1-40	3	2	160

7. Explain the concept of price-volume relationships and demand functions.

8. a) Write the design procedure of a channel section.

   b) Design an irrigation channel to carry a discharge of 19 cumec. Assume N = 0.03, m = 1 and $\frac{B}{b} = 6.2$.

9. a) What is the difference between elementary profile and practical profile of a dam ?

   b) Derive the base width for elementary profile of a dam.

10. a) What is unit hydrograph ? How will you obtain a flow hydrograph from unit hydrograph ? What is S-hydrograph ?

    b) What do you mean by base period and crop period ? Explain the different types of efficiencies in irrigation.

11. a) Define index properties of soil ?

    b) A sample of clay taken from a natural stratum was found to be partially saturated and when tested in the laboratory gave the following results. Compute the degree of saturation. Specific gravity of soil particles = 2.6 ; wet weight of sample = 2.50 N ; dry weight of sample = 210 N ; and volume of sample = 150 cm^3. Specific gravity of soil particles, G = 2.60, Wet weight, W = 2.50 N ; Volume, V = 150 cm^3, Dry weight, Wd = 2.10 N.

12. What is the effect of compaction on soil properties ? Explain the different methods of compaction adopted in the field.

13. a) Define Atterberg limits ? What is the role of plastic limit and liquid limit in the classification of soil ?

    b) A sample of silty clay has a volume of 14.88 cm^3, a total mass of 28.81 g, a dry mass of 24.83 g, and a specific gravity of solids 2.7. Determine the void ratio and the degree of saturation.

14. Technically differentiate between coagulation and flocculation.

15. What is BOD ? Derive an expression for first stage BOD exerted at any time. Find the 3 day BOD at 25° C, if the 5 day BOD at 20° C is 300 ppm. Take base 10 de-oxygenation constant as 0.12 per day at 20° C.

16. Compare Cost benefit analysis and Internal Rate of Return method.

Section – C

17. Write in detail the methodology of an engineering research problem of your choice. Explain how a systematic literature study is carried out.

18. Explain the detailed methodology to determine the accident black spots in a typical highway. Based on the outcome, suggest methods to mitigate the problem.

19. Write detailed methodology to determine the effect of M Sand in durability and strength of Concrete.

2. Electronics and Communication

Section – B

1. Differentiate between circuit switching and packet switching.

2. What is meant by Nyquist channel capacity ?

3. Compare FDMA and CDMA.

4. What is Line Of Sight (LOS) distance ? What is the typical value of LOS distance for ground based communication ?

5. Draw the basic structure of a power MOSFET and explain the switching characteristics.

6. What is graded index fibre ? Compare transmission through graded index fibre with that of step index fibre.

7. Discuss different Path loss models in wireless communication.

8. Explain how RAM memory allocation is being done in 8051 micro-controllers.

9. Explain how LVDT can be used to measure the unknown displacement. What are its advantages ?

10. Compare the structure and radiation pattern of (a) Yadi-Uda Antenna (b) Helical antenna (c) Patch antenna.

11. Design a sequential circuit to implement f (A, B, C) = Σ 1, 3, 5, 7.

12. Discuss the concept of transistorized series voltage regulator.

13. Draw and explain twin-T network for band rejection.

14. What is Discrete Wavelet Transform (DWT) ? Describe any one application for DWT.

15. Differentiate between discrete-time Fourier transform and discrete Fourier transform.

16. What is RF identification ?

Section – C

17. Discuss various steps in microwave link design.

18. Explain the concept of 'Pattern Classification' with the help of an example and describe any one pattern classification method for solving this problem given in the example.

19. Discuss a case study in the design of an embedded automatic washing machine.

M.Sc. (Engineering) by Research

3. Civil Engineering

Section – B

1. For a rectangular beam of 80 mm wide and 160 mm deep, determine the following (a) moments of inertia about the centroidal axes parallel to the two sides (b) the radii of gyration about the same axes and (c) the section modulii.

2. A bar of steel having a rectangular cross section 7.5 cm by 2.5 cm, carries an axial tensile load of 180 kN. Estimate the decrease in the length of sides of the cross section if the Young's modulus, E is 210 GPa and Poissons ratio is 0.3.

3. An aluminium rod 22 mm diameter passes through a steel tube of 25 mm internal diameter and 3 mm thick. The rod and tube are fixed at a temperature of 180° C. Find the stress in the rod and tube, when the temperature falls to 60° C.

4. In a traverse the length and bearing of line AE could not be measured directly. For the following data compute the length and bearing if AE.

Line	Length	Whole Circle Bearing
AB	102.5 m	261° 45′
BC	108.7 m	9° 0′
CD	92.5 m	282° 30′
DE	125 m	71° 30′
EA	?	?

5. What is contour interval ? Explain how contour maps are useful in determining the initial alignment of a road.

6. Explain the various permanent adjustments of a level. Describe the methods employed in reducing the errors in level measurement.

7. Prove that the efficiency of sedimentation tank is independent of its height.

8. What is meant by break point chlorination ?

9. Draw the SFD and BMD for a cantilever beam of 5 m length loaded with UDL of 20 kN/m for a length of 2 m acting beyond 2 m from the support. Two point loads of 10 kN and 20 kN act at the free end and 1 m from the support respectively.

10. Why extra widening is provided in horizontal curves ? Suggest the design formulations.

11. The speed of overtaking and overtaken vehicles are 80 and 50 kmph, respectively on a two way traffic road. If the acceleration of overtaking vehicle is 0.99 m/s^2 calculate safe overtaking sight distance, mention the minimum length of overtaking zone with neat sketch.

12. a) Describe need for super elevation and the equation for design of super elevation.

    b) The design speed of a highway is 80 kmph. There is a horizontal curve of radius 200 m on a certain locality. Calculate the super elevation needed to maintain this speed. If the maximum super elevation of 0.07 is not be exceeded, calculate the maximum allowable speed on this horizontal curve as it is not possible to increase the radius. Safe limit of transverse coefficient of friction is 0.15.

13. a) Explain the laboratory method to determine the shrinkage limit of soil ?

    b) An undisturbed saturated mass of clay has a volume of 18.9 cm^3 and a mass of 30.2 g. The oven dried soil pat is 18.0 g. The volume of dry soil specimen as determined from mercury displacement method is 9.9 cm^3. Determine the shrinkage limit, shrinkage ratio and volumetric change. Gm of mercury = 13.6.

14. a) Define Atterberg limits ? What is the role of plastic limit and liquid limit in the classification of soil ?

    b) A sample of silty clay has a volume of 14.88 cm^3, a total mass of 28.81 g, a dry mass of 24.83 g, and a specific gravity of solids 2.7. Determine the void ratio and the degree of saturation.

15. a) Explain different modes of irrigation.

    b) The base period, intensity of irrigation and duty of various crops under a canal system is given in the table below. Find the reservoir capacity if the canal base are 20% and reservoir losses are 12%.

Crop	Base period (days)	Duty hectare/cumec	Area under the crop hectare
Wheat	150	1550	4000
Sugarcane	300	950	4500
Cotton	250	1600	3000
Rice	180	750	2800
Vegetable	100	1000	1550

16. a) Explain the types of tube well with neat sketches.

    b) Explain the two methods to measure yield from a tube well.

Section – C

1. Suggest a methodology to study the effect of M Sand in concrete.

2. Explain in detail the potential of new transportation investment in bringing economic growth of a country.

3. What are the essential chapters in a thesis report ? Explain in detail how systematic literature review is carried out.

4. Electronics and Communication

Section – B

1. What is aliasing ? Explain it using a diagram.
2. Differentiate between time-division multiplexing and frequency-division multiplexing.
3. What are universal gates ? What is its significance ?
4. List different types of wired transmission lines used for communication along with the merits and demerits.
5. Differentiate between TE, TM and TEM waves.
6. Discuss Orthogonal Frequency Division Multiplexing (OFDM).
7. Explain how RAM memory allocation is being done in 8051 microcontrollers.
8. Draw the basic structure of a power MOSFET and explain the switching characteristics.
9. What are phase locked loops ? What are its applications ?
10. Compare the structure and radiation pattern of omnidirectional and directional antennas with the help of examples.
11. Draw and explain the working of a full adder circuit.
12. Draw the circuit of common emitter amplifier and list its applications.
13. Explain the working astable and monostable multivibrator using 741 op-amp.
14. What are the conditions for generating sustained oscillations in RC phase shift oscillator ?
15. Describe a fan regulator circuit using diac.
16. What is Discrete Wavelet Transform (DWT) ? Describe any one application for DWT.

Section – C

1. Design an up/down counter using D flipflops to count 0, 3, 2, 6, 4, 0, ...
2. List different biometric person authentication systems. Discuss the design of any one biometric system in detail.
3. Discuss a case study in the design of an embedded chocolate vending machine.

5. Mechanical Engineering

Section – B

1. Differentiate between Diesel cycle and Auto cycle with the help of PV diagrams.
2. Explain the working principle of a jet pump with the help of a figure.
3. What is CRDI technology in cars ? Explain with suitable illustration.
4. What is ABC analysis in Inventory Mangement ?
5. Explain how true length of a line inclined to HP and VP can be measured.
6. What are the common destructive and non-destructive tests used in the determination of casting defects ?
7. Explain a gyroscope. What are the applications of a gyroscope ?
8. Explain the principle of fuel cell. What are the limitations of fuel cells as an energy source ?
9. What is Pareto analysis ? Explain its application.
10. What is six-sigma ? What are the steps in the implementation of six-sigma ?
11. Differentiate between annealing and normalizing. Explain the application of each.
12. Explain the use of strain rosette in determining strain components. What are the different strain rosette configurations used for strain analysis ?

13. List and explain various failure criteria used in engineering design.

14. What are the basic components of a CNC machine ? Explain with the help of a schematic diagram.

15. Explain the properties of cutting tool material ? List the cutting tool materials currently in use.

16. Explain the principles of fixturing. Differentiate between jigs and fixtures.

Section – C

1. Write in detail how you will conduct a Kerala-wide sample survey to determine our people's dwelling pattern, use of energy and water, travelling habits etc. What will be your sample size ? Estimate the cost involved and time required ?

2. Write in detail how you will implement TQM in an Engineering college.

3. How would you design and experiment to compare the performance of a new tool material with an existing tool material with respect to tool life, surface finish and material removal rate ?

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