



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

SEMESTER EXAMINATION  
SEMESTER & PROGRAM : F.Y.B tech. I sem  
TIME ALLOWED : 3 HRS.  
COURSE (CourseCode) : APPLIED CHEMISTRY-I

DATE OF EXAM 02/12/11  
TIME 10 am to 1 pm  
MARKS 100

**Instructions** 1. All questions carry equal marks.  
2. Figures to the right indicate full marks.  
Atomic weights of elements: H=1, C=12, N=14, O=16, Na=23, Mg=24, S=32, Cl=35.5, Ca=40, Al=27, Fe=56

Q 1. **Answer any ten of the following:** (20)

- i) Why hard water does not form lather with soap? Write the reaction of hard water with fatty acid soap.
- ii) Thermoplastics are soluble in organic solvents but not thermosets. Justify.
- iii) State any two situations where greases are used as lubricants substituting oils.
- iv) State any four applications of biotechnology.
- v) Write the difference between atomic and molecular spectroscopy.
- vi) How many grams of  $\text{CaCl}_2$  dissolved per liter give 300 ppm hardness? Equivalent weight of  $\text{CaCl}_2$  = 55.5
- vii) Why poly methyl methacrylate (PMMA) has higher glass transition temperature ( $T_g$ )? Write the structure of PMMA.
- viii) Compare soap and detergent.
- ix) What are composites? Write the advantages and limitations of polymer as matrix phase.
- x) Draw a neat labeled diagram of electro dialysis unit of water desalination plant.

Or

- xi) Draw a neat labeled diagram of hot lime-soda water softening process plant
- xi) HDPE has more widely used as packaging films than LDPE. Justify

- Q 2.
- a) Why condensation polymerization gives both the types of plastics? Compare the addition and condensation polymerization mechanism. (06)
  - b) A water sample, on analysis gave the following data:  $\text{MgCl}_2=95\text{ppm}$ ;  $\text{CaSO}_4=272 \text{ ppm}$ ;  $\text{MgSO}_4=120 \text{ ppm}$ ;  $\text{H}_2\text{SO}_4=49\text{ppm}$ ;  $\text{KCl}= 5 \text{ ppm}$ . With the help of reactions involved calculate the amount of lime (95% pure) and soda (97% pure) for treating 1 million liters of water. If the costs of lime and soda are Rs.40 and Rs.2000 per 100kg each respectively, also calculate the total cost of chemicals used for treating 1 million liters of water. (06)
  - c) How the micelle formation occurs with fatty acid soap? Describe with the help of diagram the cleaning mechanism of soap. (04)

- d) Explain the various steps involved in biosynthesis with the example (04) of production of ethyl alcohol.

Or

What are biocomputers? Write the various applications of it.

- Q 3. a) Write the reactions involved in EDTA method and draw the (06) structure of metal-EDTA complex that are formed in the complexometric titrations for water hardness estimation.

A water sample is alkaline to both phenolphthalein and methyl orange indicator. 100 ml of water sample on titration with N/50 HCl required 4.7 ml acid to phenolphthalein end point and another 10.5 ml acid solution gives methyl orange end point. Elucidate on the type and extent of alkalinity present in the water sample.

- b) With help of flow diagram of single beam spectrophotometer (05) explain the various components of spectrophotometer.

- c) Draw the neat labeled diagram of Redwood viscometer. (05)

An oil sample of saponification value of 250 mg KOH/g was saponified using 0.5 N alcoholic KOH. Blank titer reading obtained was 50 ml 0.5 N HCl solution. Find the quantity of alcoholic KOH consumed by the oil per gram.

- d) What is glass transition temperature ( $T_g$ ) of polymers? State the (04) factors affecting the crystallinity of polymers.

- Q 4. a) Describe the significance of green chemistry towards cleaner (05) production and sustainable development with suitable examples.

- b) In a polyethylene sample, there are 100 molecules of molecular weight 1000, 300 molecules of molecular weight 10000, and 500 molecules of molecular weight 20,000. Find weight average molecular weight ( $M_w$ ), number average molecular weight ( $M_n$ ), polydispersity index (PDI) and degree of polymerization ( $DP_n$ ).

- c) Explain the mechanism of hydrodynamic lubrication. Draw the (04) structure of graphite?

- d) What is the role of cross-linking agents in thermo setting plastics (06) production? Explain with help of reactions the various steps involved in the Bakelite production.

OR

How plasticized PVC different from rigid PVC? What is vulcanization process of rubber? Compare vulcanized rubber with raw rubber.

- Q 5. **Compare any five of the following** (20)

- a) Carbonate and non-carbonate hardness  
b) Scale and sludge  
c) Fiber forming polymers & elastomers  
d) Liquid and solid lubricant  
e) Zeolite process and reverse osmosis  
f) Isotactic and atactic polymers

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## VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra state]

Matunga, Mumbai-400019

SEMESTER EXAMINATION NOVEMBER 2014

SEMESTER & COURSE I SEM. FYBTECH

SUBJECT(Code): Applied Chemistry-1 (CH0001\_T)

DATE OF EXAM: 28/11/2014

TIME ALLOWED 3 HRS

MAX MARKS : 100

Instructions:

1. All questions are compulsory.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary.
5. Illustrate your answers with neat sketches wherever necessary.

(Atomic weights: H=1, C=12, N=14, O=16, Na=23, Mg=24, S=32, Cl=35.5, Ca=40, Al=27, Fe=56)

Q.1 *Attempt any five of the following:*

(5x4=20)

- (i) Hardness of 5000 liters of water was removed completely by zeolite softener. The zeolite had required 30 liters of 100 g/liter of NaCl to regenerate. Calculate the hardness of water.
- (ii) Pure iron gets rusted in moist air but stainless steel is highly corrosion resistant. Justify. Write the composition and uses of Woods metal.
- (iii) Explain the extreme pressure lubrication mechanism with suitable examples.
- (iv) Polyethylene is crystalline but polystyrene is amorphous. Justify. Write the repeating units and properties of PVC.
- (v) What types of bonding would be expected for each of the following materials: Brass, Rubber, Carborundum (SiC) & Bricks?
- (vi) Define refractory. How are they classified?

Q.2 *Answer the following:*

- (i) Calculate the amount of lime (85% pure) and soda (95% pure) required to soften one million litres of water which contains,  $\text{Ca}(\text{HCO}_3)_2 = 324 \text{ ppm}$ ,  $\text{Mg}(\text{HCO}_3)_2 = 14.6 \text{ ppm}$ ,  $\text{CaCl}_2 = 222 \text{ ppm}$ ,  $\text{HCl} = 36.5 \text{ ppm}$ ,  $\text{NaHCO}_3 = 16.8 \text{ ppm}$  (5)
- (ii) What is deformation? What is the role of defects in material deformation? How strength of a metal is improved by alloying. (5)

Or

- For metallic and ceramic materials explain the effect of structure and atomic bonding on its strength and ductility property.
- (iii) Addition polymerization produces higher molecular weight polymers in a shorter period of time than condensation polymerization. Justify. Write the reactions involved in free radical polymerization mechanism. (5)
  - (iv) Justify the selection of lubricant in internal combustion engine. Find the acid value of oil if on testing, one gm of oil requires 0.1 ml of 0.1 N KOH in titration. State whether the oil is suitable for lubrication or not. (5)

SC

- Q.3** *Attempt the following:*
- (i) Define Glass. List different raw materials used in manufacturing of Glass. Write composition & properties of typical Borosilicate glass. (5)
  - (ii) Draw the neat, labeled diagram of reverse osmosis. Write the reactions involved in the ion-exchange water softening process. (5)
  - (iii) Why thermoplastics are soluble in organic solvents but not thermosets. Write the repeating units, two characteristic properties and two uses of polymethyl methacrylate. (5)
  - (iv) What are the drawbacks of plain carbon steel? Why engineers need to use "alloy steels"? Write the % composition of any heat resistant steel. (5)
- Q.4** *Answer the following:*
- (i) A polystyrene sample consists of 30% by weight of polymer molecules of molecular weight 10,000 and 70% by weight of molecules with molecular weight 100,000. Calculate  $\bar{M}_n$ ,  $\bar{M}_w$  and polydispersity index. Also calculate the number average degree of polymerisation (5)
  - (ii) An oil sample under test has a saybolt universal viscosity of 65 seconds at 210 °F and 565 seconds at 100 °F. The low viscosity Standard (gulf oil) possesses saybolt universal viscosity 65 seconds at 210 °F and 775 seconds at 100 °F. The high viscosity standard (pennsylvanian oil) gave the saybolt universal viscosity of 65 seconds at 210 °F and 425 seconds at 100 °F. Calculate the viscosity index of the oil under test. Draw the viscosity temperature curves of the standard and test oil. (5)
  - (iii) 1 gm of CaCO<sub>3</sub> was dissolved in HCl and the solution was made up to 1000 ml with distilled water. 50 ml of the above solution required 45 ml of EDTA solution for titration. 50 ml of hard water sample required 25 ml of EDTA and after boiling and filtering required 15 ml of EDTA solution. Calculate carbonate and non-carbonate hardness in ppm, °Fr and °Cl units. (5)
  - (iv) Which crosslinking agent is used in Bakelite production and write its significance with the help of reactions involved in Bakelite production. State any two characteristics properties of Bakelite. (5)
- Q.5** *Compare any four of the following:* (4x5=20)
- (i) Electro dialysis & Reverse osmosis
  - (ii) Isotactic & Atactic polymers.
  - (iii) Mechanical properties of Metals & Polymers
  - (iv) Semi solid and Liquid lubricant
  - (v) Scale formation & Priming in boilers



## VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra state]

Matunga, Mumbai-400019

SEMESTER EXAMINATION NOVEMBER 2014

DATE OF EXAM: 28/11/2014

SEMESTER & COURSE I SEM. FYBTECH

TIME ALLOWED 3 HRS

SUBJECT(Code): Applied Chemistry-1 (CH0001\_T)

MAX MARKS : 100

Instructions:

1. All questions are compulsory.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary.
5. Illustrate your answers with neat sketches wherever necessary.  
(Atomic weights: H=1, C=12, N=14, O=16, Na=23, Mg=24, S=32, Cl=35.5, Ca=40, Al=27, Fe=56)

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- (iii) Explain the extreme pressure lubrication mechanism with suitable examples.
- (iv) Polyethylene is crystalline but polystyrene is amorphous. Justify. Write the repeating units and properties of PVC.
- (v) What types of bonding would be expected for each of the following materials: Brass, Rubber, Carborundum (SiC) & Bricks?
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Q.2 *Answer the following:*

- (i) Calculate the amount of lime (85% pure) and soda (95% pure) required to soften one million litres of water which contains,  $\text{Ca}(\text{HCO}_3)_2 = 324 \text{ ppm}$ ,  $\text{Mg}(\text{HCO}_3)_2 = 14.6 \text{ ppm}$ ,  $\text{CaCl}_2 = 222 \text{ ppm}$ ,  $\text{HCl} = 36.5 \text{ ppm}$ ,  $\text{NaHCO}_3 = 16.8 \text{ ppm}$  (5)
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Or

For metallic and ceramic materials explain the effect of structure and atomic bonding on its strength and ductility property.

- (iii) Addition polymerization produces higher molecular weight polymers in a shorter period of time than condensation polymerization. Justify. Write the reactions involved in free radical polymerization mechanism. (5)
- (iv) Justify the selection of lubricant in internal combustion engine. Find the acid value of oil if on testing, one gm of oil requires 0.1 ml of 0.1 N KOH in titration. State whether the oil is suitable for lubrication or not. (5)

SC

- Q.3 *Attempt the following:*
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  - (ii) An oil sample under test has a saybolt universal viscosity of 65 seconds at 210 °F and 565 seconds at 100 °F. The low viscosity standard (gulf oil) possesses saybolt universal viscosity 65 seconds at 210 °F and 775 seconds at 100 °F. The high viscosity standard (pennsylvanian oil) gave the saybolt universal viscosity of 65 seconds at 210 °F and 425 seconds at 100 °F. Calculate the viscosity index of the oil under test. Draw the viscosity temperature curves of the standard and test oil. (5)
  - (iii) 1 gm of CaCO<sub>3</sub> was dissolved in HCl and the solution was made up to 1000 ml with distilled water. 50 ml of the above solution required 45 ml of EDTA solution for titration. 50 ml of hard water sample required 25 ml of EDTA and after boiling and filtering required 15 ml of EDTA solution. Calculate carbonate and non-carbonate hardness in ppm, °Fr and °Cl units. (5)
  - (iv) Which crosslinking agent is used in Bakelite production and write its significance with the help of reactions involved in Bakelite production. State any two characteristics properties of Bakelite. (5)
- Q.5 *Compare any four of the following:*
- (i) Electro dialysis & Reverse osmosis (4x5=20)
  - (ii) Isotactic & Atactic polymers.
  - (iii) Mechanical properties of Metals & Polymers
  - (iv) Semi solid and Liquid lubricant
  - (v) Scale formation & Priming in boilers



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

SEMESTER EXAMINATION      *December 2010*      DATE OF EXAM    *20-12-2010*  
SEMESTER & PROGRAM      *F.Y.B tech. I sem*      TIME    *2 p.m. - 5 p.m.*  
TIME ALLOWED                *3 HRS.*      MARKS      *100*  
COURSE (CourseCode) :      *APPLIED CHEMISTRY-I*

- Instructions
1. All questions carry equal marks.
  2. Figures to the right indicate full marks.

Atomic weights of elements: H=1, C=12, N=14, O=16, Na=23, Mg=24, S=32, Cl=35.5, Ca=40, Al=27

**Q 1.** *Attempt any ten questions:* (20)

- i) Write any two disadvantages of scale formation in boilers.
- ii) HDPE is used more widely in packaging industry but not LDPE. Justify.
- iii) Differentiate atomic and molecular spectroscopy.
- iv) State any two applications of biotechnology each in agriculture and medical sciences.
- v) Determine the multiplication factors of the following salts for converting into equivalents of  $\text{CaCO}_3$  (a)  $\text{MgCl}_2$  (b)  $\text{Al}_2(\text{SO}_4)_3$
- vi) Write the significance of viscosity index.
- vii) Define functionality of monomer. How does it affect the structure of polymer?
- viii) Write the advantages of detergents over soap.
- ix) Classify the composites based on matrix and the reinforcements.
- x) What are coagulants. Write two examples of coagulants used in lime soda process.
- xi) What are the advantages of bio-chips in bio-molecular computers.
- xii) State any four functions of lubricant.

- Q 2.**
- a) How is ethanol biosynthesized from starch? Write the role of following enzymes in industry a) amylase b) lipases (04)
  - b) Water sample on analysis gave the following data:  $\text{MgSO}_4=60 \text{ ppm}$ ,  $\text{Mg}(\text{HCO}_3)_2=73 \text{ ppm}$ ,  $\text{CaSO}_4=68 \text{ ppm}$ ,  $\text{CaCl}_2=111 \text{ ppm}$ ,  $\text{NaCl}=58 \text{ ppm}$ . Calculate temporary, permanent and total hardness in ppm, °Fr and °Cl units. (05)
  - c) Describe the hot process of soap production. State the advantages and limitations of the hot process over the cold method. (05)
  - d) In addition polymerization very high molecular weight are obtained in a short period but in condensation reactions molecular weight raises slowly. Justify. Write the characteristics of chain-growth addition polymerization mechanism. (06)

- Q 3.**
- a) What are zeolites? With the help of the diagram and the reactions explain the softening and regenerating cycle of zeolite method of water treatment process. (06)
  - b) Write briefly the ascending chromatography and state any two (04)

- Date \_\_\_\_\_  
Page No. \_\_\_\_\_
- c) applications of infrared (IR) spectroscopy. (04)
- c) Differentiate the following properties of lubricant:
- (i) Cloud and pour point.
  - (ii) Saponification and acid value.
- d) Write with suitable examples the effect of (i) structure and (ii) symmetry on the crystallinity of polymer. (06)
- Q 4. a) Write the reactions of Bakelite production. State the properties and applications of phenolic resins. (06)
- b) Graphite are used as lubricants. Justify this by its structure. Write two advantages and two limitations of solid lubricant over liquid lubricants. (04)
- c) Write the reactions based on which alkalinity of water is determined. (05)
- A sample of water was alkaline both to phenolphthalein and methyl orange indicator. 50 ml of this water sample required 28 ml of N/50  $H_2SO_4$  for phenolphthalein end point and another 16 ml for complete neutralization. What type of alkalinity is present? Express the results in ppm. (05)
- d) Describe any three principles of green chemistry. Why this approach is necessary? Comment on that. (05)
- Q 5. a) Why lubrication is necessary? Write the lubricants used in watches, internal combustion engines and refrigeration plant. Justify your answer. (06)
- OR
- Explain the mechanism of extreme pressure lubrication. (06)
- b) Draw a neat labeled diagram of reverse osmosis unit and explain the process used for desalination of water. (08)
- c) Differentiate any two of the following:
- (i) Thermoplastics and thermosets.
  - (ii) Raw rubber and vulcanized rubber
  - (iii) Scales and sludges

2/2



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra state ]  
Matunga, Mumbai-400019

SEMESTER EXAMINATION (Re-exam)

DATE OF EXAM: 26/12/12

SEMESTER & COURSE

F.Y.B.Tech.I SEM

(9.30 - 12.30 pm)

TIME ALLOWED

3 HRS

MAX MARKS : 100

SUBJECT(Code):

APPLIED CHEMISTRY-I (CH0001)

**Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Assume suitable data if necessary.
4. Illustrate your answers with neat sketches.

Atomic weights of elements: H=1, C=12, N=14, O=16, Na=23, Mg=24, S=32, Cl=35.5, Ca=40

**Q.1** Answer any five the following

(20)

- (i) Define functionality and degree of polymerization. Determine the  $M_w$  of polypropylene if the weight average degree of polymerization is 10,000.
- (ii) Draw neat labeled diagram of redwood viscometer. Write the significances of saponification value of oil.
- (iii) A standard hard water contains 15 g  $\text{CaCO}_3$  per liter. 20 ml of this required 25 ml of EDTA solution. 100 ml of sample water required 18 ml EDTA solution. The sample after boiling required 12 ml EDTA solution. Calculate the temporary hardness of the water sample in all the units.
- (iv) How ethyl alcohol is manufactured from starch? State the steps involved in the biotechnological production.
- (v) How absorption spectra differ from emission spectra? Why molecular spectra is more complicated than atomic spectra?
- (vi) What are composites? Write the various fibers and matrixes used in composites. Write the advantages of them in various applications.

**Q.2** Answer the following

(20)

- (a) With the help of diagram explain the water softening by ion exchange process. How softening differ from demineralization of water? (6)
- (b) Write the saponification reaction. Explain the hot process for the production of soap. (5)
- (c) A water sample is alkaline to both phenolphthalein and methyl orange. 100 ml of this water required 30 ml of N/50  $\text{H}_2\text{SO}_4$  for phenolphthalein end point and another 20 ml for complete neutralization. Determine the type and extent of alkalinity present. Justify the answer. (4)
- (d) With the help of the diagram explain the various components of double beam spectrophotometer. (5)

- Q.3 Answer the following (20)
- (a) Explain how the green chemistry principles improves the synthesis of chemical products. (5)
  - (b) HDPE is more widely used as packaging film as compared to LDPE. Justify. Write the repeating unit and two characteristic properties of PMMA. (5)
  - (c) Describe with the help of diagram the components and working of biosensors (5)
- Or
- What are biofertilizers? Give two applications and two advantages of them.
- (d) How crystallinity affect the properties of polymer? Write about the crystallinity of polymers. (5)
- Q.4 Answer the following (20)
- (a) With the help of reactions explain the chain growth mechanism of addition polymers. (5)
  - (b) Write the reactions and calculate the amount of lime and soda required for softening one million liters of water containing:  $H^+$ (free acidity) = 1.5 ppm;  $HCO_3^-$  = 396.5 ppm;  $Mg^{+2}$  = 42 ppm,  $Ca^{+2}$  = 90 ppm;  $FeSO_4 \cdot 7H_2O$  = 14 ppm. The purity of lime is 91% and that of soda is 97.2%. (6)
  - (c) How greases are manufactured? Write the advantages and limitations of these lubricant over liquid lubricant. (4)
  - (d) Explain with the help of reactions the production of Bakelite. What are its characteristic properties? (5)
- Or
- Write the repeating units of natural rubber. State any two drawbacks of raw rubber? Explain how vulcanization improves its properties.
- Q.5 Differentiate the following (Any four) (20)
- (a) Addition and condensation polymers
  - (b) Isotactic and atactic polymers
  - (c) Zeolite and ion exchange process.
  - (d) Solid and liquid lubricant.
  - (e) Atomic and molecular spectra



# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra state |  
Matunga, Mumbai-400019]

SEMESTER EXAMINATION NOVEMBER 2015

SEMESTER & COURSE I SEM.FYBTECH

SUBJECT(Code): Applied Chemistry-I (GH001-T)

(CH101UT)

DATE OF EXAM: 28/10/2015

TIME ALLOWED 3 HRS

MAX MARKS : 100

Time : 9.30 -12.30 pm

Instructions:

1. All questions are compulsory.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary.
5. Illustrate your answers with neat sketches wherever necessary.

{Atomic weights:C = 12, O = 16, Ca = 40, Mg = 24, H = 1, Na = 23, Cl = 35.5, S = 32, Fe = 56}

Q.1 (a) Rewrite following statements by *filling in the blanks*. (10)

- i) Plastic used for making optical lenses is.....
  - ii) ..... in watches and.....in gears are used as lubricants.
  - iii) A good refractory in general should have .....porosity.
  - iv) As the temperature increases the solubility of calcium sulphate.....
  - v) ..... is a universal constituent of all heat resisting steels.
  - vi) .....is a bi functional and .....is a tri functional monomer.
  - vii) When the resistance to moving parts is only due to the internal resistance between the lubricant itself, lubrication is called.....
  - viii) Dissolved oxygen in boiler feed water is best removed by adding.....
  - ix) .....is the time dependent deformation of a material under load.
  - x) Molar mass of polypropylene is .....if the degree of polymerization is 4000
- (b) Answer the following in *short*. (10)
- i) Write the reaction of fatty acid soap with calcium permanent hardness of water.
  - ii) Iso tactic polymers are hard but atactic polymers are soft. Justify
  - iii) How the blended oils are superior to vegetable and animal oils.
  - iv) What is meant by the term 'structure' of a material? How is it significant?
  - v) Name the ferrous alloy which can't be welded and used for knives and saws for cutting tools. State any four advantages of Non-ferrous alloy

Q.2 Answer the following:

- (a) With help of reactions differentiate the free radical polymer chain growth termination mechanism by coupling and disproportion. What is plasticized PVC? State two of its applications. (6)
- (b) What do we mean by alloy steel? How can we make iron corrosion resistant? Write composition and uses of one such type of alloy. (4)
- (c) State two limitations of zeolite process and two advantages of ion exchange process. (5)

An exhausted Zeolite softener was regenerated by passing 200 L of 10 %NaCl solution. How many litres of hard water sample having hardness 400

ppm can be softened using this softener?

- (d) Explain the mechanism of extreme pressure lubrication. Draw the structure of  $\text{MoS}_2$  lubricant and how this works as lubricant. (5)

Q.3 *Attempt the following:*

- (a) A water sample contains following impurities:  $\text{Ca}^{+2} = 20 \text{ ppm}$ ,  $\text{MgCl}_2 = 95 \text{ ppm}$ ,  $\text{CO}_2 = 24 \text{ ppm}$ ,  $\text{HCO}_3^- = 183 \text{ ppm}$ ,  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O} = 13.9 \text{ ppm}$ ,  $\text{Fe}_2\text{O}_3 = 10 \text{ ppm}$ . Calculate all types of hardness and the amount of L and S required for treating 1 million litres of water. (6)
- (b) Define materials science and engineering. Explain with any two examples the reason for differences in properties of polymers and ceramics. (4)
- (c) How the crystallinity of polymer affected by the chain & geometrical symmetry. Prove this with one example for each. Write any two effects of crystallinity on property of polymers. (5)
- (d) What is refractory? Mention any four uses of refractories. Write any four characteristics of a good refractory. (5)

Q.4 *Answer the following:*

- (a) Write the different reaction steps involved in the production of Bakelite. Write the principle of Injection molding of thermoplastics. (6)
- (b) What are the steps involved in manufacturing of a glass? (4)
- (c) Draw a neat labeled diagram of Abel's flash point apparatus (5)  
Find the suitability of an oil as lubricant whose 5 mL required 2 mL of N/100 KOH during titration. (Density = 0.92 g/mL)
- (d) Give classification of ferrous alloys with % of carbon. What are the advantages and disadvantages of addition of carbon to iron? (5)

Q.5 *Answer the following:*

- (a) Why addition polymerization do produces polymer with very high molecular weight in a short period.  
For PVC there are 100 molecules of molecular weight 7,500, 200 molecules of molecular weight 12,500 and 300 molecules of molecular weight 17,500.  
Find  $\bar{M}_n$ ,  $\bar{M}_w$  and PDI and DP. (6)
- (b) What do you mean by plastic deformation? Explain how controlling grain size and alloying contribute to strength of materials. (4)

*Or*

What is meant by deformation and give its types? Why is the theoretical strength of metals much higher than that observed experimentally?

- (c) Discuss the necessity of making alloys with example? Write the composition & properties of the alloy used to make fire alarms. (5)
- (d) Draw a neat labeled diagram for demineralization process of water. (5)  
Calculate the hardness of water sample whose 20 mL required 30 mL and 20 mL of EDTA before and after boiling, 10 mL of  $\text{CaCl}_2$  solution whose strength is equivalent to 300 mg of  $\text{CaCO}_3$  per 200 mL required 20 mL of EDTA.



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra state |  
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*Re-exam.*

SEMESTER EXAMINATION NOVEMBER 2015

DATE OF EXAM: 31/12/2015

SEMESTER & COURSE I SEM.FYBTECH

TIME ALLOWED 3 HRS

SUBJECT(Code): Applied Chemistry-I (CH0001\_T)

MAX MARKS : 100

Instructions:

1. All questions are compulsory.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary.
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{Atomic weights: C = 12, O = 16, Ca = 40, Mg = 24, H = 1, Si = 28, Na = 23, Cl = 35.5, S = 32}

- Q.1 (a) Rewrite following statements by *filling in the blanks*. (10)  
i) ..... process can't be used to treat acidic hard water.  
ii) Elasticity of the vulcanized rubber .....with increase in % S content.  
iii) .....refractory can't be used with alkaline product.  
iv) Oiliness in mineral oil can be improved by adding.....  
v) Duralumin used in aircraft industry is in .....form.  
vi) .....is a di functional and .....is tri functional monomer.  
vii) ..... lubricant used in the machine working intermittently.  
viii) Molar mass of polypropylene is .....if the degree of polymerization is 4000  
ix) .....is a measure of degree of plastic deformation before fracture.  
x) The residual .....in boiler feed water causes caustic embrittlement.  
(b) Answer the following in short. (10)  
i) Justify the selection of suitable lubricant in refrigeration system.  
ii) Rubber becomes stiff while stretching. Justify this observation.  
iii) Name the boiler problem which can be minimized by the addition of hydrazine. Write the reaction of hydrazine in this case.  
iv) Define the following terms: 1) Nucleation, 2) Edge dislocation  
v) State any 4 advantages of Non ferrous alloy
- Q.2 Answer the following:  
(a) With help of reactions differentiate the free radical polymer chain growth termination mechanism by coupling and disproportion. Write any two properties and two applications of PMMA. (6)  
(b) What do we mean by alloy steel? How can we make iron heat resistant? Write composition and uses of one such type of alloy. (4)  
(c) Draw a neat labeled diagram of demineralization process of water. An exhausted Zeolite softener was regenerated by passing 200 L of 15 % NaCl solution. How many litres of hard water sample having hardness 400 ppm can be softened using this softener? (5)

- (d) With the help of lubricants explain the mechanism of extreme pressure lubrication. (5)

Q.3 *Attempt the following:*

- (a) A water sample contains following impurities:  $\text{Ca}^{2+} = 80 \text{ ppm}$ ,  $\text{MgCl}_2 = 95 \text{ ppm}$ ,  $\text{CO}_2 = 24 \text{ ppm}$ ,  $\text{HCO}_3^- = 183 \text{ ppm}$ ,  $\text{SO}_4^{2-} = 15 \text{ ppm}$ ,  $\text{SiO}_2 = 10 \text{ ppm}$ . Calculate all types of hardness and the amount of L and S required for treating 1 million litres of water. (6)
- (b) Define materials science and engineering. Explain with any two examples the reason for differences in properties of metals and ceramics. (4)
- (c) With help of diagram explain glass transition temperature. With the help of one example each write how the chain symmetry & chain branching affect crystallinity and the properties of polymer. (5)
- (d) What is refractory? Mention any four uses of refractories. Write any four characteristics of a good refractory. (5)

Q.4 *Answer the following:*

- (a) Write any two differences of LDPE and HDPE. Write the different reaction steps involved in the production of Bakelite. (6)
- (b) What are the steps involved in manufacturing of a glass? (4)
- (c) Draw a neat labeled diagram of redwood viscometer. (5)  
Find the suitability of an oil as lubricant whose 7 g required 0.04 mL of N/40 KOH for neutralization of fatty acids.
- (d) What are the purposes of making alloys? Write the composition & properties of the material used to make parts of high pressure steam plants & marine pumps. (5)

Q.5 *Answer the following:*

- (a) Draw the structure of natural rubber and state any two limitations of raw rubber and two advantages of vulcanized rubber. (6)  
For PVC there are 100 molecules of molecular weight 7,500, 200 molecules of molecular weight 12,500 and 300 molecules of molecular weight 17,500. Find  $\bar{M}_n$ ,  $\bar{M}_w$  and PDI and DP.
- (b) What is meant by deformation and give its types? Define strength of a material. Why is the theoretical strength of metals much higher than that observed experimentally? (4)

*Or*

- What do you mean by plastic deformation? Explain how controlling grain size and alloying contribute to strength of materials.
- (c) Give classification of ferrous alloys with % of carbon. What are the advantages and disadvantages of addition of carbon to iron? (5)
- (d) Draw a neat labeled reverse osmosis process diagram of water treatment. Calculate the hardness of water sample whose 20 mL required 20 mL and 15 mL of EDTA before and after boiling, 10 mL of  $\text{CaCl}_2$  solution whose strength is equivalent to 300 mg of  $\text{CaCO}_3$  per 200 mL required 20 mL of EDTA. (5)



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
**Matunga, Mumbai-400 019**

SEMESTER 2 Oct/Nov 2015 DATE OF EXAM 30/10/2015  
 EXAMINATION  
 SEMESTER & PROGRAM I & F.Y.B.Tech. TIME 9:30 - 12:30 pm.  
 TIME ALLOWED 3 HRS. MARKS 100  
 COURSE (Course Code) : Applied Physics-I( PH1011T)

**Instructions**

- 1 All questions carry equal marks.
- 2 Figures to the right indicate full marks.
- 3 Assume suitable data where ever necessary

- Q.1 a. Define Ligancy and show that critical radius ratio for ligancy 4 is 0.225 with neat diagram 5

b. Draw the following in the unit cell. Planes:  $(1\bar{2}\bar{1})$ ,  $(2\bar{2}1)$ ,  $(111)$  and directions:  $[011]$  and  $[121]$ . 5

c. Draw the unit cell diagrams of  $\text{BaTiO}_3$  before and after curie temperature and explain its structure 5

d. Discuss Laue method for crystal structure analysis with neat diagram. 5

Q.2 a. Draw and also give the lattice parameter relationships for cubic, hexagonal, tetragonal, rhombohedral, orthorhombic. 5

b.  $\text{RbCl}$  has simple cubic diatomic structure. Calculate its packing efficiency, lattice constant, and density. Given, ionic radii of  $\text{Rb}^+$  &  $\text{Cl}^-$  are  $1.48 \text{ \AA}$  &  $1.87 \text{ \AA}$  respectively. Atomic weights of  $\text{Rb}^+$  &  $\text{Cl}^-$  are  $85.47 \text{ amu}$  &  $35.45 \text{ amu}$  respectively 5

c. What is crystal imperfection? Explain edge and screw dislocation 5

d. Prove that the number of holes in valence band is given by  

$$P = N_V e^{-(E_F - E_V)/kT}$$
 5

Q.3 a. Describe the band structure of conductor at  $0\text{K}$  and at  $T > 0\text{K}$  with neat diagrams and define Fermi level and Fermi energy. 5

b. The band gap of silicon is  $1.1 \text{ eV}$ . Find the temperature at which the number of electrons in the conduction band of silicon are doubled over the number of electron in it at  $T = 300\text{K}$ .  $(k = 8.62 \times 10^{-5} \text{ eV/K})$  5

c. Discuss conductors, semiconductors and insulators on the basis of band theory of solids. 5

d. Calculate the cohesive energy of  $\text{NaCl}$  from the given data: The equilibrium separation of  $\text{Na}^+$  and  $\text{Cl}^-$  ion is  $0.281 \text{ nm}$ ,  $a = 1.748 \times 10^{-28} \text{ J-m}$ ,  $n = 9$ ,  $m = 1$ . 5

- Q.4 a. Derive the expression for equilibrium spacing of two atoms for which the potential energy is minimum. 5
- b. Derive the relation for total polarization 5
- c. Calculate the induced dipole moment per unit volume of helium gas if placed in the field of  $6 \times 10^5$  volts /m. The atomic polarizability of helium is  $0.18 \times 10^{-40}$  Fm<sup>2</sup> and the concentration of helium atoms is  $2.6 \times 10^{25}$  /m<sup>3</sup>. Also calculate the separation of positive and negative charges in each atom. 5
- d. What is electronic polarization? Derive Gauss's Law for the dielectric medium. 5
- Q.5 a. Explain the origin of ferromagnetism and explain ferromagnetic hysteresis on the basis of Weiss theory of domains. 5
- b. A magnetic material has magnetization  $3.15 \times 10^3$  A/m and flux density  $4.5 \times 10^{-3}$ . Calculate magnetizing force and relative permeability of the material. 5
- c. Discuss magnetic permeability, magnetization and magnetic susceptibility 5
- d. What is the significance of critical temperature, critical magnetic field and critical current density for superconductors? 5



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
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**Matunga, Mumbai-400 019**

SEMESTER EXAMINATION      **28 Oct/Nov 2015**      DATE OF EXAM **30/10/2015**  
SEMESTER & PROGRAM **I & F.Y.B.Tech.**      TIME **9:30 - 12:30 pm**  
TIME ALLOWED **3 HRS.**      MARKS **100**  
COURSE (Course Code) : **Applied Physics-I ( PH1011T )**

- Instructions
1. All questions carry equal marks.
  2. Figures to the right indicate full marks.
  3. Assume suitable data where ever necessary.

- Q.1 a. Define Ligancy and show that critical radius ratio for ligancy 4 is 0.225 with neat diagram      5  
b. Draw the following in the unit cell. Planes:  $(12\bar{1})$ ,  $(2\bar{2}1)$ ,  $(1\bar{1}1)$  and directions:  $[011]$  and  $[121]$ .      5  
c. Draw the unit cell diagrams of  $\text{BaTiO}_3$  before and after curie temperature and explain its structure      5  
d. Discuss Laue method for crystal structure analysis with neat diagram.      5
- Q.2 a. Draw and also give the lattice parameter relationships for cubic, hexagonal, tetragonal, rhombohedral, orthorhombic.      5  
b.  $\text{RbCl}$  has simple cubic diatomic structure. Calculate its packing efficiency, lattice constant, and density. Given, ionic radii of  $\text{Rb}^+$  &  $\text{Cl}^-$  are  $1.48 \text{ \AA}$  &  $1.87 \text{ \AA}$  respectively. Atomic weights of  $\text{Rb}^+$  &  $\text{Cl}^-$  are  $85.47 \text{ amu}$  &  $35.45 \text{ amu}$  respectively      5  
c. What is crystal imperfection? Explain edge and screw dislocation      5  
d. Prove that the number of holes in valence band is given by  
$$P = N_V e^{-(E_F - E_v)/kT} \quad 5$$
- Q.3 a. Describe the band structure of conductor at  $0\text{K}$  and at  $T > 0\text{K}$  with neat diagrams and define Fermi level and Fermi energy.      5  
b. The band gap of silicon is  $1.1 \text{ eV}$ . Find the temperature at which the number of electrons in the conduction band of silicon are doubled over the number of electron in it at  $T = 300\text{K}$ .      ( $k = 8.62 \times 10^{-5} \text{ eV/K}$ )      5  
c. Discuss conductors, semiconductors and insulators on the basis of band theory of solids.      5  
d. Calculate the cohesive energy of  $\text{NaCl}$  from the given data: The equilibrium separation of  $\text{Na}^+$  and  $\text{Cl}^-$  ion is  $0.281 \text{ nm}$ ,  $a = 1.748 \times 10^{-28} \text{ J-m}$ ,  $n = 9$ ,  $m = 1$ .      5

- Q.4 a. Derive the expression for equilibrium spacing of two atoms for which the potential energy is minimum. 5
- b. Derive the relation for total polarization 5
- c. Calculate the induced dipole moment per unit volume of helium gas if placed in the field of  $6 \times 10^5$  volts /m. The atomic polarizability of helium is  $0.18 \times 10^{-40}$  Fm<sup>2</sup> and the concentration of helium atoms is  $2.6 \times 10^{25}$  /m<sup>3</sup>. Also calculate the separation of positive and negative charges in each atom. 5
- d. What is electronic polarization? Derive Gauss's Law for the dielectric medium. 5
- Q.5 a. Explain the origin of ferromagnetism and explain ferromagnetic hysteresis on the basis of Weiss theory of domains. 5
- b. A magnetic material has magnetization  $3.15 \times 10^3$  A/m and flux density  $4.5 \times 10^{-3}$ . Calculate magnetizing force and relative permeability of the material. 5
- c. Discuss magnetic permeability, magnetization and magnetic susceptibility 5
- d. What is the significance of critical temperature, critical magnetic field and critical current density for superconductors? 5



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**Matunga, Mumbai-400 019**

|                         |                             |              |                 |
|-------------------------|-----------------------------|--------------|-----------------|
| SEMESTER<br>EXAMINATION | 28 Oct/Nov 2015             | DATE OF EXAM | 30/10/2015      |
| SEMESTER & PROGRAM      | I & F.Y.B.Tech.             | TIME         | 9:30 - 12:30 PM |
| TIME ALLOWED            | 3 HRS.                      | MARKS        | 100             |
| COURSE (Course Code)    | Applied Physics-I (PH1011T) |              |                 |

- Instructions
1. All questions carry equal marks.
  2. Figures to the right indicate full marks.
  3. Assume suitable data where ever necessary.

- Q.1 a. Define Ligancy and show that critical radius ratio for ligancy 4 is 0.225 with neat diagram 5
- b. Draw the following in the unit cell. Planes:  $(1\bar{2}\bar{1})$ ,  $(2\bar{2}1)$ ,  $(1\bar{1}1)$  and directions:  $[0\bar{1}1]$  and  $[1\bar{2}1]$ . 5
- c. Draw the unit cell diagrams of  $\text{BaTiO}_3$  before and after curie temperature and explain its structure 5
- d. Discuss Laue method for crystal structure analysis with neat diagram. 5
- Q.2 a. Draw and also give the lattice parameter relationships for cubic, hexagonal, tetragonal, rhombohedral, orthorhombic. 5
- b.  $\text{RbCl}$  has simple cubic diatomic structure. Calculate its packing efficiency, lattice constant, and density. Given, ionic radii of  $\text{Rb}^+$  &  $\text{Cl}^-$  are  $1.48 \text{ \AA}$  &  $1.87 \text{ \AA}$  respectively. Atomic weights of  $\text{Rb}^+$  &  $\text{Cl}^-$  are  $85.47 \text{ amu}$  &  $35.45 \text{ amu}$  respectively 5
- c. What is crystal imperfection? Explain edge and screw dislocation 5
- d. Prove that the number of holes in valence band is given by  
$$P = N_V e^{-(E_F - E_v)/kT}$$
 5
- Q.3 a. Describe the band structure of conductor at 0K and at  $T > 0\text{K}$  with neat diagrams and define Fermi level and Fermi energy. 5
- b. The band gap of silicon is 1.1 eV. Find the temperature at which the number of electrons in the conduction band of silicon are doubled over the number of electron in it at  $T = 300\text{K}$ .  $(k = 8.62 \times 10^{-5} \text{ eV/K})$  5
- c. Discuss conductors, semiconductors and insulators on the basis of band theory of solids. 5
- d. Calculate the cohesive energy of  $\text{NaCl}$  from the given data: The equilibrium separation of  $\text{Na}^+$  and  $\text{Cl}^-$  ion is  $0.281 \text{ nm}$ ,  $a = 1.748 \times 10^{-28} \text{ J-m}$ ,  $n = 9$ ,  $m = 1$ . 5

- Q.4 a. Derive the expression for equilibrium spacing of two atoms for which the potential energy is minimum. 5
- b. Derive the relation for total polarization 5
- c. Calculate the induced dipole moment per unit volume of helium gas if placed in the field of  $6 \times 10^5$  volts /m. The atomic polarizability of helium is  $0.18 \times 10^{-40}$  Fm<sup>2</sup> and the concentration of helium atoms is  $2.6 \times 10^{25}$  /m<sup>3</sup>. Also calculate the separation of positive and negative charges in each atom. 5
- d. What is electronic polarization? Derive Gauss's Law for the dielectric medium. 5
- Q.5 a. Explain the origin of ferromagnetism and explain ferromagnetic hysteresis on the basis of Weiss theory of domains. 5
- b. A magnetic material has magnetization  $3.15 \times 10^3$  A/m and flux density  $4.5 \times 10^{-3}$ . Calculate magnetizing force and relative permeability of the material. 5
- c. Discuss magnetic permeability, magnetization and magnetic susceptibility 5
- d. What is the significance of critical temperature, critical magnetic field and critical current density for superconductors? 5



VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

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Matunga, Mumbai-400 019

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SEMESTER

Oct/Nov 2015

DATE OF EXAM 01/01/2016

**SEMINAR FOR  
EXAMINATION**

## Re-examination 2015/16

18-21 Page

## **EXAMINATION SEMESTER & PROGRAM**

J.F.Y.B.Tech.

TIME 6

12.

**TIME ALLOWED**

3 HRS.

## MARKS

### **COURSE (Course Code)**

Applied Physics-I(PH1011T )

**Instructions** 1 All questions carry equal marks.

2. Figures to the right indicate full marks

3 Assume suitable data wherever necessary.

- Q.1 a. What is atomic packing factor? Prove that the packing efficiency of body centered cubic is 68 % 5

b. The radiation of wavelength 1.54 Å from x-ray tube is diffracted by a BCC of sodium crystal of atomic mass 22.99 amu and density  $0.97 \times 10^3 \text{ kg/m}^3$ . Calculate the glancing angle for first order diffraction from the principle plane (110) of the crystal 5

c. Describe cubic close packing (CCP) and Hexagonal close packing (HCP) structure. 5

d. Describe the rotating crystal method for crystal structure analysis. 5

Q.2 a. Define ligancy and determine the critical radius ratio for ligancy 3 and ligancy 8. 5

b. How to obtain miller Indices of Direction [uvw]? Write set of direction in the families of <100> and <110>. 5

c. Aluminum has FCC structure (monoatomic). Its lattice constant is 4.0 Å° Calculate its density and atomic radius. Given, atomic weight of Al = 26.98 amu and Avogadro's number is  $6.032 \times 10^{26} / \text{Kg-mole}$ . 5

d. Show in case of intrinsic semiconductors the Fermi level lies midway between the energy band gap i.e.  $E_f = \frac{E_g}{2}$  5

Q.3 a. Describe with energy band diagram how lithium and magnesium act as good conductors of electricity 5

b. The Fermi energy level for copper is 6.25 eV. Determine the temperature at which there is a 1% probability that an energy state 0.30 eV below the Fermi energy level will not contain an electron. 5

c. Prove that conductivity if intrinsic semi conductor is  $\sigma = \sigma_0 e^{-E_g/2kT}$  5

d. For the NaCl crystal, Madelung constant is 1.7476,  $n$  is 8 and equilibrium separation is 0.281nm. Calculate B and minimum potential energy per ion pair. If ionization energy of Na is 5.14 eV and electron affinity of the Cl is 3.61 eV, then calculate the bond energy. ( permittivity constant =  $8.854 \times 10^{12} \text{ C/Vm}$ ) 5

- Q.4 a. Describe ionic bonds in solids with suitable examples. 5  
b. Explain the variation of dielectric constant with the frequency of alternating field. 5  
c. What is dielectric loss? Derive the relation for loss tangent. 5  
d. A potential difference of 100V is applied across a parallel plate capacitor of plate separation of 1cm and then a dielectric slab of  $\epsilon_r = 7.0$  are inserted between the plates. Calculate E, D and P vectors. 5
- Q.5 a. What is Bohr Magneton? Find its value. Give the relation between i) Orbital magnetic moment and Bohr magneton and ii) Spin magnetic moment and Bohr magneton. 5  
b. Discuss Langevin's theory of Paramagnetism and obtain an expression for the magnetization 5  
c. A magnetic material has magnetization  $3.15 \times 10^3$  A/m and flux density  $4.5 \times 10^{-3}$ . Calculate magnetizing force and relative permeability of the material. 5  
d. Discuss the differences between type I and type II superconductors. 5



VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

Re-exam. Dec.  
SEMESTER EXAMINATION November 2012  
SEMESTER & PROGRAM I F.Y.B.Tech.  
TIME ALLOWED 3 HRS.  
COURSE (CourseCode) : Applied Physics-I(PH0001)

DATE OF EXAM 27/12/12  
~~23-11-2012~~  
TIME 9.30am-12.30pm  
MARKS 100

Instructions

1. All questions carry equal marks.
2. Figures to the right indicate full marks.
3. Assume suitable data where ever necessary.

- Q.1 a. The Bragg's angle for (220) reflection from nickel (FCC) is  $38.2^\circ$  in the first order when X-ray of wavelength  $1.54 \text{ \AA}$  are employed in diffraction experiment. Determine the lattice constant of nickel. 4
- b. Describe CCP and HCP lattice. 4
- c. In an intrinsic semiconductor the energy gap is  $0.4 \text{ eV}$ . Calculate the probability of occupation of the lowest level in conduction band at  $0^\circ\text{C}$ ,  $50^\circ\text{C}$  and  $100^\circ\text{C}$ . 4
- d. Define Superconductivity and distinguish between Type-I and Type-II Superconductors. 4
- e. Aluminium has FCC structure (monoatomic). Its density is  $2700 \text{ kg/m}^3$ . Calculate the lattice constant and diameter of aluminium atom. Given. Atomic weight of aluminium =  $26.98 \text{ amu}$ , Avogadro's no  $6.023 \times 10^{26}/\text{K. mole}$  4
- Q.2 a. What is polarization? Explain its types and derive the relation for total polarization. 5
- OR  
Explain Langevin's theory of paramagnetic materials and derive the equation for magnetization & curie constant. 5
- b. A dielectric material has  $\epsilon_r = 4.94$  &  $n^2 = 2.69$  where  $n$  is the index of refraction. Calculate the ratio between electronic & ionic polarizabilities for this material. 5
- c. Derive general expression for internal fields in a solid and write the same expression for a solid having cubic symmetry. 5
- d. With the help of diagrams, explain ferromagnetic hysteresis on the basis of Weiss theory of Domains. 5
- Q.3 a. A paramagnetic substance has  $10^{28} \text{ atoms/m}^3$ . The magnetic moment of each atom is  $1.8 \times 10^{-23} \text{ A.m}^2$ . Calculate the paramagnetic susceptibility at  $300\text{K}$ . What would be the dipole moment of a bar of this material  $0.1\text{m}$  long and  $1 \text{ sq.cm}$  area of cross section placed in a field of  $8 \times 10^4 \text{ A/m}$ . ( $k=1.38 \times 10^{-23} \text{ J/K}$ ) 5

- b. What is persistent current in superconductors? Calculate critical current density through a superconducting wire of aluminum of diameter  $10^{-3}$  m. The critical magnetic field for aluminum is  $7.9 \times 10^3$  A/m 5

- c. Draw the unit cell of diamond structure and describe it with respect to coordination number, atoms per unit cell, density and packing fraction. 5
- d. Define Ligancy and calculate Critical Radius Ratio for ligancy 8. 5

- Q.4 a. Calculate the distance between two adjacent atoms of a rocksalt (NaCl) crystal, packing fraction and its density. Given, atomic weight of  $\text{Na}^+ = 22.99$  amu, atomic weight of  $\text{Cl}^- = 35.45$  amu, and ionic radius of  $\text{Na}^+ = 0.98\text{\AA}$ , Ionic radius of  $\text{Cl}^- = 1.81\text{\AA}$  5

- b. i. Derive Bragg's Law of X-ray diffraction.  
ii. Silver has FCC structure and its atomic radius is  $1.414\text{\AA}$ . Find the spacing of the (220), (200) and (111) planes. 5

- c. Draw the following in the unit cell. Planes:  $(1 \bar{2} \bar{1})$ ,  $(1 \bar{3} 2)$ ,  $(1 \bar{1} 0)$ , directions:  $[0 \bar{1} 1]$ ,  $[121]$  5

- d. Define Fermi level, Fermi energy. Show that the Fermi function of conductor is symmetrical at  $T > 0\text{K}$ . 5

- Q.5 a. Derive the expression:

$$E_F = \frac{E_C + E_V}{2} + \frac{3}{4} kT \ln \left( \frac{m_h^*}{m_e^*} \right)$$

- b. Describe energy band structure of lithium and silicon with diagram 5
- c. Derive the expression for the equilibrium spacing of two atoms for which the potential energy is minimum 5
- d. Prove that the number of holes in valence band is given by 5

$$p = N_v e^{-(E_F - E_V)/KT}$$



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|                      |                           |              |                  |
|----------------------|---------------------------|--------------|------------------|
| SEMESTER EXAMINATION | Nov 2011                  | DATE OF EXAM | 30.11.11         |
| SEMESTER & PROGRAM   | I F.Y.B.Tech.Sem-I        | TIME         | 10.00 am-1.00 pm |
| TIME ALLOWED         | 3 HRS.                    | MARKS        | 100              |
| COURSE (CourseCode)  | Applied Physics-I(PH0001) |              |                  |

Instructions

1. All questions carry equal marks.
2. Figures to the right indicate full marks.
3. Assume suitable data where ever necessary.

- Q.1 a. Draw Miller planes for miller indices (101) and ( $\bar{1}\bar{1}\bar{1}$ ). Draw Miller directions for miller indices [112] and [221]. 04
- b. Calculate the angle of first-order diffraction maximum when thermal neutrons of kinetic energy = 0.02 eV undergo diffraction from a crystal plane (100). The Braggs spacing of crystal is 2.0 Å. 04
- c. Mass of neutron is 1.00898 amu,  $h = 6.63 \times 10^{-34}$  J-S. 04
- d. Define Lattice Parameter and explain how it is related to molecular weight. 04
- e. Diamagnetic  $Al_2O_3$  is subjected to an external magnetic field of  $10^5$  A/m. Evaluate magnetization and magnetic flux density in  $Al_2O_3$  given magnetic susceptibility of  $Al_2O_3 = 5 \times 10^{-5}$  S.I.Units 04
- Q.2 a. Derive the formula for Lorentz field in dielectrics and give the significance of internal field constant. 05
- OR
- b. With neat diagram, explain the frequency dependence of dielectric constant. 05
- c. State Curie's Law and Curie-Weiss Law of paramagnetic materials. The susceptibility of paramagnetic  $FeCl_3$  is  $3.7 \times 10^{-3}$  S.I.Unit at 27°C. What will be the relative permeability at 200 K and 500K. 05
- d. Explain Langvin's theory of Para magnetism. A field strength of 300A/m produces a magnetization of 4400A/m in a ferromagnetic material. What is the relative permeability of the material. 05
- Q.3 a. With the help of domain theory explain hysteresis loss. Also define Coercivity, retentivity and reluctance of ferromagnetic materials. 05
- b. Define dielectric loss and dielectric strength in dielectrics. Explain three important applications of Dielectrics. 05
- c. Explain the powder method to study crystal diffraction. 05
- OR
- D. Define London penetration depth. The London penetration depth of lead varies from 39.6nm to 173nm, if its temperature is changed from 3K to 7.1K. Determine the critical temperature of lead. 05
- E. What is the significance of critical temperature, critical magnetic field 05

- and critical current density for super conductors. Also explain the relation between them. 05
- d. Define Ligancy and calculate Critical Radius Ratio for ligancy 8. 05
- Q.4 a. The crystal structure of Copper is FCC mono atomic. Its density is 8.9gm/cm<sup>3</sup> and atomic weight 63.55. Calculate the lattice parameter of Copper and effective diameter of Copper atom. Given Avagadro Number =  $6.023 \times 10^{26}/\text{Kg.Mol}$ . 05
- b. Prove that the number of electrons in conduction band is given by 05
- $$n = N_c e^{-\frac{(E - E_f)}{kT}}$$
- c. Draw a neat diagram showing experimental setup of Hall effect, define 05  
Hall effect, hence show that the Hall coefficient is inversely proportional to the number of electrons per unit volume.
- d. Explain in detail the energy band structure of Lithium & Beryllium 05
- Q.5 a. Explain with diagram the crystal structure of simple cubic diatomic hence find an expression for its packing efficiency. Give examples. 05
- b. Explain ionic crystal bonding and Hydrogen bonded crystals. 05
- c. The potential energy function is expressed as 05

$$\Phi = -\alpha/r^6 + \beta/r^{12},$$

where  $\alpha$  &  $\beta$  are constants. Show that :

- (1) the intermolecular separation  $r_0$  for which the potential energy is minimum is given by  $(2\beta/\alpha)^{1/6}$ ,
- (2) the internuclear distance  $r_0$  for which the potential energy is zero is given by  $r_0 \times (2)^{-1/6}$ ,
- (3) the minimum potential energy is given by,  $\phi_0 = -\alpha^2/4\beta$ .

OR

Germanium belongs to DC structure. Atomic radius and weight of germanium is 1.22 Å and 72.59 amu respectively. Calculate its lattice constant and density.

- d. Derive Bragg's Law of X-ray diffraction and state its application. 05



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[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

SEMESTER EXAMINATION November 2012 DATE OF EXAM 23-11-2012  
SEMESTER & PROGRAM I F.T.B.Tech. TIME 9.30am-12.30pm  
TIME ALLOWED 3 HRS. MARKS 100  
COURSE (CourseCode) : Applied Physics-I(PH10001)

- Instructions:
1. All questions carry equal marks.
  2. Figures to the right indicate full marks.
  3. Assume suitable data where ever necessary.

- Q.1 a. Copper crystallizes in FCC structure. Its density is  $8.69 \text{ g/cm}^3$  and an atomic weight of 63.5 amu. Calculate the distance between two nearest copper atoms. The Avogadro's number is  $6.023 \times 10^{23} / \text{g-mole}$ . 4
- b. Distinguish between single crystals and polycrystalline materials. 4
- c. Describe ionic bonds in solids with suitable examples. 4
- d. Silicon belongs to DC lattice. Its density is  $2.33 \times 10^3 \text{ Kg/m}^3$  and atomic weight is 28.09 amu. Calculate lattice constant and atomic radius. 4
- e. Calculate the induced dipole moment per unit volume of helium gas if placed in the field of  $6 \times 10^5 \text{ V/m}$ . The atomic polarizability of helium is  $0.18 \times 10^{-40} \text{ F.m}^2$  and the concentration of helium atoms is  $2.6 \times 10^{25}/\text{m}^3$ . 4
- Q.2 a. Define susceptibility and explain dielectric strength; loss angle & loss tangent OR With neat diagram explain the behavior of dielectric in alternating electric field. 5
- b. The curie temperature of iron is 1043K. Assume each atom of iron has magnetic moments of 2 Bohr magneton. If the iron is BCC with lattice parameter 0.286nm, Calculate a) saturation magnetization and b) internal molecular field. 5
- c. Draw the hysteresis curve and explain coercivity, retentivity & hysteresis loss. 5
- d. Discuss the factors affecting superconductivity of the material. London penetration depth of Lead changes from 39.6nm to 173nm when temperature changes from 3K to 7.4K. Find critical temperature. 5
- Q.3 a. The molecular weight of a paramagnetic salt is 168.5 and its density is  $4370 \text{ Kg/m}^3$  at  $27^\circ\text{C}$ . Calculate its susceptibility and magnetization produced in it in a field of  $2 \times 10^5 \text{ A/m}$ . Assume that the contribution to paramagnetism is 2 Bohr magnetons per molecule. Avogadro No. =  $6.02 \times 10^{26}/\text{K.mole}$   $(k=1.38 \times 10^{-23} \text{ J/K})$  5

- J  
5
- b. The atomic weight and density of sulfur are 32 & 2.08 gm per cc respectively. The relative permittivity of sulfur is 3.8. If sulfur has cubical symmetry, find electronic polarizability of sulfur atom. 5
- c. Draw the neat diagram of Bragg's spectrometer and explain its construction and working. 5
- d. Define ligancy and critical radius ratio in ionic crystals. Show that critical radius ratio for ligancy 3 is 0.155. 5
- Q.4 a. Derive the expression for the interplaner spacing  $d_{hkl}$  for a set of  $(hkl)$  planes in the cubic lattices. 5
- b. Draw the following in the unit cell. Planes:  $(1 \bar{2} \bar{1})$ ,  $(\bar{1} \bar{3} 2)$ ,  $(100)$ ; directions:  $[0 \bar{1} 1]$ ,  $[121]$ . 5
- c. Magnesium oxide has FCC diatomic structure. Oxygen ions are at FCC position and magnesium ions occupy all octahedral voids. Calculate lattice constant, packing fraction, and density of  $MgO$  crystal.  
 Given: Radii of magnesium and oxygen ions are 0.78 Å and 1.32 Å respectively.  
 Atomic mass of magnesium and oxygen ions is 24.3 amu and 16 amu respectively. 5
- d. Derive the expression: 5
- $$E_F = \frac{E_C + E_V}{2} + \frac{3}{4} kT \ln \left( \frac{m_h^*}{m_e^*} \right)$$
- Hence show that  $E_F = E_G/2$ . 5
- Q.5 a. Prove that the number of electrons in conduction band of intrinsic semiconductor is given by  $n = N_C e^{-(E_C - E_F)/KT}$ . 5
- b. Explain covalent crystal bonding and Inert gas crystal. 5
- c. The energy of two particles in the field of each other at a separation  $r$  is given by,  
 $\Phi = -\alpha/r + \beta/r^2$ , where  $\alpha$  &  $\beta$  are constants. At what separation they will form a stable compound? 5
- d. Describe energy band structure of silicon with diagram. 5



VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE  
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SEMESTER EXAMINATION : November 2013  
SEMESTER & PROGRAM : I.F.Y.B.Tech.  
TIME ALLOWED : 3 HRS.  
COURSE (Course Code) : Applied Physics-I (FH0001)

DATE OF EXAM : 29/11/2013  
TIME : 9:30 + 12:30  
MARKS : 100

- Instructions : 1. All questions carry equal marks.  
2. Figures to the right indicate full marks.  
3. Assume suitable data wherever necessary.

- Q.1 a. Draw the following in a cubic unit cell (1 $\bar{2}1$ ), (203), [021], [1 $\bar{2}1$ ]. 4  
b. The Fermi energy level for copper is 6.25 eV. Determine the 4  
temperature at which there is a 1% probability that an energy state 0.30 eV below the Fermi energy level will not contain an electron. 4  
c. Calculate the distance between two adjacent atoms of NaCl crystal, its packing fraction and density. Given atomic weight of Na = 22.99 amu, Cl = 35.45 amu, ionic radius of Na = 0.98 $\text{\AA}$ , 4  
ionic radius of Cl = 1.81 $\text{\AA}$ . 4  
d. What is superconductivity? Explain Meissner Effect. State two 4  
applications of superconductivity. 4  
e. The value of Dielectric Constant ( $\epsilon_r$ ) for glass is 6.75 at frequencies 4  
 $10^9$  Hz. What mechanisms are contributing towards dielectric constant? What percentage may be attributed to ionic polarizability? Given refractive index of glass is 1.5. 4
- Q.2 a. Derive and explain Clausius Mosotti relation in dielectrics. 5  
OR  
What are direct piezoelectric effect and inverse piezoelectric effect? 5  
Explain their importance and applications. 5
- b. A coil of wire 0.20 m long and having 200 turns carries a current of 5  
10 A.  
(i) What is the magnitude of the magnetic field strength  $H$ ?  
(ii) Compute the flux density  $B$  if the coil is in a vacuum  
( $\mu_0 = 1.257 \times 10^{-6} \text{ H/m}$ ). 5  
(iii) Compute the flux density inside a bar of titanium that is positioned within the coil. The susceptibility for titanium is  $1.81 \times 10^{-4}$ . 5  
(iv) Compute the magnitude of the magnetization  $M$ . 5
- c. Explain the origin of ferromagnetism and explain ferromagnetic hysteresis on the basis of Weiss theory of domains. 5
- d. Explain briefly the BCS theory of superconductivity. 5
- Q.3 a. Distinguish between hard and soft magnetic materials. Give two examples of each. 5  
b. Explain construction and working of Bragg's spectrometer with neat diagram. 5

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OR

Explain X-ray diffraction by powder method and its analysis.

- C. (I) Explain what is meant by coordination number and atomic packing factor. 5  
(II) Derive the relationships between unit cell edge length and atomic radius for face-centered cubic and body-centered cubic crystal structures. 5
- d. Describe structure of zinc sulphide with neat diagram and derive formula for its packing efficiency. 5

- Q.4 a. Describe with diagram how band gap formation takes place in Silicon at room temperature with the help of band theory of solids. 5  
b. Prove that the number of holes in valence band is given by  $p = N_v e^{-(E_F - E_v)/kT}$ . 5  
c. The conductivity of pure Ge increases by 50 % when the temperature is increased from 20 °C to 30 °C. Calculate the energy gap in Ge from these data. 5  
d. Define Hall effect. Show that the Hall coefficient is inversely proportional to the number of electrons per unit volume. 5

- Q.5 a. Derive the expression for the interplaner spacing  $d_{hkl}$  for a set of  $(hkl)$  planes in the cubic lattices. 5  
b. Explain polar and Non-polar covalent bonds with suitable examples. 5  
c. Define Ligancy and determine the critical radius ratio for ligancy 4. 5

OR

- d. Polonium belongs to SC lattice at room temperature. Its density is  $9.36 \times 10^3$  Kg/m<sup>3</sup> and atomic weight is 210 amu. Calculate lattice constant  $a$ , atomic radius  $r$ , and atoms per unit volume. 5

- d. Assume that the energy of the two particles in the field of each other is given by 5.

$\phi = \frac{\lambda}{r^6} - \frac{\mu}{r}$  where  $\lambda$  and  $\mu$  are constants and  $r$  is the distance between the centers of the particles. Show that in the stable configuration, the energy of attraction is 8 times the energy of repulsion.



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|------------------------|--------------------------|--------------|---------------------------------|
| SEMESTER EXAMINATION   | <i>November 2014</i>     | DATE OF EXAM | <i>1<sup>st</sup> Dec. 2014</i> |
| SEMESTER & PROGRAM     | <i>I F.Y.B.Tech.</i>     | TIME         | <i>9.30-12.30</i>               |
| TIME ALLOWED           | <i>3 HRS.</i>            | MARKS        | <i>100</i>                      |
| COURSE (Course Code) : | <b>Applied Physics-I</b> |              |                                 |

**Instructions**

4. All questions carry equal marks.
5. Figures to the right indicate full marks.
6. Assume suitable data where ever necessary.

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|-----|--|-----------------------|
| Q.1 | <p>a. Draw the following in a cubic unit cell <math>(1\bar{2}3)</math>, <math>(220)</math>, <math>[\bar{2}\bar{2}1]</math>, <math>[102]</math>.</p> <p>b. In a semiconductor it is observed that three quarter of current is carried by electrons and one quarter by holes. If the drift speed of electrons is three times that of holes, determine the ratio of electrons to holes in semiconductor.</p> <p>c. Describe space lattice and unit cell.</p> <p>d. Distinguish between soft and hard magnetic materials.</p> <p>e. Write the equation for energy density <math>U_0</math> of capacitor with and without dielectrics. Derive the relation between free charge density <math>\sigma</math> and induced charge density <math>\sigma_p</math> on a dielectric introduced between the plates of a capacitor</p>  | 4<br>4<br>4<br>4<br>4 |
| Q.2 | <p>a. Derive the equation for electronic polarizability for a mono-atomic gas. Does its polarizability vary with the size of the atom.</p> <p style="text-align: center;">OR</p> <p>Explain a) Electrostriction b) Dielectric strength and c) Any two properties of ferroelectrics</p> <p>b. Explain origin of magnetic moments of atoms responsible for magnetic properties of materials. Classify magnetic materials and give two examples of each.</p> <p>c.</p> <ul style="list-style-type: none"> <li>I. Explain persistent current</li> <li>II. Effect of external magnetic fields on superconductor (with equation)</li> <li>III. If lead has London penetration depth <math>39.6 \text{ nm}</math> at <math>3^\circ\text{K}</math>. Find penetration depth at <math>0^\circ\text{K}</math> (<math>T_c = 7.2\text{K}</math>)</li> </ul> <p>d. For BCC ion the magnetic moment for atom is about 2 Bohr magneton. If Curie temperature is <math>1043^\circ\text{K}</math>, find value of internal molecular field. If lattice constant of BCC ion is <math>0.286\text{nm}</math>, find saturation magnetization (Boltzmann constant = <math>1.38 \times 10^{-23} \text{ J/K}</math>)</p> | 5<br>5<br>5<br>5      |

- 5
- Q.3 a. Derive and explain Clausius Mosotti equation in dielectrics. Rewrite the equation in terms of atomic weight, density, Avogadros number for the given element. 5  
b. Define Braggs law. Hence derive an expression for it. Give its applications.

OR

- c. Explain Laue method in crystal diffraction with neat diagram. 5  
d. Determine the percentage of ionic polarisability in the sodium chloride crystal which has the optical index of refraction and the static dielectric constants as 1.5 and 5.6, respectively. 5  
d. Describe structure of diamond with neat diagram and derive formula for its packing efficiency. 5
- Q.4 a. Describe with diagram how band gap formation takes place in Silicon at room temperature with the help of band theory of solids. 5  
b. Prove that the number of electrons in conduction band is given by  $n = Nce^{-(Ec-Ef)/kT}$  5  
c. Find the temperature at which there is 1% probability that a state with an energy 0.5 eV above Fermi energy will be occupied. 5  
d. Define Hall effect. Show that the Hall coefficient is inversely proportional to the number of electrons per unit volume. 5
- Q.5 a. Explain with diagram the structure of MgO FCC diatomic and show that its void space is 0.26. 5  
b. Explain ionic and hydrogen bonded crystals with suitable examples. 5  
c. Define Ligancy and determine the critical radius ratio for ligancy 4. 5

OR

- RbCl has simple cubic diatomic structure. Calculate its packing efficiency, lattice constant, and density. Given, ionic radii of  $\text{Rb}^+$  &  $\text{Cl}^-$  are  $1.48 \text{ \AA}$  &  $1.87 \text{ \AA}$  respectively. Atomic weights of  $\text{Rb}^+$  &  $\text{Cl}^-$  are 85.47amu & 35.45 amu respectively  
d. Compute the net potential energy of a simple  $\text{Na}^+ \text{Cl}^-$  ion pair. 5  
The equilibrium distance between the ion pairs is 0.28 nm. The potential energy due to repulsion between electrons is given by  $U_r = \beta / r^8$ . Given, force of attraction between ions is  $3.02 \times 10^{-9} \text{ N}$ .



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SEMESTER EXAMINATION *November 2010* DATE OF EXAM *22-12-2010*  
SEMESTER & PROGRAM *I FYBTECH* TIME *2 p.m. - 5 p.m.*  
TIME ALLOWED *3 HRS.* MARKS *100*  
COURSE (Course Code) : *APPLIED PHYSICS-I(PH0001)*

Instructions

1. All questions carry equal marks.
2. Figures to the right indicate full marks.
3. Assume suitable data where ever necessary.
4. Answers to all sub questions should be written together.

- Q.1 a. Draw planes for miller indices (231) and (123). 04  
b. Explain the formation of energy bands in Silicon. 04  
c. What is the concentration of holes in Silicon which is having a donor concentration  $1.4 \times 10^{24}/\text{m}^3$  and intrinsic concentration  $1.4 \times 10^{18}/\text{m}^3$ . Consider concentration of electrons equals to concentration of holes. Also find the ratio of electron concentration to the hole concentration. 04  
d. Explain the Statement ' Superconductor in a weak magnetic field acts as perfect diamagnetic material'. 04  
e. Argon gas contain  $2.6 \times 10^{25}$  atoms/m<sup>3</sup> at 0° C and 1 atm pressure. Calculate the di-electric constant of Argon gas at this temperature, if the diameter of the atom is 0.384nm. 04  
Q.2 a. Define Polarization. Also derive the relation between Gauss Law and di-electric. 05

OR

- Define di-electric susceptibility, Polarizability and relative permittivity. Also derive the relation between field vectors. 05  
b. The di-electric constant of He as measured at 0° C and 1atm pressure is 1.0000684. Under these conditions the gas contain  $2.7 \times 10^{25}$  atoms/m<sup>3</sup>. Calculate the radius of electron cloud(atomic radius). Also calculate the displacement 'x' when a He atom is subjected to a field of  $10^6 \text{V/m}$ . 05  
c. What is Hysteresis in ferro magnetic materials. With the help of Domain theory explain Hysteresis loop and also explain the nature of Hysteresis loop in Hard and Soft magnetic materials. 05  
d. State BCS theory of Superconductors and explain type I and type II superconductors. 05  
Q.3 a. Calculate the critical current density for 1mm diameter wire of Lead at 1) 4.2K and 2) 7.0 K. A parabolic dependence of  $H_c$  with T may be considered. Given  $T_c$  for Lead = 7.18K and  $H_0$  for Lead is  $6.5 \times 10^4$  amp/m. 05

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- b. Describe Zinc Blend structure and determine its packing efficiency. 05

OR

Explain the properties of Polar and Non-polar covalent crystals with example.

- c. An atom of Oxygen on being polarized produce dipole moment of  $0.5 \times 10^{-22}$  Coul.m. If the distance of centre of the negative charge cloud from the nucleus be  $4 \times 10^{-17}$ m. Calculate the Polarizability of the Oxygen atom. 05
- d. Draw neat diagram of Diamond structure and determine its packing efficiency. 05

- Q.4 a. Define Fermi level in semi conductors. With the diagram mention the location of Fermi level in intrinsic and extrinsic semi conductors. Prove that Fermi level in Intrinsic semi conductors lies exactly middle of forbidden energy gap. 05

- b. Discuss 1) the density of states in semi conductors and 2) Fermi- Dirac distribution function. 05
- c. Find the drift velocity of free electrons in a Copper wire whose cross-sectional area is  $1.0 \text{ mm}^2$ , when the wire carries a current of 1.0amp. Assume that each Copper atom contributes one electron to the electron gas. Given the number of electrons per unit volume is  $8.5 \times 10^{28} \text{ electrons/m}^3$ . 05

- d. Define space Lattice, Basis and Crystal structure. Derive Critical radius ration for ligancy 8. 05

- Q.5 a. Derive the relationship between inter planar spacing 'd' and cube edge 'a' in cubic crystals. Also obtain the relation between  $d_{100}$ ,  $d_{110}$  and  $d_{111}$  in the case of simple cubic lattice. 05

- b. Aluminum has FCC structure mono atomic. Its density is  $2700 \text{ kg/m}^3$ . Calculate the lattice constant and the diameter of aluminum atom. Given atomic weight of Aluminum = 26.98 and Avagadro Number =  $6.023 \times 10^{26}/\text{kg.mole}$ . 05

OR

Find the maximum radius of interstellar sphere that can just fit into the void formed in between two body centered atoms of bcc structure.

- c. With neat diagram explain the crystal structure of  $\text{BaTiO}_3$ . 05
- d. Explain cohesive energy of ionic crystals and Calculate the total potential energy per ion pair in the crystal. 05

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|                        |  |              |                     |
|------------------------|--|--------------|---------------------|
| Semester Examination   | End Semester Examination                                       | Date Of Exam | R. Exam<br>30/12/15 |
| Semester & Program     | I F.Y.B.Tech<br>(I.T./Comp/Extc/EI/Ec/Prod/Mech/Civil/Textile) | Time:        | 9:30 A.M– 12:30 Pm  |
| Time Allowed           | 3.0 Hrs.   | Marks:       | 100                 |
| Course (Course Code) : | Mathematics For Engineers – I (MA10011S)                       |              |                     |

- Instructions:**
1. All questions are compulsory and carry equal marks.
  2. Calculators (programmable or non programmable) are not allowed.
  3. Answers to individual question must be grouped and written together.
  4. Figures to the right indicate full marks.

**Q. No. 1 Attempt the following:**

- a) If  $u = \sin \frac{x}{y}$  and  $x = e^t$  and  $y = t^2$ , verify  $\frac{du}{dt} = \frac{\partial u}{\partial x} \cdot \frac{dx}{dt} + \frac{\partial u}{\partial y} \cdot \frac{dy}{dt}$  (4)
- b) Discuss the applicability of Rolle's theorem to find the function , (4)
- $$f(x) = \log \left( \frac{x^2 + ab}{x(a+b)} \right) \quad \text{in } [a, b], \quad a > 0, b > 0.$$
- c) Prove that:  $e^{ex} = e \left( 1 + x + x^2 + \frac{5x^3}{6} + \frac{5x^4}{8} + \dots \dots \dots \dots \dots \right)$  (4)
- d) Evaluate:  $\lim_{x \rightarrow 0} \frac{1}{x^2} - \cot^2 x.$  (4)
- e) Prove that real part of principal value  $(\sqrt{i})^{\sqrt{3}}$  is  $e^{-\frac{\pi}{4\sqrt{2}}} \left( \cos \left( \frac{\pi}{4\sqrt{2}} \right) \right)$  (4)

**Q. No. 2 Attempt the following:**

- a) i) Find the continued product of all the values of  $(1+i)^{\frac{1}{8}}$  is  $-(1+i).$  (6)
- ii) Prove that,  $\tanh(\log \sqrt{3}) = 0.5.$  (2)
- b) If  $y = \tan^{-1} \frac{x}{a}$  then prove that  $y_n = \frac{(-1)^{n-1}(n-1)! \sin n\theta \sin^n \theta}{a^n}$  where  $\theta = \tan^{-1} \frac{a}{x}.$  (6)
- c) Find the non singular matrix P and Q such that 'PAQ' is in the normal form where (6)

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \\ 3 & 0 & 5 & -10 \end{bmatrix}$$

Also find its rank.

**Q. No. 3 Attempt the following:**

- a) i) Show that the following vectors are linearly dependent (8)

$$X_1 = [1, 3, 5, 4], X_2 = [0, -2, -2, -2], X_3 = [-5, 1, -9, -4], X_4 = [6, 2, 14, 8]$$

$$\text{ii) Expand } 2x^3 + 3x^2 - 8x + 7 \text{ in terms of } x - 2. \quad (2)$$

- b) If  $z = f(x, y), x = e^u \cos v, y = e^u \sin v$ , prove that: (6)

$$\text{i) } x \frac{\partial z}{\partial v} + y \frac{\partial z}{\partial u} = e^{2u} \frac{\partial z}{\partial y} \quad \text{ii) } \left( \frac{\partial z}{\partial u} \right)^2 + \left( \frac{\partial z}{\partial v} \right)^2 = e^{2u} \left[ \left( \frac{\partial z}{\partial x} \right)^2 + \left( \frac{\partial z}{\partial y} \right)^2 \right]$$

- c) Express  $\tan 7\theta$  in terms of powers of  $\tan \theta$ . Hence, deduce that (6)

$$7\tan^6 \frac{\pi}{14} - 35\tan^4 \frac{\pi}{14} + 21\tan^2 \frac{\pi}{14} - 1 = 0.$$

**Q. No. 4 Attempt the following:**

- a) i) If  $u$  is homogenous function in  $x, y$  and  $z$  of degree  $n$ , then (6)

$$x^2 \frac{\partial^2 u}{\partial x^2} + y^2 \frac{\partial^2 u}{\partial y^2} + z^2 \frac{\partial^2 u}{\partial z^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + 2yz \frac{\partial^2 u}{\partial y \partial z} + 2zx \frac{\partial^2 u}{\partial z \partial x} = n(n-1)u.$$

- ii) Verify Euler's theorem on homogeneous function when (2)

$$f(x, y, z) = 3x^2yz + 5xy^2z + 4z^4.$$

- b) Test for consistency the following equations and if possible solve them (6)

$$4x - 2y + 6z = 8; \quad x + y - 3z = -1; \quad 15x - 3y + 9z = 21.$$

- c) Use  $n^{\text{th}}$  derivative of  $x^{2n}$  to show that: (6)

$$\frac{(2n)!}{(n!)^2} = \left[ 1 + \frac{n^2}{1^2} + \frac{n^2(n-1)^2}{1^2 \cdot 2^2} + \frac{n^2(n-1)^2(n-2)^2}{1^2 \cdot 2^2 \cdot 3^2} + \dots \right]$$

**Q. No. 5 Attempt the following:**

- a) i) Examine for minimum and maximum values  $\sin x + \sin y + \sin(x+y)$ . (4)

- ii) Find  $[(3.82)^2 + 2(2.1)^3]^{\frac{1}{5}}$  by using the theory of approximations. (4)

- b) If  $\cos \left( \frac{\pi}{4} + ia \right) \cdot \cosh \left( b + \frac{i\pi}{4} \right) = 1$  where  $a, b$  are real numbers, show that (6)

$$2b = \log(2 + \sqrt{3}).$$

- c) If  $z = \log(x^3 + y^3 - x^2y - xy^2)$ , then prove that: i)  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 3$  (6)

$$\text{ii) } \left( \frac{\partial}{\partial x} + \frac{\partial}{\partial y} \right)^2 u = \frac{-4}{(x+y)^2}.$$



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**SEMESTER EXAMINATION** End Semester Examination – N/W ~ 2015  
**SEMESTER & PROGRAM** I F.Y.B.Tech  
 (I.T./Comp/Extc/EI/Ec/Prod/Mech/Civil/Textile)  
**TIME ALLOWED** 3.0 HRS.  
**COURSE (Course Code) :** Mathematics For Engineers – I (MA10011S)

**DATE OF EXAM** : 26/11/2015  
**TIME:** 9:30 a.m– 12:30 pm

**MARKS:** 100

- Instruct ions:**
1. All questions are compulsory.
  2. Calculators (programmable or non programmable) are not allowed.
  3. Answers to individual question must be grouped and written together.
  4. All questions carry equal marks.
  5. Figures to the right indicate full marks.

**Q. No. 1 Attempt the following:**

- a) If  $u = xy^2 + x^2y$  where  $x = at^2$  and  $y = 2at$ , find  $\frac{du}{dt}$  & verify the result by direct substitution. (4)
- b) Using appropriate mean value theorem then Prove that if  $0 < a < b$ ,  

$$\frac{b-a}{1+b^2} < \tan^{-1}b - \tan^{-1}a < \frac{b-a}{1+a^2}$$
  
 And deduce that  $\frac{\pi}{4} + \frac{3}{25} < \tan^{-1}\frac{4}{5} < \frac{\pi}{4} + \frac{1}{6}$ . (4)
- c) Expand  $\frac{x}{e^x-1}$  upto  $x^4$ . Hence prove that no odd powers of  $x$  occur in the expansion in ascending powers of  $x$  of the function  $\frac{x}{2} \left( \frac{e^x+1}{e^x-1} \right)$ . (4)
- d) Evaluate  $\lim_{x \rightarrow 0} \frac{e^{1/x} + e^{2/x} + e^{3/x} + \dots + e^{x/x}}{x}$ . (4)
- e) Prove that the real part of principal value  $(1+i)^{2-3i}$  is  $2e^{\left(\frac{3\pi}{4}\right)} \cos\left(\frac{\pi}{2} - \frac{3}{2} \log 2\right)$ . (4)

**Q. No. 2 Attempt the following:**

- a) i) Show that all the roots of  $(x+1)^7 = (x-1)^7$  are given by  $\pm \cot\left(\frac{r\pi}{7}\right)$ ,  $r = 1, 2, 3$ . Why  $r \neq 0$ ? (6)
- ii) Prove that  $\cosh^2 x = 1 + \sinh^2 x$  and  $\operatorname{sech}^2 x = 1 - \tanh^2 x$  (2)
- b) If  $y = \sin px + \cos px$ , prove that  $y_n = p^n [1 + (-1)^n \sin 2px]^{\frac{1}{2}}$ . And also find  $y_8(\pi)$  where  $= \frac{1}{4}$ . (6)
- c) Find the non singular matrix P and Q such that 'PAQ' is in the normal form where (6)

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \\ 3 & 0 & 5 & -10 \end{bmatrix}.$$

Also find its rank.

**Q. No. 3 Attempt the following:**

- a) i) Show that the following vectors are linearly independent (8)

$$X_1 = [1, 2, -1, 0], X_2 = [1, 3, 1, 2], X_3 = [4, 2, 1, 0], X_4 = [6, 1, 0, 1].$$

ii) Expand  $2x^3 + 3x^2 - 8x + 7$  in terms of  $x - 2$ . (2)

- b) If  $x = u + v + w, y = uv + vw + wu, z = uvw$  and  $\varphi$  is a function of  $x, y$  and  $z$ , then prove that  $x \frac{\partial \varphi}{\partial x} + 2y \frac{\partial \varphi}{\partial y} + 3z \frac{\partial \varphi}{\partial z} = u \frac{\partial \varphi}{\partial u} + v \frac{\partial \varphi}{\partial v} + w \frac{\partial \varphi}{\partial w}$  (6)

- c) Express  $\tan 7\theta$  in terms of powers of  $\tan \theta$ . Hence deduce that (6)

$$7\tan^6 \frac{\pi}{14} - 35\tan^4 \frac{\pi}{14} + 21\tan^2 \frac{\pi}{14} - 1 = 0.$$

**Q. No. 4 Attempt the following:**

- a) i) If  $u$  is homogenous function in  $x, y$  and  $z$  of degree  $n$ , But  $H_n = f(u)$  then, prove that : (6)

$$x^2 \frac{\partial^2 u}{\partial x^2} + y^2 \frac{\partial^2 u}{\partial y^2} + z^2 \frac{\partial^2 u}{\partial z^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + 2yz \frac{\partial^2 u}{\partial y \partial z} + 2zx \frac{\partial^2 u}{\partial z \partial x} = G(u)[G'(u) - 1]$$

$$\text{Where } G(u) = n \frac{f(u)}{f'(u)}$$

ii) If  $(x, y) = \frac{1}{x^2} + \frac{1}{xy} + \frac{\log x - \log y}{x^2 + y^2}$ , prove that  $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} + 2f = 0$ . (2)

- b) Show that the equations  $x + 2y - z = 2, 3x + 8y + 2z = 10, 4x + 9y - z = 12$  are consistent and hence obtain the solution. (6)

- c) If  $y = \left(\frac{\log x}{x}\right)$ , Prove that  $y_n = \frac{(-1)^n n!}{x^{n+1}} \left\{ \log x - \left(1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}\right)\right\}$  (6)

**Q. No. 5 Attempt the following:**

- a) i) Find the maximum or minimum values of  $x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$ . (4)

ii) Find  $[(3.82)^2 + 2(2.1)^3]^{\frac{1}{5}}$  by using the theory of approximations. (4)

- b) If  $\tan\left(\frac{\pi}{4} + i\beta\right) = re^{i\theta}$  then prove that i)  $r = 1$ . (6)

$$\text{ii) } \tan\theta = \sinh 2\beta$$

$$\text{iii) } \tanh\beta = \tan \frac{\theta}{2}$$

- c) If  $x^x y^y z^z = c$ , show that:  $\frac{\partial^2 z}{\partial x^2} + 2xy \frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} = \frac{2(x^2 - 2)}{x(1 + \log x)}$  at (6)  
 $x = y = z$



# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

EXAMINATION ESE RE EXAM

SEMESTER & PROGRAM

I B.Tech

TIME ALLOWED

3 HRS.

COURSE CODE & COURSE: *Engineering Graphics*

DATE OF EXAM

5 Jun 2016

TIME

9:30 - 12:30 PM

MARKS

100

- Instructions
1. Neatness and labelling will carry marks.
  2. All questions are compulsory
  3. Assume suitable data if necessary

- Q.1 a. The FV of a straight line CD measures 50 mm and makes an angle 45° with the XY line. The point C is 10 mm above the HP and 20 mm in front of the VP. Draw the projections of line AB and determine its inclination with HP and VP. 10
- b. A rectangular plate ABCD 30 mm X 50 mm size has one of its shorter edge in the HP and surface of the plate is 30° inclined with HP. If TV of the longer edge of the plate is 45° inclined with the VP, then draw its projections. 10
- Q.2 a. A pentagonal prism has a base of side 30 mm is resting on one of its corner in the HP and axis 60 mm long is making an angle 45° with the HP. Then draw its projections. 10
- b. A right circular cone of base diameter 40 mm, axis height 50 mm has its base in the HP. It is cut by an auxiliary inclined plane which makes an angle 45° with the HP and passes through the point on the axis 20 mm below the apex. Draw the sectional TV, Sectional SV, FV and true shape of the section. 10
- Q.3 a. A square pyramid of 40 mm side of base and 65 mm height stands with its base in the HP. Its sides of the base are parallel to the VP. And Auxiliary inclined plane cuts the pyramid passing through a point on axis 30 mm from apex and inclined to HP at 45°. Draw the development of lateral surfaces of pyramid assuming apex is to be removed. 10
- b. For the objects shown in figure 2 draw the isometric drawing. 10
- Q.4 a. Figure 1 shows the pictorial view of an object. Draw the following 20  
a) FV  
b) TV  
c) RHSV
- Q.5 a. Figure 3 shows front view and side view. Draw the following 20  
a) Isometric view  
b) FV  
c) TV  
d) LHSV

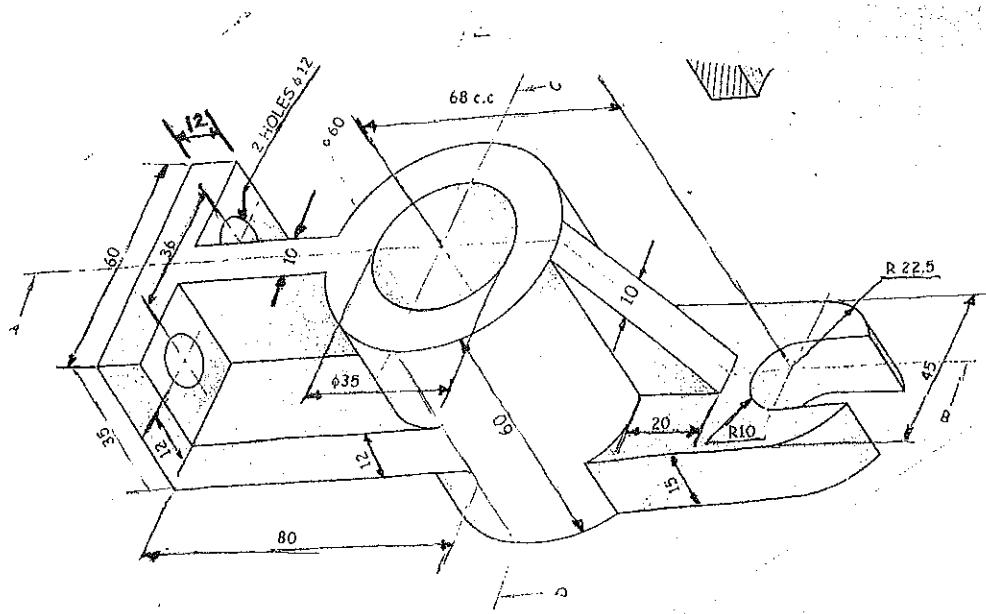


Figure 1

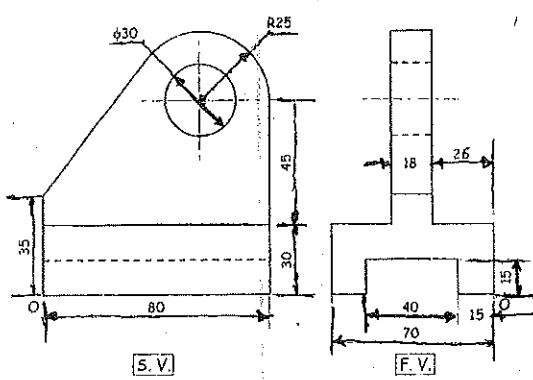


Figure 2

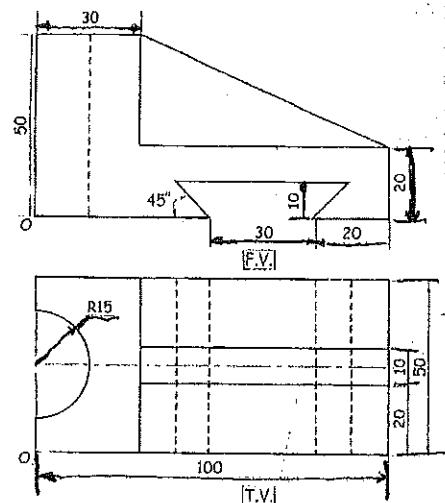


Figure 3



# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

EXAMINATION

BSR-NOV-2015

DATE OF EXAM

04/11/2015

SEMESTER & PROGRAM

I B.Tech

TIME

9:30 - 12:30 PM

TIME ALLOWED

3 HRS.

MARKS

100

COURSE CODE & COURSE: ME1001 Engineering Graphics

- Instructions
1. Neatness and labelling will carry marks.
  2. All questions are compulsory
  3. Assume suitable data if necessary

- Q.1 a. A FV and TV of line AB measures 50mm and 60mm respectively. A line is 10 mm long. A point A is 10mm above the HP and 20mm in front of VP. Draw the projections of line AB and determine its inclinations with the HP and VP. Assume the line to be in the first quadrant. 10
- b. A pentagonal plate of 25mm side has one of its side in the HP. Draw its projections if its surface is inclined at  $45^{\circ}$  to the HP and side in the HP is  $30^{\circ}$  inclined with the VP. 10
- Q.2 a. A cone of base diameter 50mm and axis 70mm long has its base in HP. Draw its projections if one of its generator is lying on HP. 10
- b. A hexagonal pyramid of 35 mm side of base and 65mm axis length rest on its base on the HP with one of its side of a base perpendicular to the VP. It is cut by the section plane which makes an angle  $30^{\circ}$  with VP and is 15 mm away from the axis of the pyramid. Draw the TV, sectional SV and true shape of a section. 10
- Q.3 a. A cylinder of base dia. 40mm and axis height 60mm has its axis perpendicular to HP and parallel to VP. It is cut by a cutting plane perpendicular to VP and inclined at  $60^{\circ}$  to HP, bisecting the axis of cylinder. Show the development of lateral surface of truncated cylinder. 10
- b. For the objects shown in figure 2 draw the isometric drawing. 10
- Q.4 a. Figure 1 shows the pictorial view of an object. Draw the following 20  
a) FV  
b) TV  
c) RHSV
- Q.5 a. Figure 3 shows front view and top view. Draw the following 20  
a) Isometric drawing  
b) FV  
c) TV  
d) LHSV

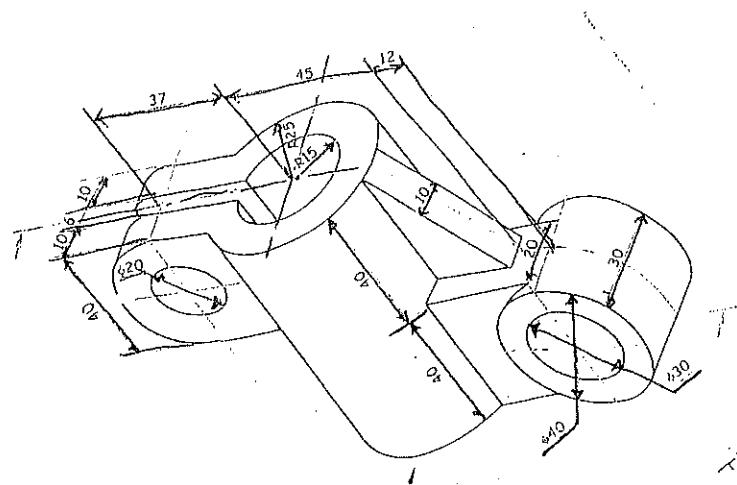


 Figure. 1

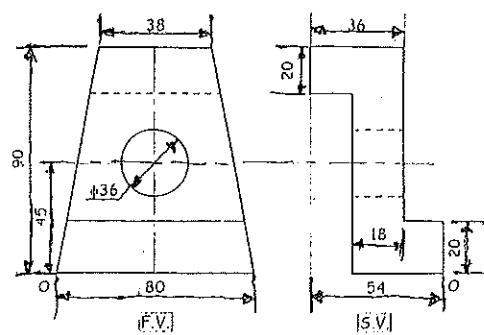
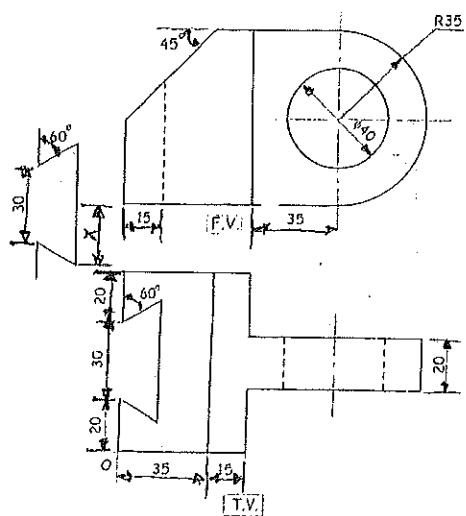


Figure 3

## Figure 2



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
**Matunga, Mumbai-400 019**

SEMESTER EXAMINATION      *28 NOV 2015*      DATE OF EXAM : *01/11/2015*  
SEMESTER & PROGRAM      *I FYB TECH*      TIME : *9:30-12:30 PM*  
TIME ALLOWED      *3.0 HRS.*      MARKS      *100*  
COURSE (Course Code) : *ELEMENTS OF MECHANICAL ENGINEERING*

- Instructions    1. All questions are compulsory.  
                  2. Figures to the right indicate full marks.

- |     |   |             |
|-----|---|-------------|
| Q.1 | a. (i) Explain types of fluids with the help of diagram.<br>(ii) Differentiate impulse and reaction turbine   | 2<br>2      |
|     | b. State with example second laws of thermodynamics: Kelvin-planks and Clausius statement.  | 4           |
|     | c. Write classification of heat exchangers and explain construction and working of shell and tube type of heat exchanger  | 8           |
| Q.2 | a. Explain construction and working of Francis turbine.<br>b. Write assumptions in air standard cycle and derive an expression for air standard efficiency of diesel cycle.<br>c. Explain construction and working of gas turbine with Brayton cycle and derive its thermal efficiency. | 6<br>6<br>6 |
| Q.3 | a. Write construction and working of refrigeration cycle.<br>b. Write construction and working of solar water heater.<br>c. (i)Write advantages and disadvantages of nonconventional energy sources.<br>(ii) Explain phenomenon of cavitation.  | 6<br>6<br>2 |
| Q.4 | a. Explain different types of gears with neat sketch and write their applications.<br>b. Explain construction and working of Lathe machine with neat sketch.  | 2<br>8      |
| Q.5 | a. Explain Metal inert gas welding with neat sketch.<br>b. Explain Oxy acetylene gas welding with neat sketch.  | 6<br>6      |
| Q.6 | a. Write down the purpose of clutch and explain in brief cone clutch with neat sketch.<br>b. Write down the types brake and explain Band brake in brief with neat sketch.<br>c. Explain the construction and working of Drilling machine with neat sketch.                              | 8<br>6<br>8 |

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## VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

SEMESTER EXAMINATION  
SEMESTER & PROGRAM  
TIME ALLOWED  
COURSE :

EB-NN-2015  
F. Y. B. Tech, Sem I  
3 HRS.  
*Elements of Civil Engineering* (CC 810015)

DATE OF EXAM : 06/11/2015  
TIME 09.30am - 12.30 pm  
MARKS 100

- Instructions 1. All questions are compulsory.  
2. Figures to the right indicate full marks.

|     |  |     |
|-----|--|-----|
| Q.1 | a. Define workability of concrete. Enumerate four factors affecting workability.   | 04- |
|     | b. Enlist the standard tests on Cement.  | 02  |
|     | c. Enumerate the ingredients of paints.  | 02  |
|     | d. Which are harmful ingredients in bricks?  | 02  |
|     | e. Draw neat labeled sketch of cross-section of road.  | 04  |
|     | f. Define town planning.   | 02  |
|     | g. What are the characteristics of ideal distempers?   | 02  |
|     | h. Define PCC & RCC.   | 02  |
| Q.2 | a. Explain the types of glass and types of plastics. Give their uses in civil engineering.   | 08  |
|     | b. Describe the classification of roads in India.  | 06  |
|     | c. Define following a) FSI b) TDR c) Foundation.   | 06  |
| Q.3 | a. Describe soundness test on cement.  | 08  |
|     | b. What are the qualities of a good brick? Mention the factor affecting quality of good bricks.  | 07  |
| Q.4 | a. Draw the conventional symbols for the following<br>i. North line ii. River iii. Railway line (single) iv. Building (katcha)<br>v. Boundary line vi. Wire fencing vii. Open well | 07  |
|     | b. Describe the functional classification of surveying.  | 08  |
| Q.5 | a. Draw a typical neat sketch of longitudinal section of a bridge showing its components. Write the functions of each component.   | 07  |
|     | b. What are the characteristics of first class and second class bricks? (4 for each)   | 08  |
| Q.6 | a. What is rehabilitation? Give the different reasons for rehabilitation & its effects.  | 08  |
|     | b. Describe the classification of buildings as per National Building Code.   | 07  |

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Matunga, Mumbai-400 019

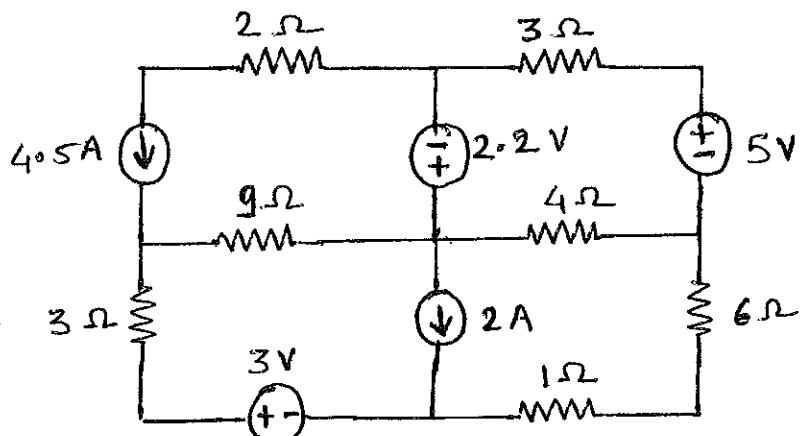
SEMESTER EXAMINATION      Oct-Nov 2015  
SEMESTER & PROGRAM      I - F.Y.B.Tech  
TIME ALLOWED      3 Hrs.  
COURSE (Course Code)      BEE (EE1001T)

DATE OF EXAM. : 06/11/2015  
TIME : 0.30 - 12.30 pm  
MARKS : 100

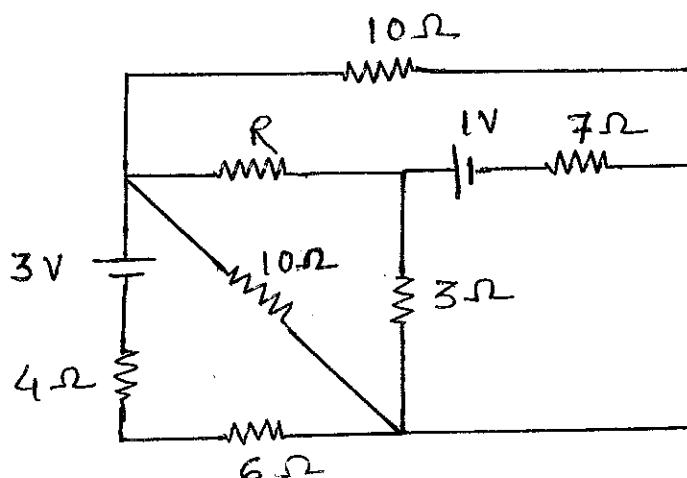
**Instructions:-**

- 1) All questions are compulsory.
- 2) All sub-questions of a given question should be grouped & written together.

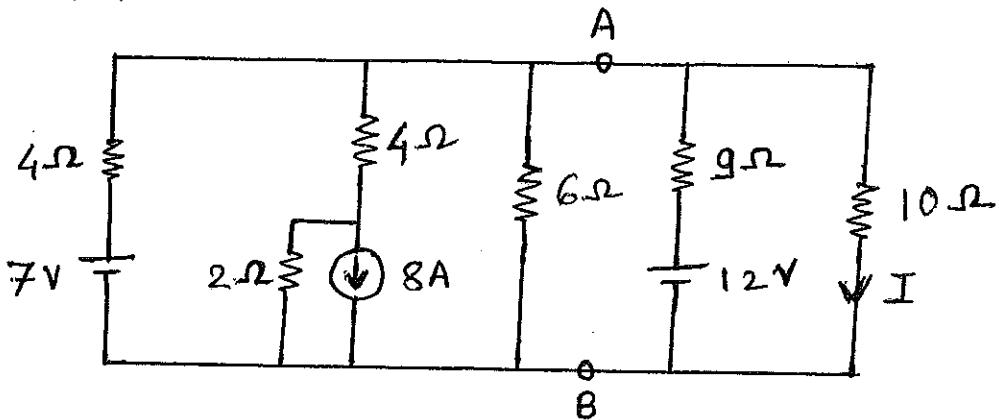
**Q.1** (a) The field coil of motor has a resistance of  $2.12\ \Omega$  at  $15^\circ\text{C}$ . By how much will the resistance increase, if the motor attains an average temperature of  $45^\circ\text{C}$ , when running. Take  $\alpha=0.004/\text{ }^\circ\text{C}$  referred to  $0^\circ\text{C}$ . 5  
(b) Find power supplied by  $2.2\text{V}$  source by using Nodal Analysis. 10



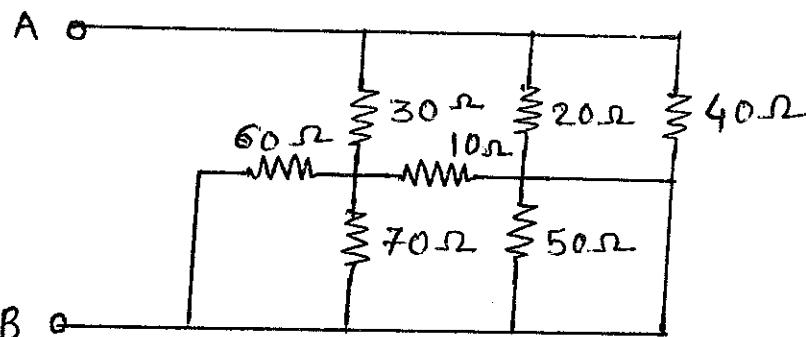
(c) Draw the block diagram of Thermal Power Plant 5  
**Q.2** (a) Derive the expression for maximum power transfer. Calculate the value of  $R$  that will absorb maximum power from the circuit. Also compute the value of maximum power. 10



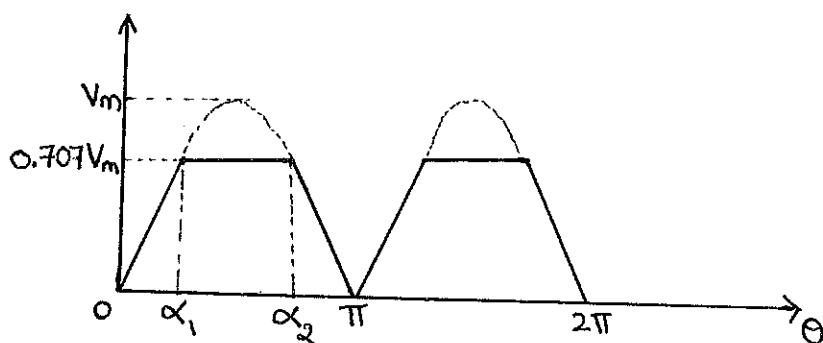
- (b) Find Norton's equivalent to the left of AB then find I by using superposition theorem. 5



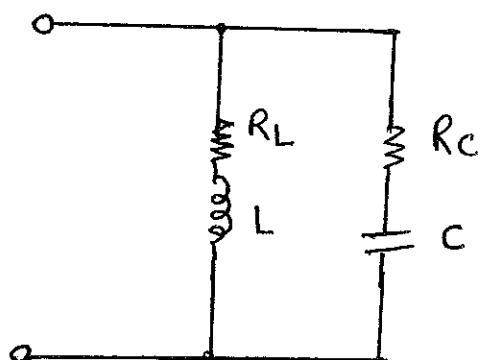
- (c) Find equivalent resistance between AB. 5



- Q.3 (a) Find form factor and peak factor of the following waveform. 5



- (b) Show that the network is resonant at all frequencies if  $R_L = R_C = \sqrt{L/C}$  5



(2)



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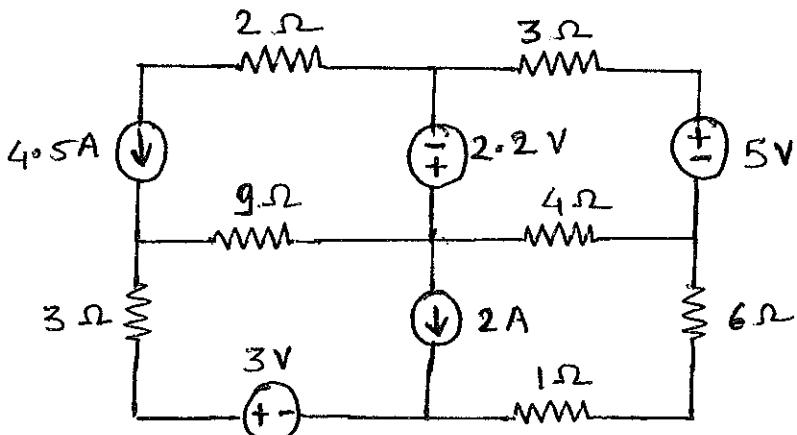
SEMESTER EXAMINATION      Oct-Nov2015  
SEMESTER & PROGRAM      I - F.Y.B.Tech  
TIME ALLOWED      3 Hrs.  
COURSE (Course Code)      BEE (EE1001T)

DATE OF EXAM. : 06/11/2015  
TIME : 0.30-12.30 pm  
MARKS : 100

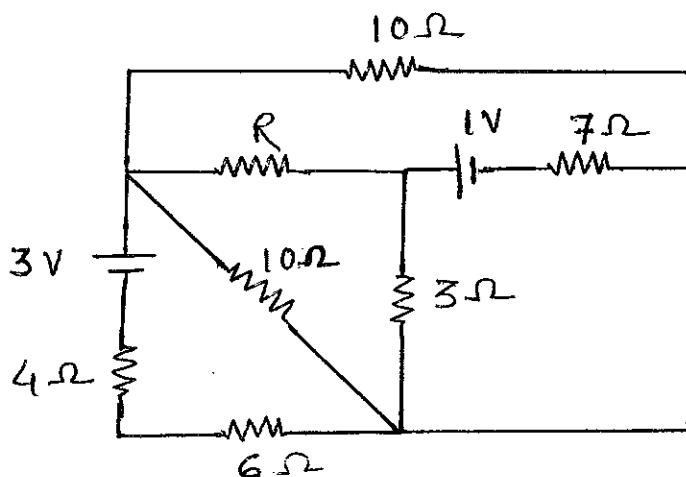
**Instructions:-**

- 1) All questions are compulsory.
- 2) All sub-questions of a given question should be grouped & written together.

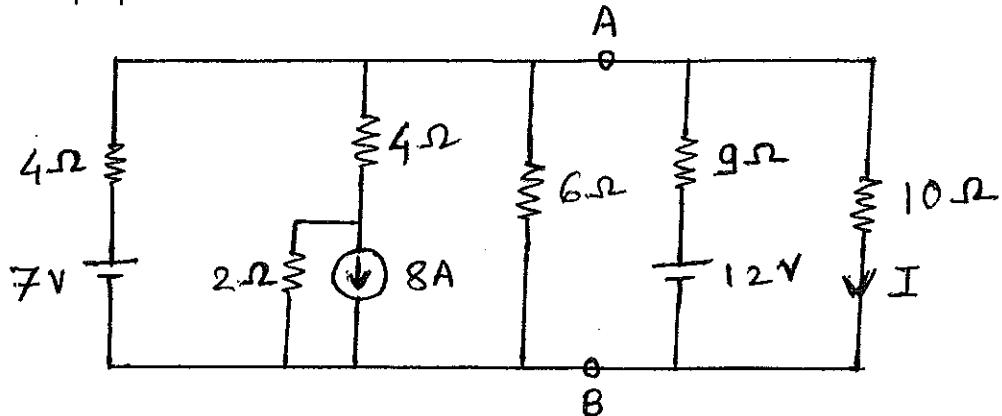
- Q.1** (a) The field coil of motor has a resistance of  $2.12\ \Omega$  at  $15^\circ\text{C}$ . By how much will the resistance increase, if the motor attains an average temperature of  $45^\circ\text{C}$ , when running. Take  $\alpha=0.004/\text{ }^\circ\text{C}$  referred to  $0^\circ\text{C}$ . 5  
(b) Find power supplied by  $2.2\text{V}$  source by using Nodal Analysis. 10



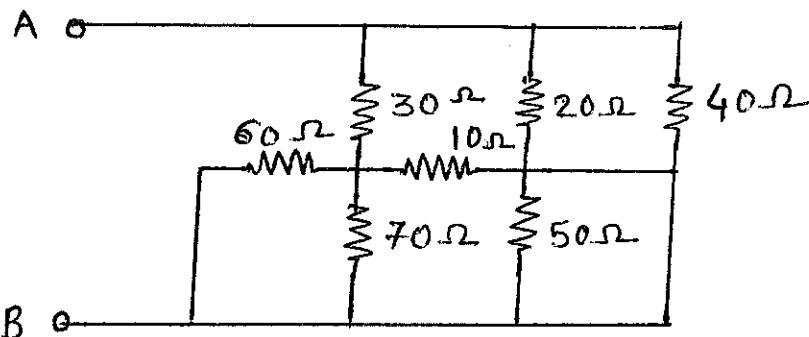
- (c) Draw the block diagram of Thermal Power Plant 5  
**Q.2** (a) Derive the expression for maximum power transfer. Calculate the value of  $R$  that will absorb maximum power from the circuit. Also compute the value of maximum power. 10



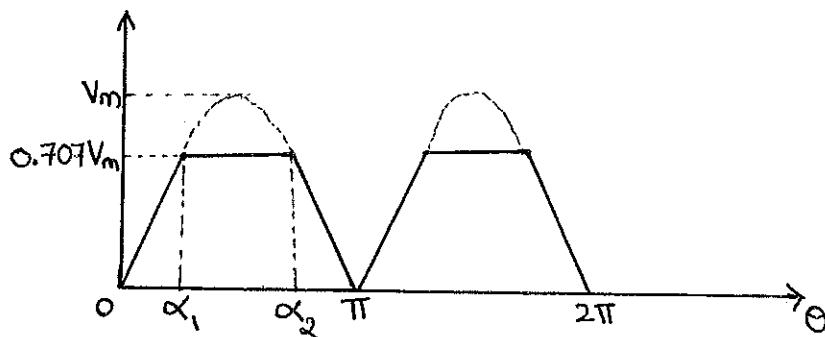
- (b) Find Norton's equivalent to the left of AB then find I by using superposition theorem. 5



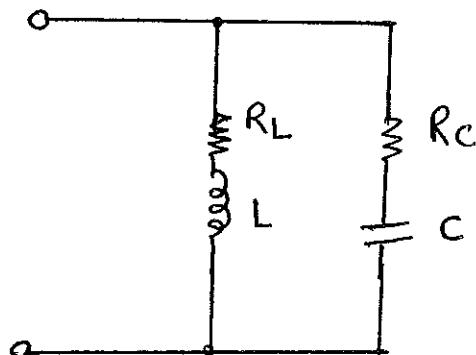
- (c) Find equivalent resistance between AB. 5



- Q.3 (a) Find form factor and peak factor of the following waveform. 5

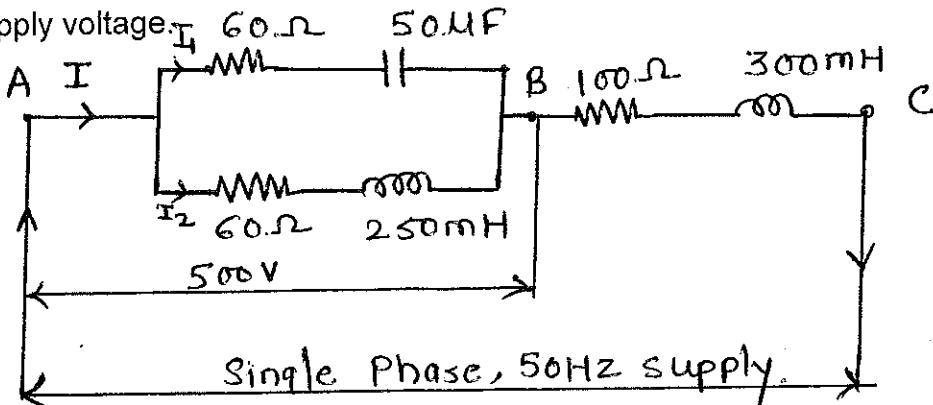


- (b) Show that the network is resonant at all frequencies if  $R_L = R_C = \sqrt{L/C}$  5



(2)

- (c) The voltage across the branch AB of the circuit shown in figure is 500V when the terminals A and C are connected to a single phase 50Hz supply. Determine the voltage between the points B and C and total supply voltage.



- Q.4** a) A Balance three phase star connected load of 150KW takes a leading current of 100A with a line voltage of 1100V, 50 Hz, find the circuit constants of the load per phase. Draw the phasor diagram. 8
- b) Derive the expression for line current, phase current and line voltage phase voltage for three phase star connected load. 6
- c) An iron ring of mean diameter 10cm and area of cross-section  $2.5 \text{ cm}^2$  has a saw cut of 2 mm in it .The ring is wound with a coil of 1000 turns and carrying a current of 0.1 A .Assuming the relative permeability of iron to be 800, determine the flux density in the air gap. 6
- Q.5** a) Explain the construction and the working of three phase induction motor. 8  
Explain how the rotating field is produced.
- b) Derive and prove the following relation for a 1- ph transformer 6  
 $E_1/E_2 = N_1/N_2 = I_2/I_1$
- c) Draw and explain the phasor diagram of practical transformer for Resistive, Inductive and Capacitive load. 6





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[Central Technological Institute, Maharashtra State]  
**Matunga, Mumbai-400 019**

SEMESTER EXAMINATION Re-Exam Dec-Jan 2015/16 DATE OF EXAM 04/01/2016  
SEMESTER & PROGRAM F.Y.B.Tech Sem - I TIME 0-30 am - 12-30 pm  
TIME ALLOWED 3.0 HRS. MARKS 100  
COURSE (Course Code) : ME10035

Instructions 1. All questions are compulsory.

- |     |   |             |
|-----|---|-------------|
| Q.1 | a. (i) Explain absolute and vacuum pressure.<br>(ii) Differentiate impulse and reaction turbine.  | 2<br>2      |
|     | b. Prove : Violation of Kelvin-Plank statement result in violation of Clausius statement.   | 4           |
|     | c. Write classification of heat exchangers and explain construction and working of shell and tube type of heat exchanger.   | 8           |
| Q.2 | a. Explain construction and working of Pelton wheel turbine.<br>b. Write assumptions in air standard cycle and derive an expression for air standard efficiency of diesel cycle.<br>c. Explain construction and working of steam power plant with Rankine cycle.                  | 6<br>6<br>6 |
| Q.3 | a. Write construction and working of centrifugal pump. Explain phenomenon of cavitation.<br>b. Write advantages and disadvantages of nonconventional energy sources and write construction and working of nuclear power plant.  | 8<br>8      |
| Q.4 | a. Write down different operations of the Lathe machine and explain any three of them with neat sketch.<br>b. Explain construction and working of principle of Shaping machine with neat sketch.  | 8<br>6      |
| Q.5 | a. Explain arc welding with neat sketch.<br>b. Explain Resistance welding with neat sketch.   | 6<br>6      |
| Q.6 | a. Write down the purpose of clutch and explain in brief Single plate clutch with neat sketch .<br>b. Write down the types brake and explain internal expanding brake in brief with neat sketch.<br>c. Explain the construction and working of Drilling machine with neat sketch. | 8<br>8<br>8 |

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# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(Central Technological Institute, Maharashtra State)

Matunga, Mumbai - 400 019.

## END SEMESTER EXAMINATION (Re-exam)

PROGRAM : F.Y.B.Tech. SEM-I(Elect., Tex., Prod., I.T.) DATE : 31/12/12  
SUBJECT : ENGINEERING GRAPHICS Theory Course TIME : 3 Hrs.  
MARKS : 100

### Instructions :

1. All questions are COMPULSORY
2. Retain all construction lines
3. Assume suitable data if necessary
4. Figures to the right indicate full marks.

**Q. 1a)** A line PQ has its end P 15mm above HP and 25mm in front of VP. The line makes an angle  $20^\circ$  with HP and it's top view measures 90mm. The end Q is in second quadrant and equidistant from both reference planes. Draw the projections of line and find inclination with the VP. (10)

**1b)** PQR is a triangular lamina in first quadrant as follows : (10)

- i) Corner P is on HP and 50mm in front of VP
- ii) Corners Q & R both are on VP.
- iii) FV of PR is inclined  $30^\circ$  to HP, 50mm long whereas TV of PQ is 57mm. Q is 65mm above HP. Draw the projections of lamina and find it's surface inclinations with both reference planes. Also find the trueshape of lamina.

**Q. 2** One of the longer edge of a pentagonal prism is inclined  $30^\circ$  to VP and rectangular face opposite to the longer edge is parallel to HP and nearer to HP. Draw the three views of prism in this position. Assume the base side 40mm and axis 85mm long. (20)

**Q. 3a)** A hexagonal pyramid 30mm side of base axis 70mm long has its base on HP with one edge of base parallel to VP. It is cut by plane whose VT is inclined  $60^\circ$  to XY line passing through the point on axis 30mm below the apex. Draw - F.V., Sect. T.V. and true shape of section. (12)

OR

**3a)** Draw Isometric view from Fig. 1 using 'O' as origin. (12)

**3b)** Fig. 2 shows TV of a pentagonal pyramid of height of axis 50mm long, with triangular hole P -- t -- r as shown. Draw the development of lateral surface of retained part 'Q' showing the positions of pts. p-q-r-s-t-u-v on it. (8)

**Q. 4** Draw the following views from Fig. 3 to the full scale .

- i) F.V. (6)
- ii) T.V. (6)
- iii) Sect. R.H.S. (P-Q) (6)

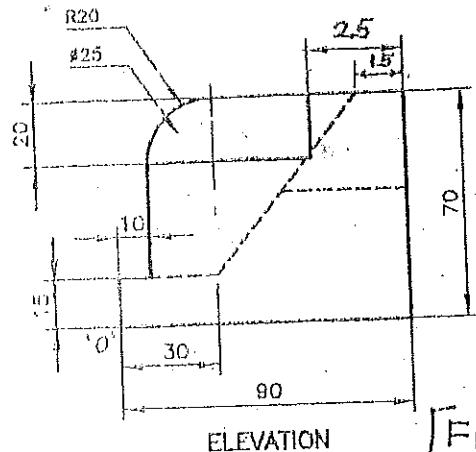
Insert 12 major dimensions (2)

**Q. 5** Draw the following views from Fig. 4 to the full scale .

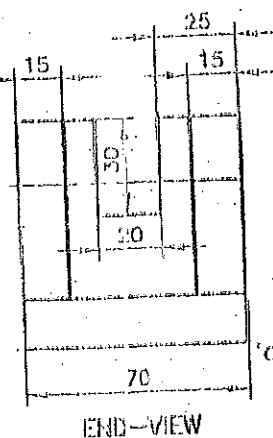
- i) Secl. F.V. (A-A) (6)
- ii) L.T.V. (6)
- iii) L.H.S.V. (6)

Insert 12 major dimensions (2)

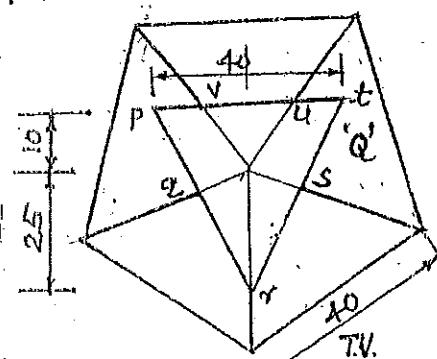
8



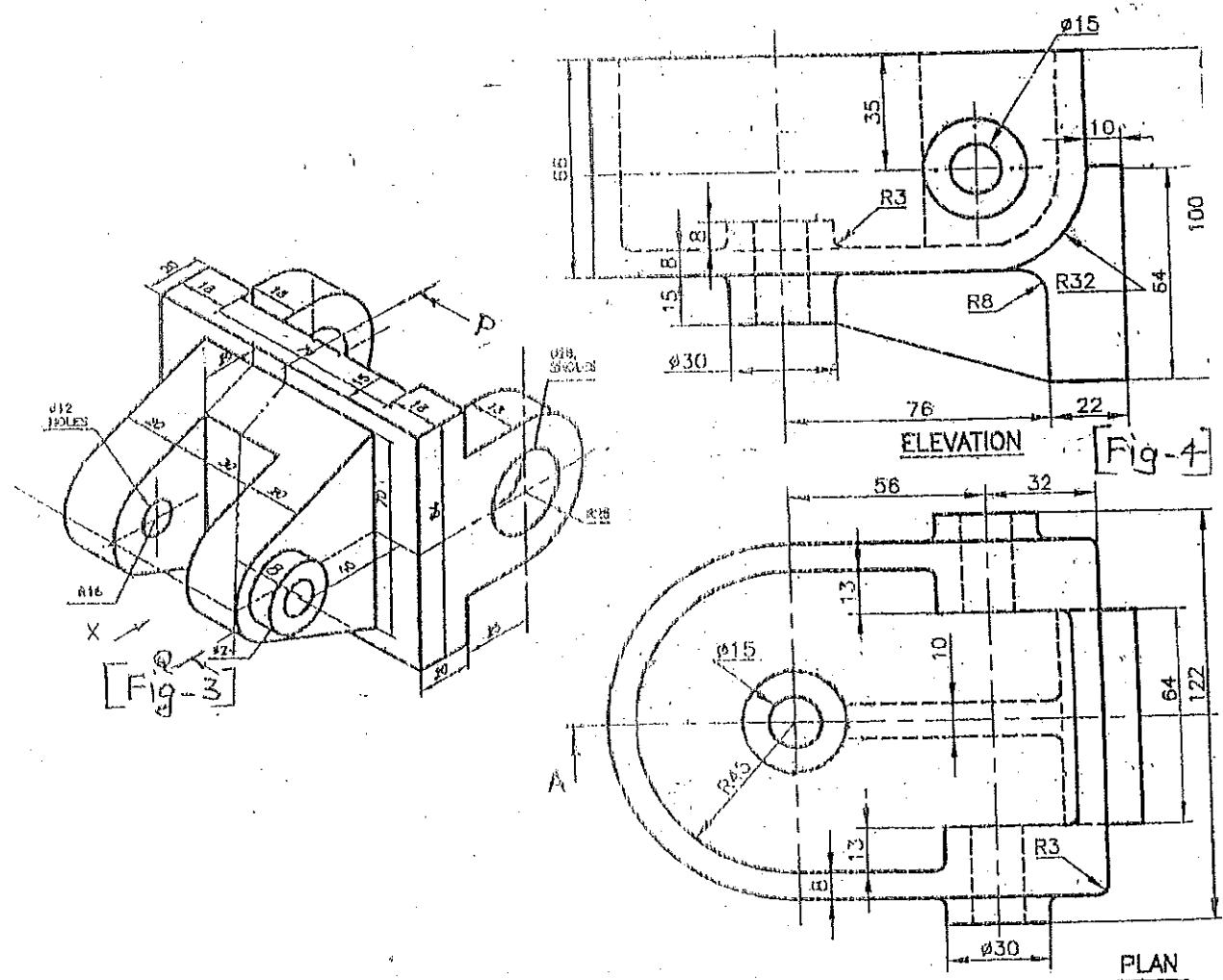
[Fig-1]



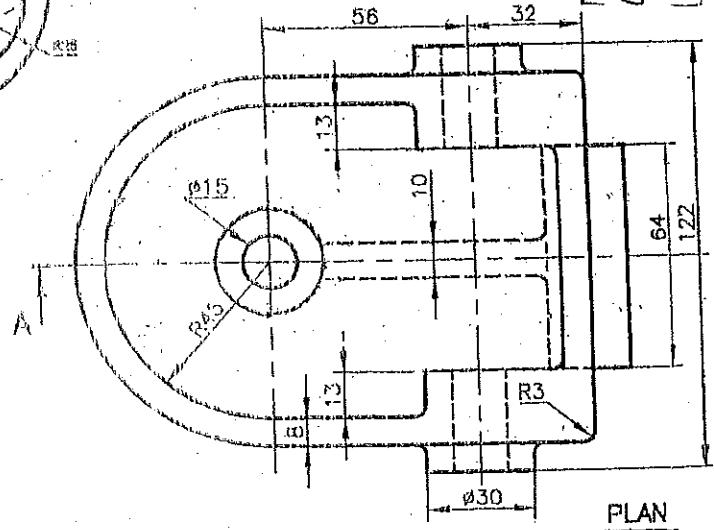
END-VIEW



[Fig-2]



[Fig-3]



PLAN



# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

## END SEMESTER EXAMINATION

PROGRAM : F.Y.B.Tech SEM - I (Elect., Txt., Prod., I.T.)  
SUBJECT : ENGINEERING GRAPHICS – Theory Course  
MARKS : 100

DATE: 07/12/11  
TIME: 10 am to 1.00 pm

### Instructions:

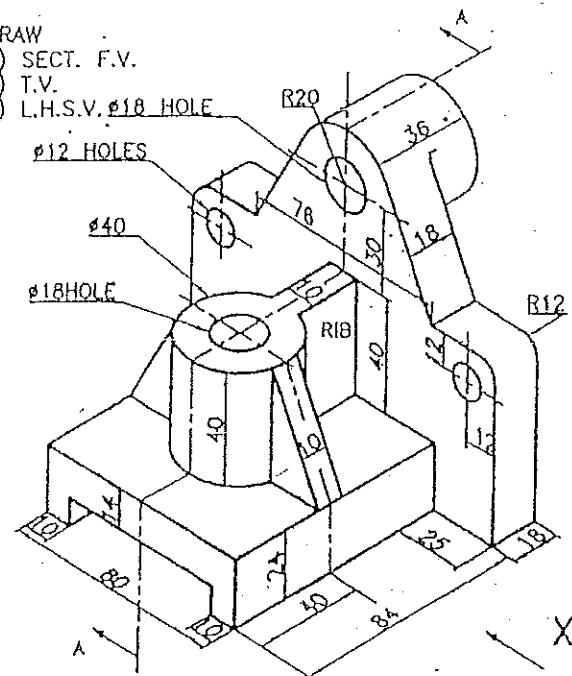
1. All questions are **COMPULSORY**.
2. Retain all construction lines
3. Assume suitable data if necessary
4. Figures to the right indicate full marks

- Q.1. a) The plan of 100 mm long line AB measures 70 mm. Point A is 10 mm below H.P. and 60 mm in front of V.P. Point B is above H.P. and 15 mm in front of V.P. Draw the projections of line AB and determine its true inclinations with H.P. and V.P. Also find the distance of point B from H.P. 10
- b) A trapezium ABCD has side AB, 90 mm long, is in H.P. and inclined at  $30^\circ$  to V.P. while side AD lies in V.P. Draw the projections of trapezium in this position and find the inclinations of plane with H.P. and V.P. Assume side CD = 30 mm, side AB is parallel to side CD and distance between AB and CD is 60 mm. 10
- Q.2 A pentagonal prism 30 mm edge of base, axis 70 mm long, has one of the longer edges inclined  $30^\circ$  to V.P., which is nearer to H.P. and a rectangular face opposite to that longer edge is parallel to H.P. Draw three views of prism. 20
- Q.3 a) A vertical cone 60 mm diameter of base, 60 mm length of axis is cut by an A.I.P. such that the true shape of section is an ellipse of minimum length of major axis **and maximum area**. Find the inclination of cutting plane with XY line and draw its 1) F.V. 2) Sect. T.V. and 3) True shape of section 12
- OR
- Draw isometric view of the object from Fig. 1 12
- b) Draw the development of lateral surface of the retained portion 'S' of tetrahedron of 60 mm side length resting on its base on H.P. whose front view with through hole cut into it as shown in Fig. 2 08
- Q.4 Draw the following views from Fig. 3 to the full scale 06
1. Sectional F.V. (AA)
  2. T.V.
  3. L.H.S.V.
- Insert 12 measure dimensions 02
- Q.5 Draw the following views from Fig. 4 with scale 1:1 06
1. Sectional F.V. (PQ)
  2. Sectional T.V. (RS)
  3. R.H.S.V.
- Show 12 measure dimensions 02

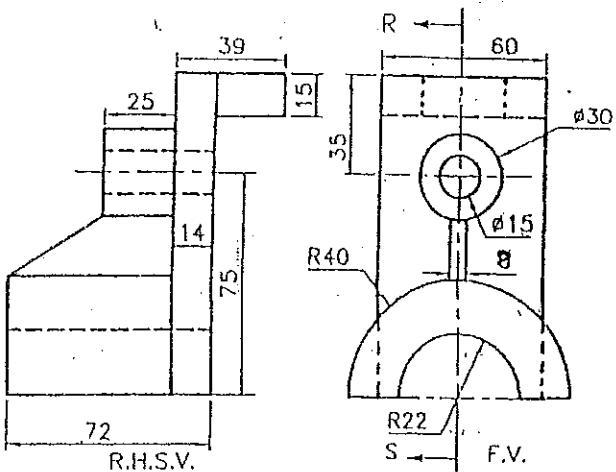
P.T.O

۹

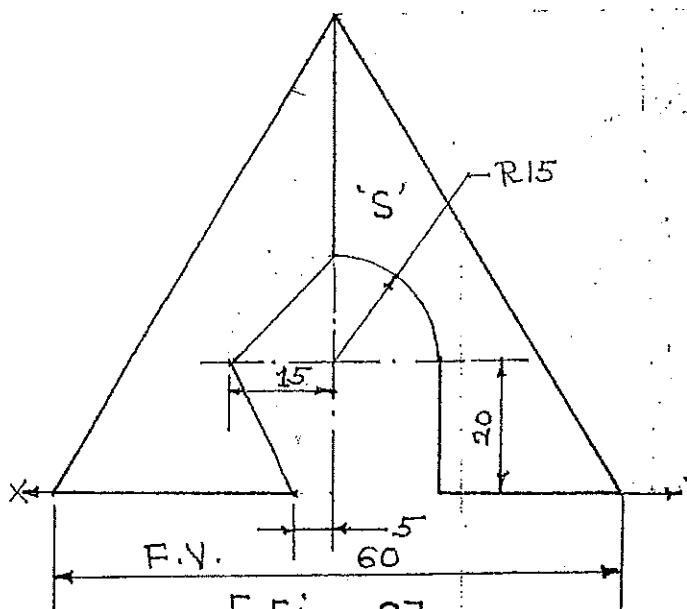
DRAW  
1) SECT. F.V.  
2) T.V.  
3) HSV 618 H



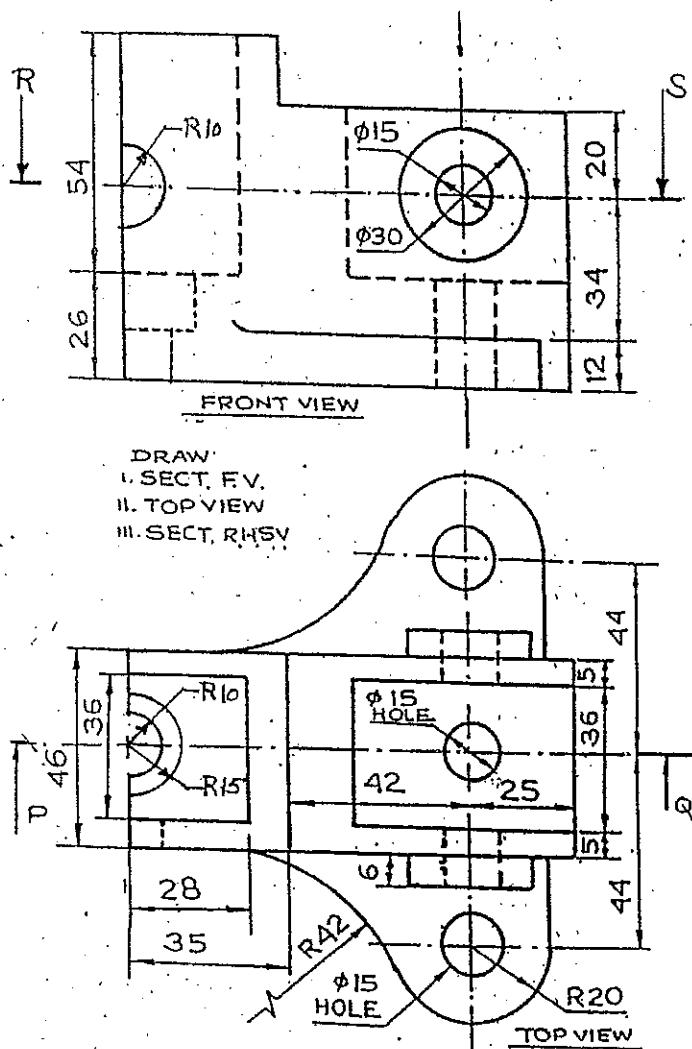
[Fig-3]



[Fig-1]



[Fig- 2]



[Fig-4]

# **VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**

(Central Technological Institute, Maharashtra State)

Matunga, Mumbai - 400 019.

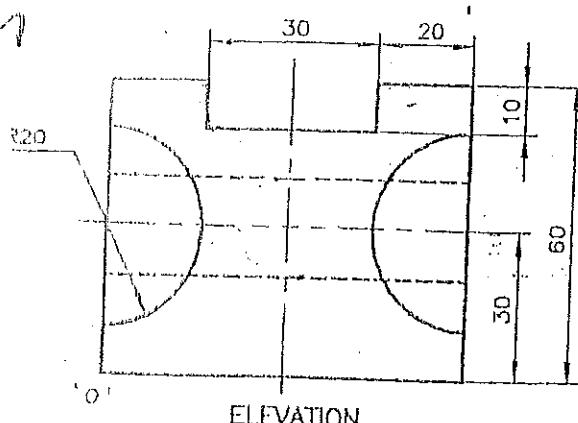
## **END SEMESTER EXAMINATION**

PROGRAM : F.Y.B.Tech.SEM-I(Elect.,Txt.,Prod.,I.T.) DATE : 29-11-12.  
SUBJECT : ENGINEERING GRAPHICS-Theory Course TIME : 3 Hrs.  
MARKS : 100

### **Instructions :**

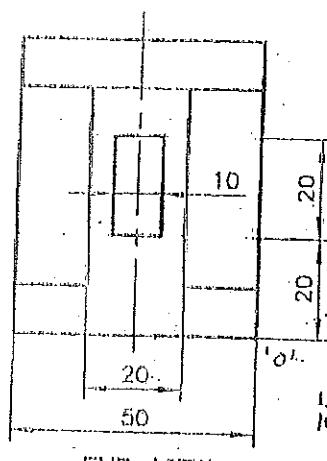
1. All questions are **COMPULSORY**.
2. Retain all construction lines.
3. Assume suitable data if necessary.
4. Figures to the right indicate full marks.

- Q. 1a)** End A of a line AB is in second quadrant and is 40mm and 15mm from HP and VP respectively. The line is inclined at  $40^\circ$  to both reference planes. Draw the projections when end B is in third quadrant and 45mm from HP. Find its true length and distance of B from VP. (10)
- Q. 1b)** Altitude DK, 60mm long of a pentagonal plane ABCDE is inclined at  $38^\circ$  and  $62^\circ$  with HP & VP respectively. Draw the projections of plane when side AB is 20mm from HP. Also find the length of side AB graphically. (10)
- Q. 2** FV. of one of the triangular face of pentagonal pyramid appears to be equilateral triangle of 40mm sides. Draw the three views of pyramid in this position when axis is inclined to VP, parallel to HP and 60mm long. (20)
- Q. 3a)** A square pyramid of 50mm edge of base is resting on its base on HP. It is cut by an inclined plane such that true shape of section is an isosceles triangle of base 40mm with apex angle  $40^\circ$ . Draw the three views and trueshape of section cut pyramid. Also find inclination of cutting plane and length of its axis. (12)  
**OR**
- 3a)** Draw the Isometric view from Fig. 1 using 'O' as origin. (12)
- 3b)** Fig. - 2 shows the FV of a square prism of axis 70mm long resting with its base on HP, with through cut hole as shown. Draw -  
i) FV ii) TV & iii) Development of lateral surface of retained portion 'B' showing positions of points p-q-r-s-t-w on it. (8)
- Q. 4** Draw the following views from Fig. 3 to the full scale. (6)  
i) Sectional E.V. (RS) (6)  
ii) T.V. (6)  
iii) R.H.S.V. (6)
- Q. 5** Insert 12 major dimensions. (2)
- Q. 5** Draw the following views from Fig. 4 to the full scale : (6)  
i) Sectional E.V. (A-A) (6)  
ii) Sectional T.V. (B-B) (6)  
iii) L.H.S.V. (6)
- Insert 12 major dimensions. (2)



ELEVATION

[Fig.-1]



END-VIEW

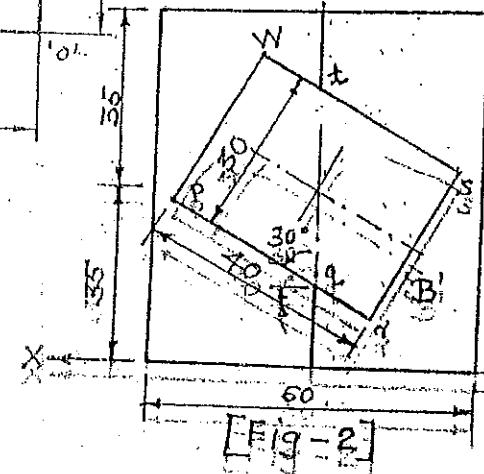


Fig-2

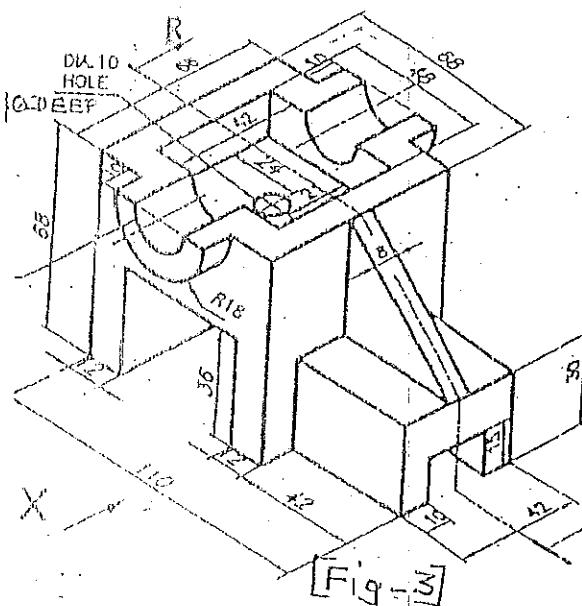
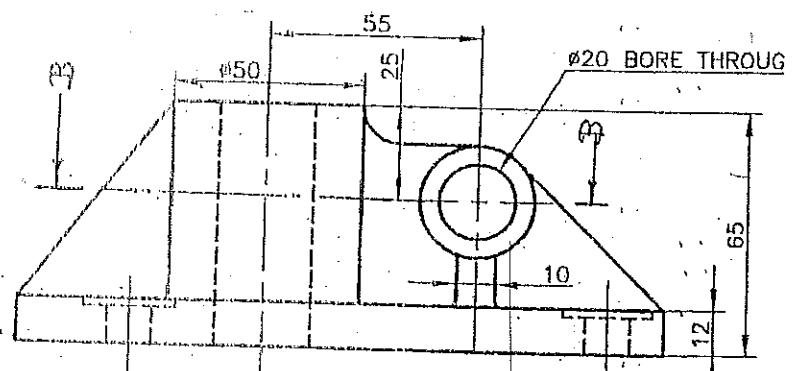
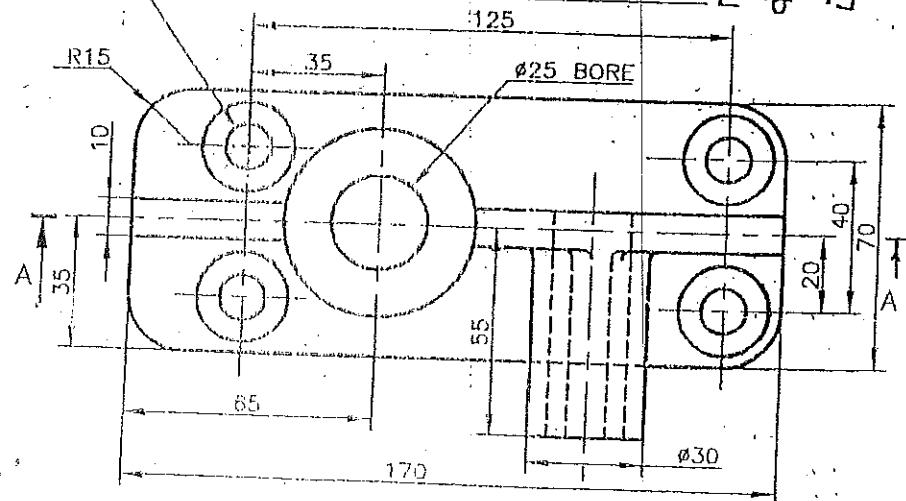


Fig. 15



ELEVATION

S Ø1.2 DRILL, SPOT FACE Ø24x1/2-DEEP, 4 HOLES [Fig-4]





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[Central Technological Institute, Maharashtra State]  
**Matunga, Mumbai-400 019**

## **SEMESTER EXAMINATION**

SEMESTER & PROGRAM

**TIME ALLOWED**

**COURSE (Course Code)**

F.Y.B.Tech Sem-II

**DATE OF EXAM**

TIME

## MARKS

1001)

24 (05) 2014

9.30.6m - 12.30.1pm

- Instructions**

  1. All questions are compulsory.
  2. Assume necessary data.
  3. All dimensions are in mm.

- Q.1**

  - a. The distance between the end projectors of the line PQ is 50mm. The end P is 45mm behind VP and 10mm below HP. The end Q is 30mm above HP and 40mm in front of VP. Draw the projections of line. Determine the true length of the line and the true inclination of the line with both the reference plane.
  - b. A circular metal sheet of 60mm diameter and negligible thickness has a regular hexagonal hole of side 22mm punched centrally through it. The sheet is resting on HP on one point of its rim such that its plane is inclined at  $30^\circ$  to the HP and the diameter through the point on the HP is inclined at  $45^\circ$  to the VP. Take one of the sides of the hexagon perpendicular to the diameter of the sheet passing through the point on which it rests. Draw the front and top view of the sheet held in the given position.

- Q.2** a. A thin lamp shade in the form of a frustum of a cone, has its larger end 95mm diameter, smaller end 40mm diameter and height 70mm. Draw its projections when it is lying on its side on the HP with its axis inclined at  $45^{\circ}$  to the HP.

- b. A regular pentagonal prism of 25mm base edge and 60mm long is lying on one of its longer edges on HP such that its two rectangular faces containing the longer edge make equal angles with the HP and the longer edges inclined at  $35^\circ$  to VP. A section plane perpendicular to the HP and passing through the corner of the rear pentagonal face farthest away from the VP. Draw the top view and sectional view of the cut prism, held in the given position.

- Q.3 a. A cone made up of sheet with base circle diameter 65 mm and axis length 75 mm is kept on its base on the ground. A circular hole of 30 mm diameter is cut through the cone such that its axis remains perpendicular to V.P.; 10 mm to the right of the axis of cone and 25 mm above the base of cone. Develop the lateral surface of the cone.





- Q.5 a. Fig. 3 Shows two views of an object. Draw its isometric view with O as origin

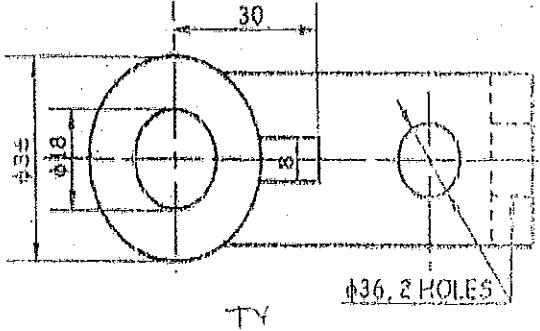
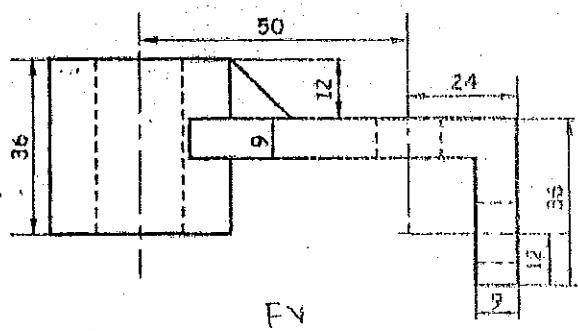


Fig. 3

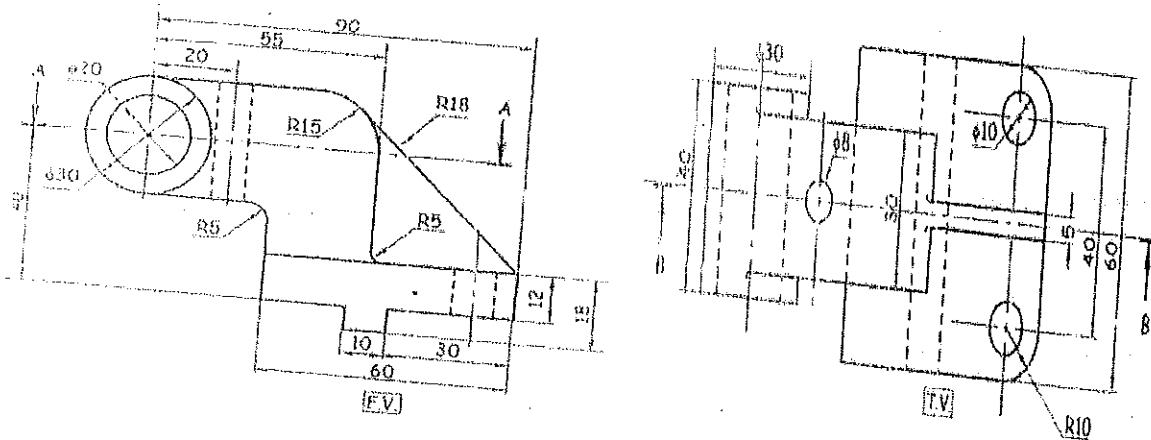
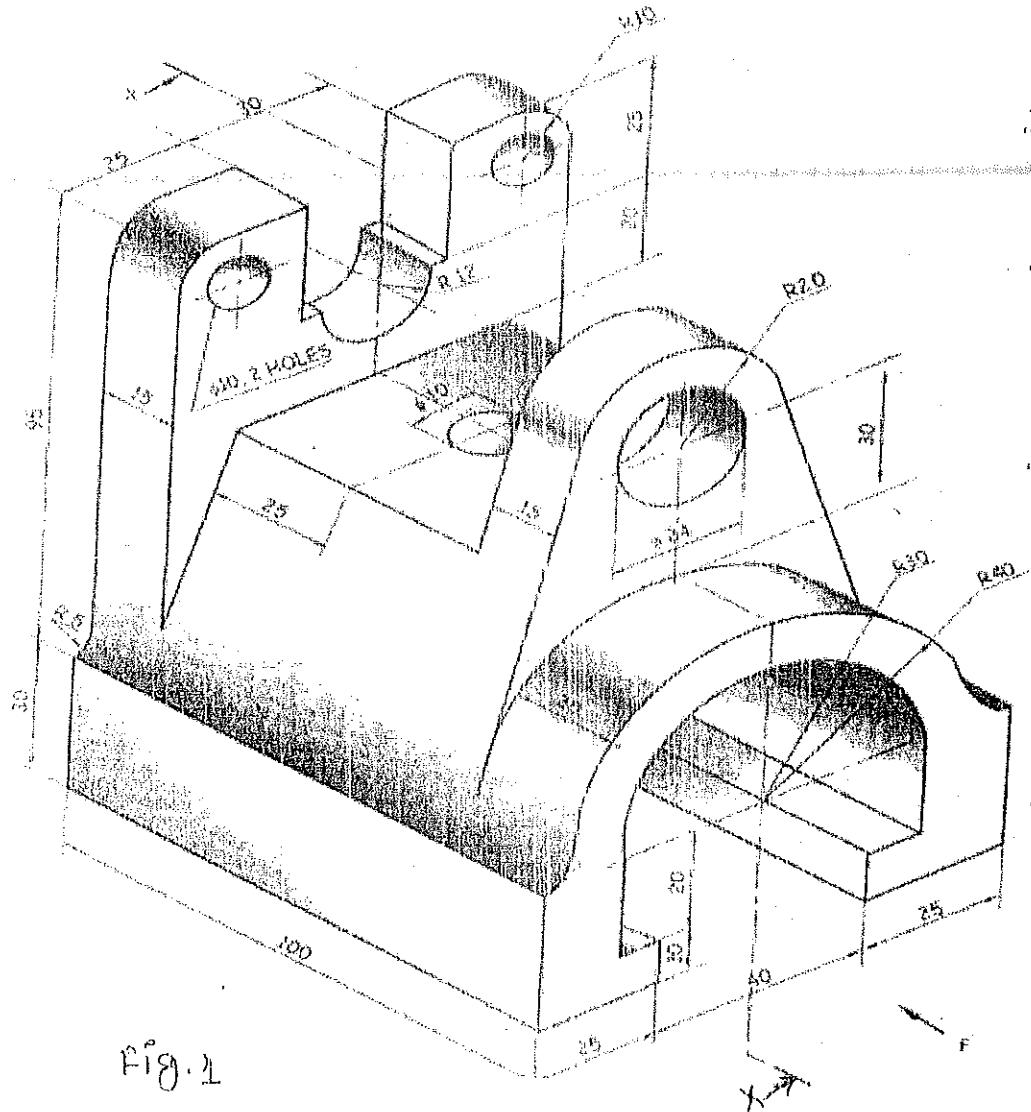


Fig. 2.

**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
**[Central Technological Institute, Maharashtra State]**  
**Matunga, Mumbai- 400 019**

|                       |                       |              |                           |
|-----------------------|-----------------------|--------------|---------------------------|
| SEMESTER EXAMINATION  | F.Y.B.Tech ESE        | DATE OF EXAM | 8 <sup>th</sup> Dec. 2014 |
| SEMESTER & PROGRAM    | Sem- I Engg. Graphics | TIME         | 9.30 to 12.30 PM          |
| TIME ALLOWED          | 3 HRS                 | MARKS        | 100                       |
| COURSE ( Course Code) | ME001                 |              |                           |

- Instructions:**
1. Figure to the right indicate full marks.
  2. All questions are compulsory.
  3. Assume the necessary data and dimensions.

- Q.1** a) The distance between the end projectors of line AB is 50 mm and end A is 20 mm above the HP and 10 mm in front of VP, the line is inclined at  $45^\circ$  to the HP and its TV measures 70 mm . Draw its projections of line. 10
- b) A pentagonal plate lamina of sides 30 mm is resting on HP on one of its corner so that the surface makes an angle of  $60^\circ$  with the HP. If the side opposite to this corner makes an angle of  $30^\circ$  with the VP & is parallel to HP, draw projections of pentagonal plate. 10
- Q.2** a) A hexagonal pyramid 30 mm edge of base and axis is 70 mm long is lying on one of its corner on HP such that two edges of base are parallel to the VP. Draw its projection if base makes an angle of  $30^\circ$  to HP. 10
- b) A square pyramid, side of base 40 mm and 65 mm height stands on HP. Two edges of base are parallel to VP. It is cut by section plane perpendicular to VP and inclined to HP in such way that the true shape of section is a trapezium whose parallel sides measures 40 mm and 20 mm. Draw FV, sectional TV, sectional SV and true shape of section. 10
- Q.3** Fig.1 shows FV of triangular pyramid with one of the edge of base parallel to VP and away from observer. A trapezium hole is drilled as shown. Draw development of lateral surface of the pyramid. 10
- OR
- Vertical cylinder of 40 mm diameter and 70 mm height is resting on its base on the HP. It is cut by an equilateral triangular slot of 36 mm side so that the axis of the slot is perpendicular to VP. And parallel to HP and is at a height of 35 mm above the base of cylinder. Develop lateral surface of cylinder when one of the flat face of triangular slot is contained by the axis of cylinder. 10
- Q.4** Fig. 2 shows the isometric view of an object. Draw its FV, TV and LHSV. 20
- Q.5** Fig. 3 shows F.V. and L.H.S.V. of an object. Draw the following views: 20  
 1. F.V.    2. Sectional L.H.S.V.    3. T.V.
- Q.6** Fig. 4 shows front and side view of an object. Draw its isometric view about origin O. 10

Fig. 1

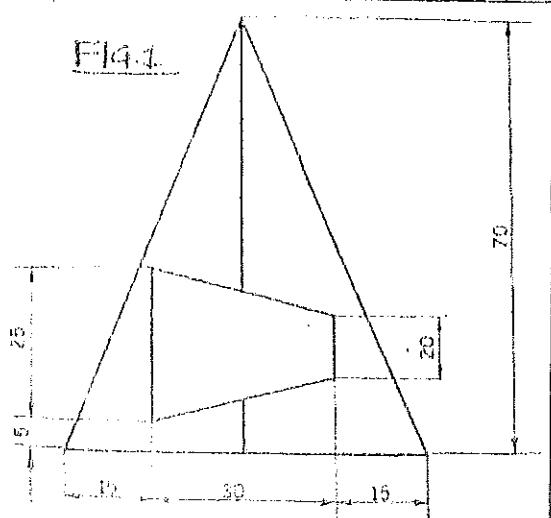
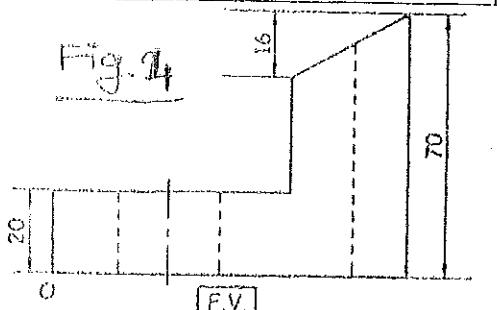


Fig. 4



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## VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

### END SEMESTER EXAMINATION

SEMESTER & COURSE: F.Y. B. TECH. SEM II 2011-12

(Civil, Mech, Electronics, E&TC, Comp)

SUBJECT: ENGG. GRAPHICS - THEORY COURSE

DATE: 18/5/12

TIME: 3 hr 9:30 To 12:30 MARKS: 100

#### Instructions:

1. All questions are compulsory.
2. Retain all the construction lines.
3. Assume suitable data if necessary.
4. Figures to the right in bracket indicate max. Marks.

**Q 1 a)** The plan of a 90mm long line AB measures 70mm and it make an angle  $50^{\circ}$  with XY line. The end A is in VP. The end B is 15mm from HP and lies in second quadrant. Draw the projections of line AB. Determine its inclination with both reference planes and find the distance of A from HP. (10)

**b)** A regular pentagonal plate ABCDE of 40mm sides has one edge AB in VP and makes an angle  $45^{\circ}$  with HP. Draw its projections when corner D is 30mm away from VP and is in HP. Also finds its surface inclination with HP and VP. (10)

**Q 2** A pentagonal prism 30mm edge of base axis 70mm long is held such that one of the edge of base is in HP normal to VP and highest corner opposite to that edge remains 65mm above HP. Draw its three views and find inclination of axis with HP. (10)

**Q 3 a)** A pentagonal pyramid has base in VP and one of the edge of the base is parallel to HP. It is cut by an AIP which is inclined at  $45^{\circ}$  to XY line and 10mm away from axis of pyramid.

Draw its

- I) F.V.
- II) Sectional T.V.
- III) True shape of section retaining larger portion.

Assume base side 40mm and axis 30mm long.

(12)

OR

- a) Draw isometric view of the object whose projections are shown in fig. 1 (12)

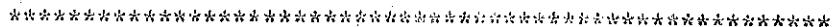
- b) Draw the development of the lateral surface of the retained portion "M" of square prism whose FV with through hole cut as shown in fig. 2 (8)

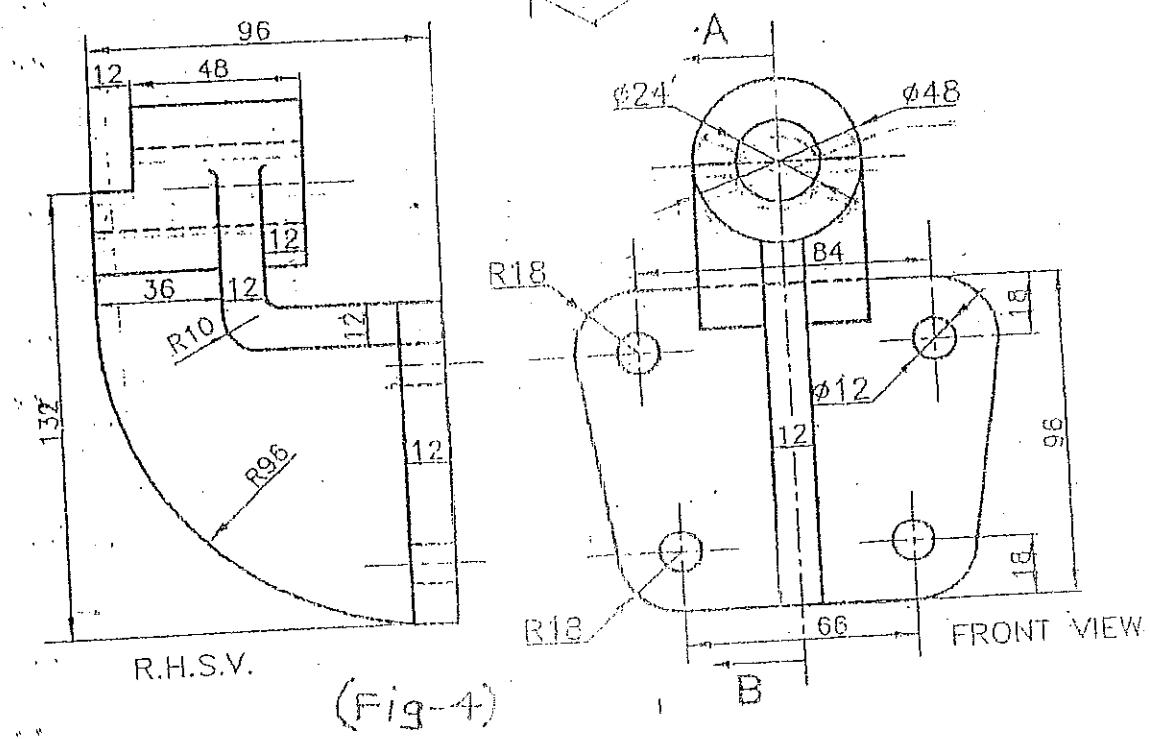
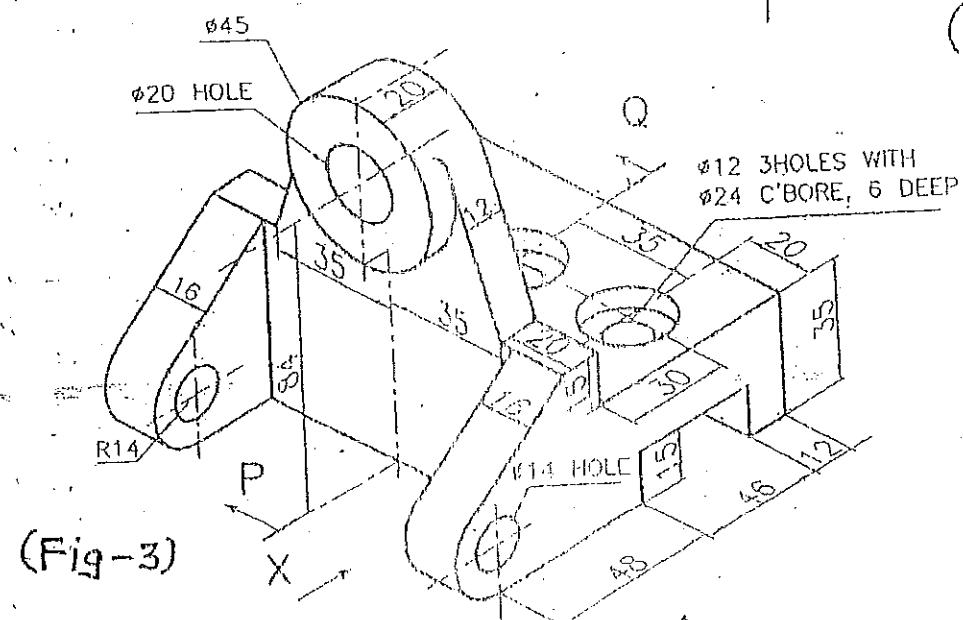
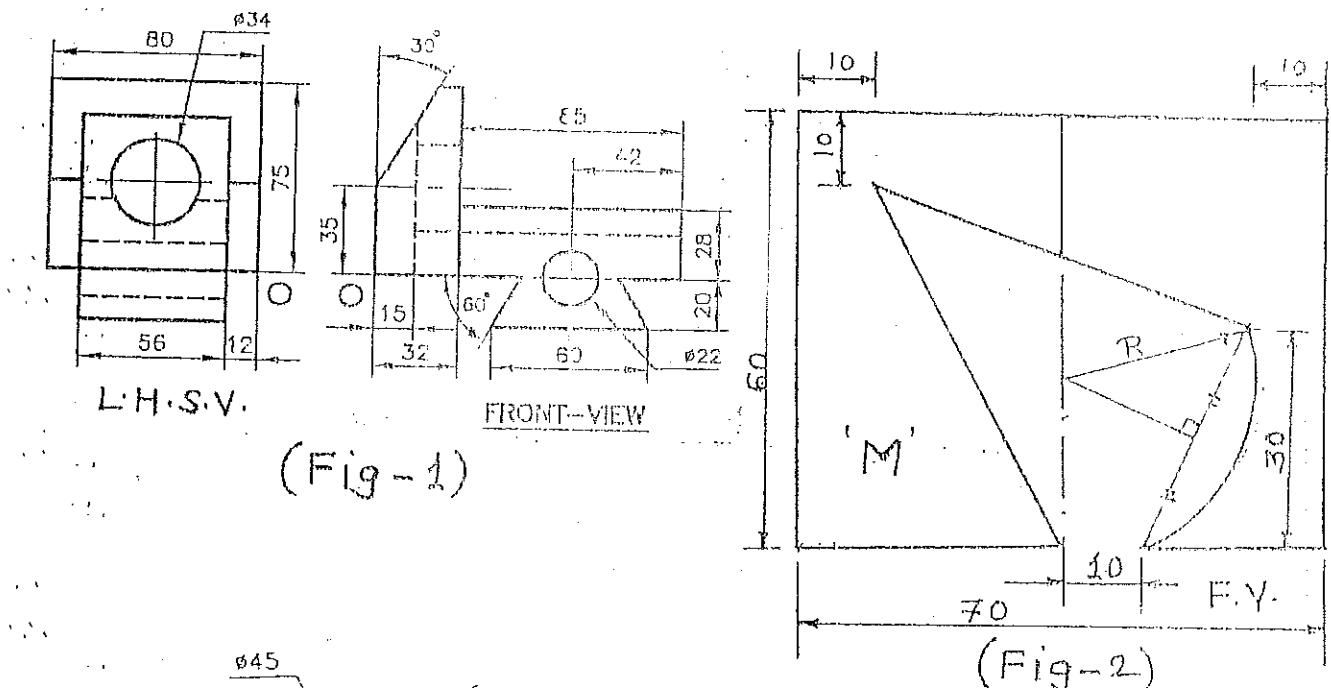
Q 4 Draw the following views from the pictorial view shown in fig. 3:-

- |      |                          |     |
|------|--------------------------|-----|
| i.   | Sectional FV [P-Q]       | (6) |
| ii.  | TV                       | (6) |
| iii. | LHSV                     | (6) |
|      | Show 12 major dimensions | (2) |

Q 5 Draw the following views fig.4:-

- |      |                          |     |
|------|--------------------------|-----|
| i.   | FV                       | (2) |
| ii.  | TV                       | (8) |
| iii. | Sectional RHSV [A-A]     | (8) |
|      | Show 12 major dimensions | (2) |





20



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

EXAMINATION  
SEMESTER & PROGRAM  
TIME ALLOWED  
COURSE (Course Code) :

ESE - May 2014  
Sem II F.Y. B.Tech (Batch-I, II, III)  
3 HRS.  
Engineering Graphics (ME0001)

DATE OF EXAM 23 /04/2014  
TIME  
MARKS 100

- Instructions
1. All questions are *Compulsory*.
  2. Assume suitable data, if required.
  3. All dimensions are in mm.
  4. Use First angle method

- Q.1. a. The F.V. and the T.V. of line AB measures 50 mm and 60 mm respectively. The line is 70 mm long. Point A is 10 mm above the H.P. and 20 mm in front of the V.P. Draw the projections of line AB and determine its inclination with the H.P. and V.P. Assume the line to be in the 1<sup>st</sup> quadrant. 8
- b. A circular plate of negligible thickness and diameter 80 mm has a point A on its circumference in the V.P. The surface of the plate is inclined to the V.P. in such a way that the F.V. is seen as an ellipse of 50 mm long minor axis. Draw the projections of the plate when F.V. of diameter AB makes 45° with the H.P. Find inclination of the plate with the V.P. 12
- Q.2. a. A square prism with side of base 40 mm and axis length 60 mm has one of its side of base in the V.P., which makes an angle 45°( $\Theta$ ) with the H.P. and axis inclined at an angle 30°( $\Phi$ ) with the V.P. Draw its projections. 10
- b. A pentagonal pyramid edge of base 40 mm long and height 75 mm is lying in the H.P. on the triangular face with an axis parallel to the V.P. It is cut by the section plane perpendicular to the H.P., inclined at 30° to the V.P. and bisecting the axis of a pyramid. Draw the sectional F.V., T.V. and the true shape of a section of the pyramid when the apex is retained. 15
- Q.3. a. A square pyramid (side of base 50 mm and axis 60 mm) is kept on the H.P. on its base with two of its sides of base parallel to V.P. An vertical axial square hole of sides 25 mm is cut through the pyramid, so that the vertical faces of the hole are equally inclined to V.P. Draw projection of the solid and show the D.L.S. 10
- Q.4. a. Fig. 1 shows the isometric view. Draw the following views  
1. Sectional F.V.-AA( in X direction), 2. T.V.  
3. L.H.S.V (Show any 10 major dimensions) 18
- b. Fig. 2 shows F.V. and R.H.S.V. Draw the following views  
1. F.V. 2. R.H.S.V.  
3. Missing T.V. (Show any 10 major dimensions) 12
- Q.5. a. Fig. 3 shows two views of an object. Draw its isometric view using natural scale with O as origin. 15

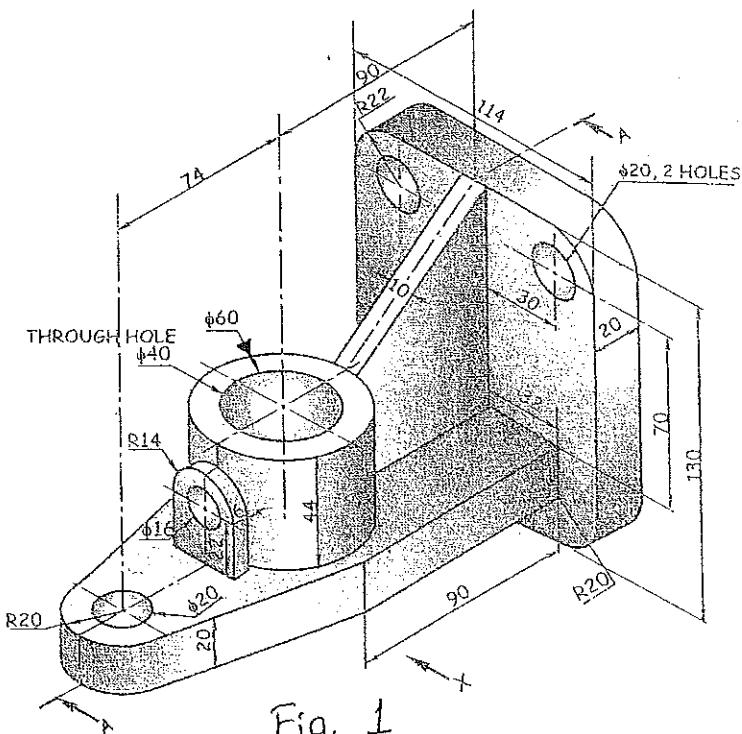
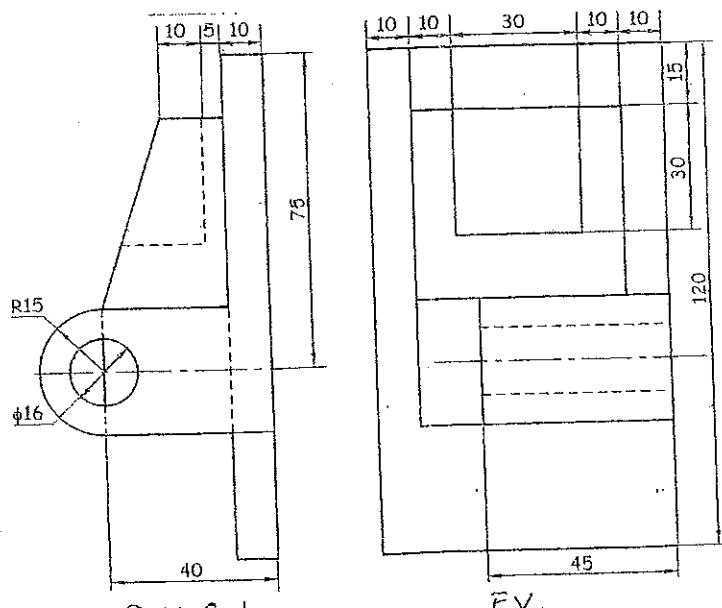
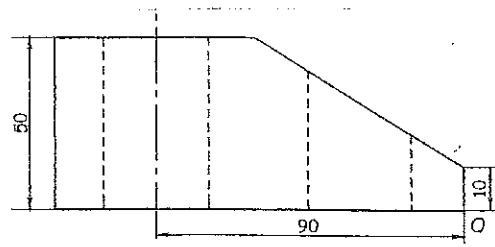


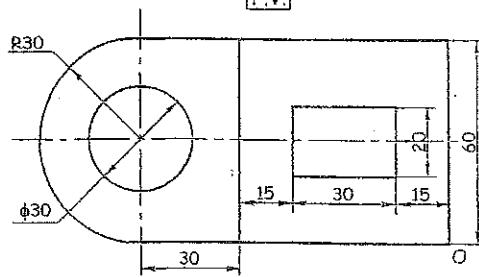
Fig. 1



R.H.S.V. F.V.



F.V.



T.V.

Fig. 3



# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

EXAMINATION ESE MAY-2015

SEMESTER & PROGRAM II B.Tech

TIME ALLOWED 3 HRS.

COURSE CODE & COURSE: Engineering Graphics

DATE OF EXAM 05/05/2015

TIME 9:30 am to 12:30 pm

MARKS 100

- Instructions
- Figures to the right indicate full marks.
  - All questions are compulsory
  - Assume suitable data if necessary

- Q.1 a. The plan of a straight line of 90 mm length measures as 65 mm. If the line is inclined at  $30^\circ$  to the VP and if its end point 'A' is 10mm behind VP and 45mm above the HP, draw its projections assuming the complete line to be in 2<sup>nd</sup> quadrant. 10
- b. A regular hexagonal plate of 25mm side has one of its corner in the HP. The diagonal passing through that corner makes an angle  $30^\circ$  and  $45^\circ$  to the HP and the VP respectively. Draw its projections. 10
- Q.2 a. A hexagonal pyramid of base side 30 mm and axis length 60 mm is resting on HP o one of its base corners with its axis inclined at  $35^\circ$  to HP. The base sides containing the resting corner are equally inclined to HP. Draw its projection. 10
- b. A square pyramid with base edge 30 mm and height 50 mm rests with base on HP with two edges of base parallel to VP. Cutting plane is perpendicular to VP and true shape of section is trapezium with parallel sides 24 mm and 12 mm respectively. Show the cutting plane and draw the FV, sectional top view & sectional side view of solid. 10
- Q.3 a. A pentagonal prism with base edges 30mm and axis height 60mm is resting with base on HP with one edge of base parallel to VP and away from VP. A circular hole of diameter 40mm is drilled in the prism such that the axis of the hole is perpendicular to the VP and bisects the axis of the prism. Draw the lateral surface development of the prism. 10
- b. For the objects shown in figure 2 draw the isometric drawing. 10
- Q.4 a. Figure 1 shows the pictorial view of an object. Draw the following 20  
a) FV  
b) TV  
c) LHSV
- Q.5 a. Figure 3 shows front view and top view. Draw the following 20  
d) Sectional FV (Section along XX)  
e) TV  
f) LHSV

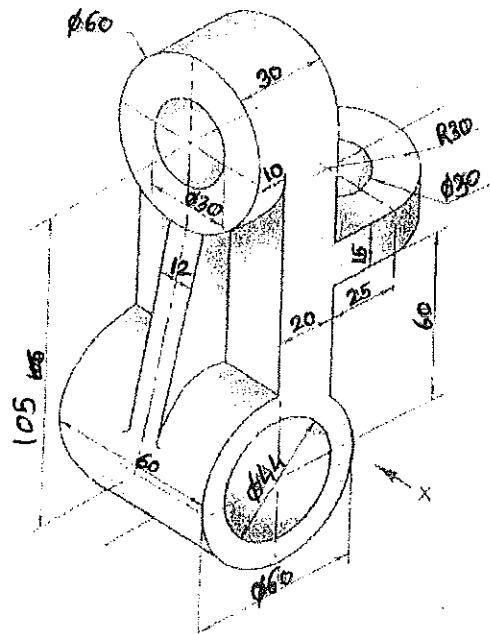


Figure -1

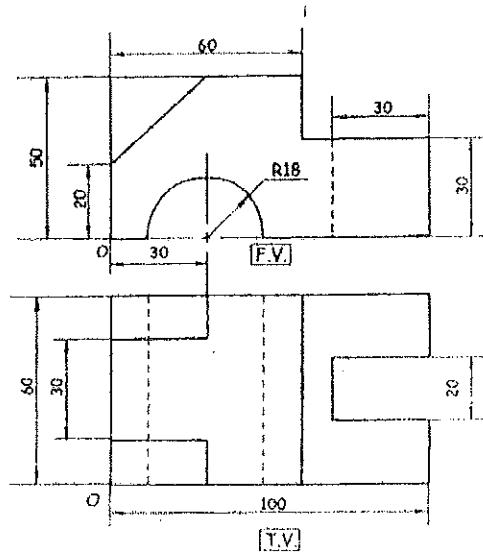


Figure - 2

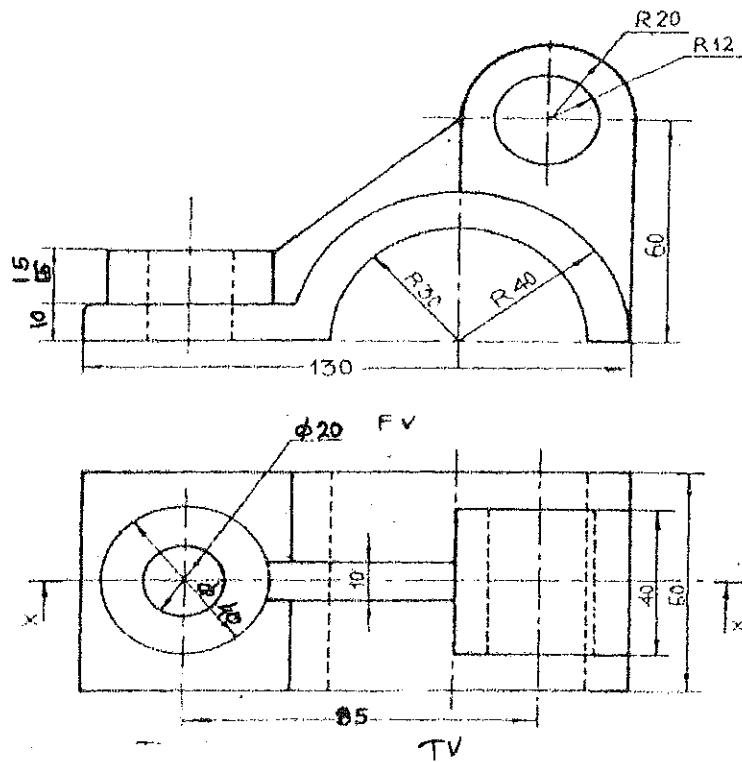


Figure -3



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
**Matunga, Mumbai-400 019**

SEMESTER EXAMINATION

*Re-ESE Exam*

*Ent Semester Exam (Oct-Nov)*

DATE OF EXAM

4/01/2016

SEMESTER & PROGRAM

I F.Y. B.Tech

TIME

9.30 am to 12.30

TIME ALLOWED

3 HRS.

MARKS

100

COURSE (Course Code) :

**ENGINEERING MECHANICS (SA0001T)**

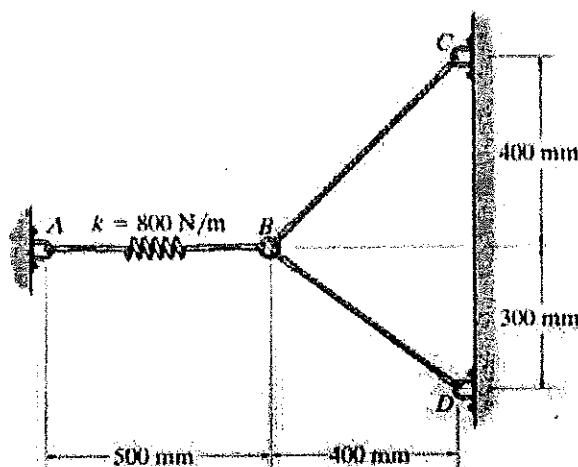
P.M.

Instructions 1. All questions are compulsory.

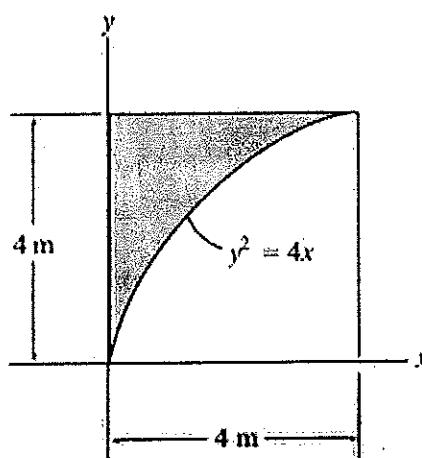
2. Figures to the right indicate full marks.

3. Assume suitable data whenever necessary.

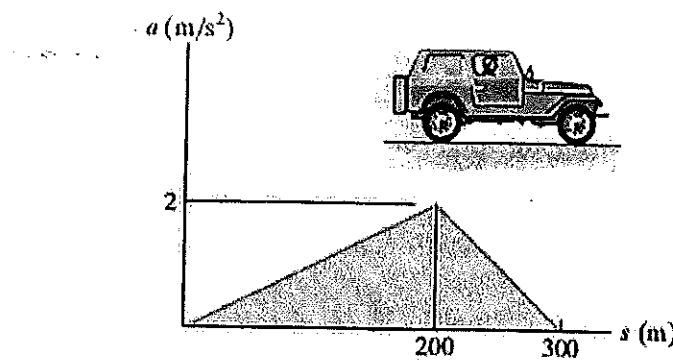
- Q.1 a. The spring has a stiffness of  $K = 800 \text{ N/m}$  and un stretched length of 200 mm. Determine the force in cables BC and BD when the spring is held in the position shown. 5



- b. Derive the equation for determining the centroid of shade area shown in figure. 5

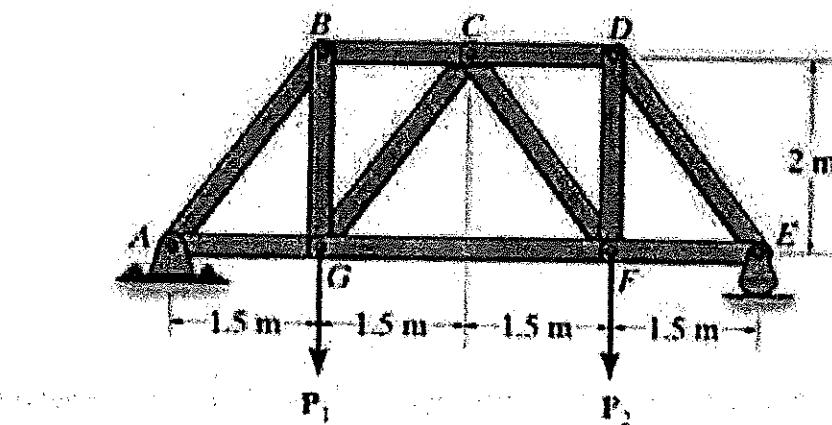


- c. The a-s graph for a jeep traveling along a straight road is given for the first 300 m of its motion. Construct the v-s graph. At s= 0, v = 0 5

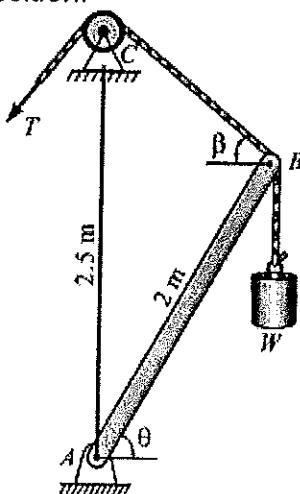


- D. Explain with neat sketch translation motion and rotational motion of rigid bodies. 5

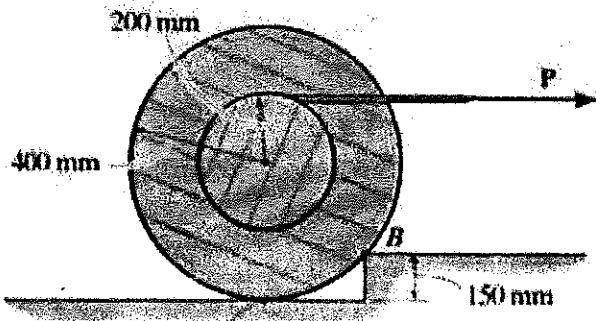
- Q.2 a Determine the forces in each member of truss and if state the member are in tension or compression. Set  $P_1 = 20 \text{ kN}$  and  $P_2 = 10 \text{ kN}$ . 10



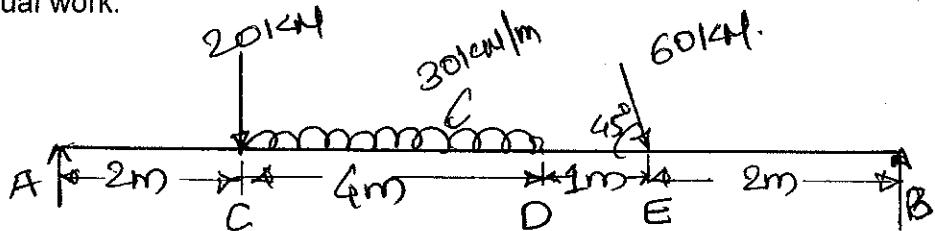
- b A bar AB pinned at A carries a load  $W = 5 \text{ kN}$ . The chord attached at B is passing through frictionless pulley as shown in figure. Find the compression in the bar AB and also the limiting value of the tension in chord when bar approaches the vertical position. 10



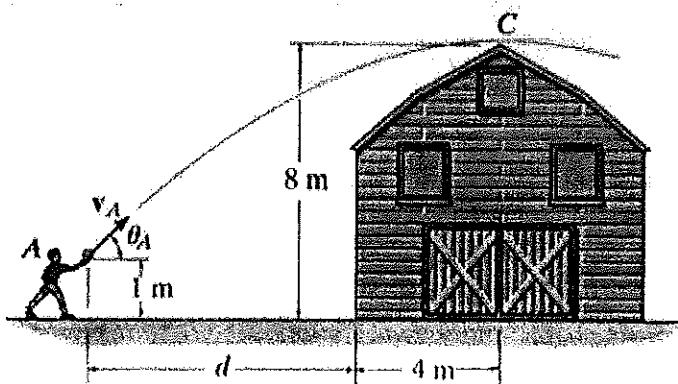
- Q3 a If the coefficient of static friction at contact points A and B are  $\mu_s = 0.3$  and  $\mu'_s = 0.4$  respectively. Determine the smallest force P that will cause the 150 kg spool to have impending motion. 10



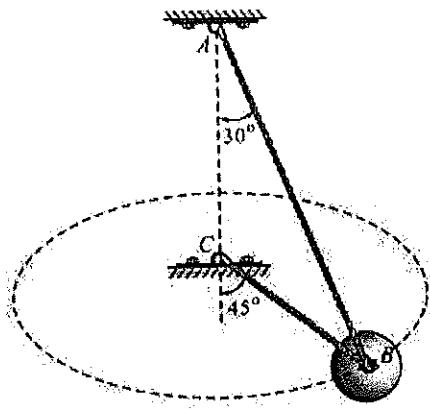
- b. Find the reactions at the support for the beam shown in figure by principle of virtual work. 10



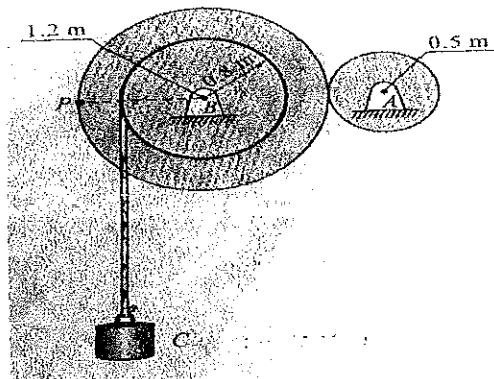
- Q4 a. The boy at A attempts to throw a ball over the roof of a barn such that it is launched at an angle  $\theta_A = 40^\circ$ . Determine the minimum speed  $v_A$  at which he must throw the ball so that it reaches its maximum height at C. Also find the distance d where the boy must stand so that he can make the throw. 10



- b. A 10 kg sphere is connected to two strings as shown in figure. The mass is revolving in the horizontal plane around a vertical axis. Find the range of speeds that the mass can have if both the strings must remain taut. AC = 2m 10



- Q.5 a. Pulley A starts from rest and rotates with a constant angular acceleration of  $2 \text{ r/s}^2$  anticlockwise. Pulley A causes double pulley B to rotate without slipping. Block C hangs by a rope wound on B, refer to figure. Determine at  $t = 3\text{sec}$ . 10  
 (i) Acceleration, velocity and position of block C.  
 (ii) Acceleration of point P on pulley B.



- b. State and derive the impulse momentum equation. 5  
 c. Explain the following terms for rotating rigid body:  
 (i) Angular Displacement   (ii) Angular velocity   (iii) Angular acceleration. 5



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
**Matunga, Mumbai-400 019**

SEMESTER EXAMINATION

*End Semester Exam (Oct-  
Nov)*

DATE OF EXAM :

02/11/2015

SEMESTER & PROGRAM

I F.Y.B.Tech

TIME

: 9.30 - 12.30 pm,

TIME ALLOWED

3 HRS.

MARKS

100

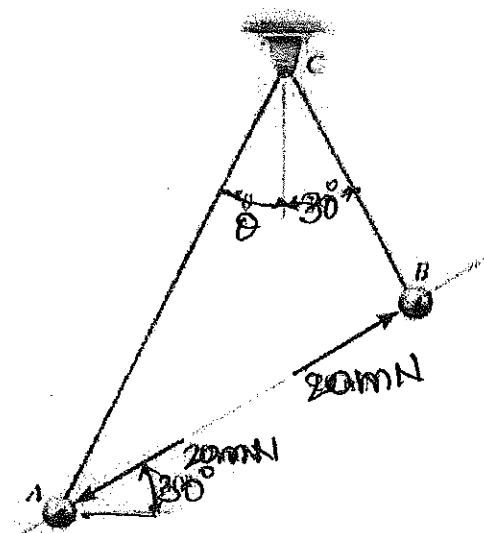
COURSE (Course Code) :

**ENGINEERING MECHANICS (SA1001T)**

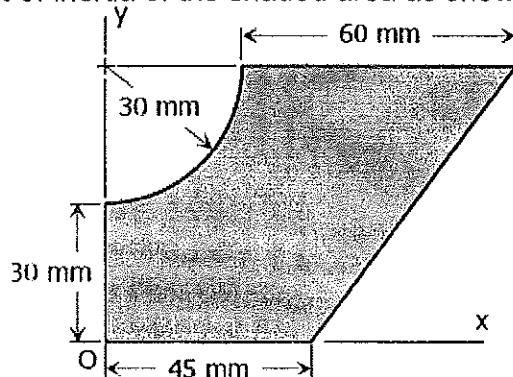
Instructions

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Assume suitable data whenever necessary.

Q.1 a. Two spheres A and B have an equal mass and are electrostatically charged such that the repulsive force acting between them has a magnitude of 20m.N and is directed along line AB. Determine the angle  $\theta$ , the tension in cords AC and BC and the mass m of each sphere. 5



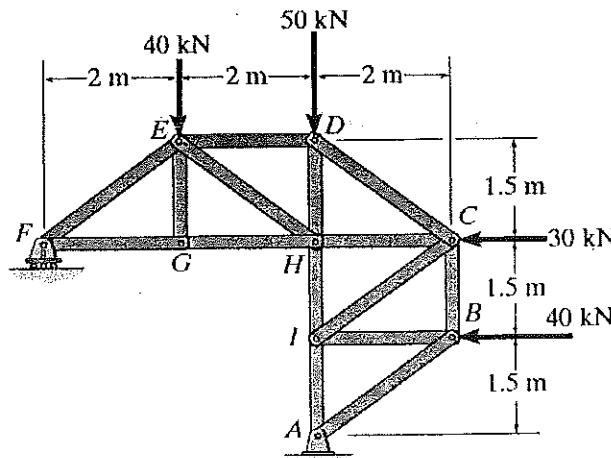
b. Evaluate moment of inertia of the shaded area as shown in figure. 5



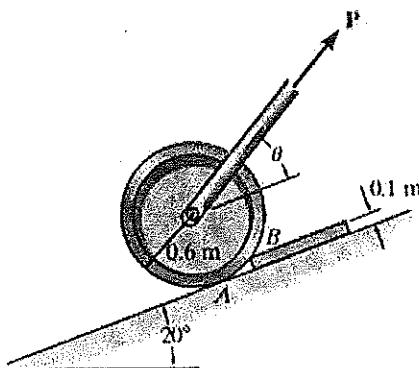
c. In Asian games, for 100 m event an athlete accelerates uniformly from the start to his maximum velocity in a distance of 4 m and runs the remaining distance with that velocity. If the athlete finishes the race in 10.4 sec, determine (i) his initial acceleration and (ii) his maximum velocity. 5

- d. An airplane has a mass of 25000 kg and its engines develop a total thrust of 40 kN along the run way. The force of air resistance to motion of airplane is given by  $R = 2.25 v^2$  where  $v$  is m/s and  $R$  is in Newton. Determine the length of runway required if the plane takes off and becomes airborne at a speed of 240 km/hr. 5

- Q.2 a. Determine the force in members DC, HC, HI, ED, EH, and GH of the truss, 10 and state if the members are in tension or compression.

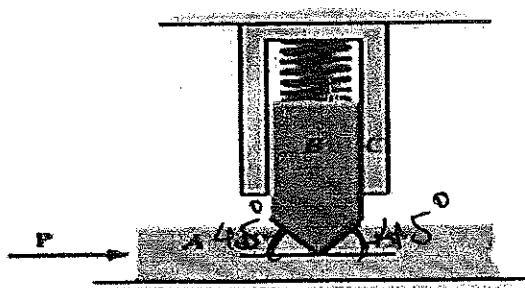


- b. Determine the magnitude and direction  $\theta$  of the minimum force  $P$  needed to 6 pull the 50 kg roller over the smooth step.

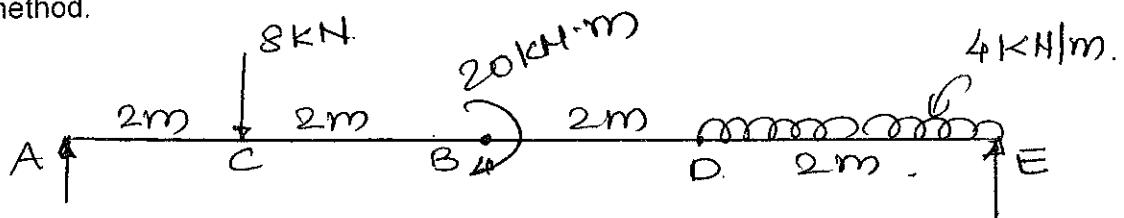


- c. State and derive the Perpendicular Axis Theorem. 4

- Q3 a. Determine the smallest horizontal force  $P$  required to just move block A to the right if the spring for ice is 600 N and the coefficient of statics friction at all contacting surfaces on A is  $\mu_s = 0.3$ . The sleeve at C is smooth. Neglect the mass of A and B. 10



- b. Find the support reaction for the shown in figure by using virtual work 10 method.

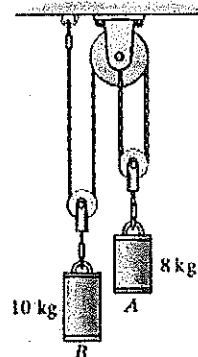


- Q.4 a The 2-Mg car has a velocity of  $v_1 = 100 \text{ km/h}$  when the driver sees an obstacle in front of the car. If it takes 0.75 s for him to react and lock the brakes, causing the car to skid, determine the distance the car travels before it stops. The coefficient of kinetic friction between the tires and the road is  $\mu_k = 0.25$ . 5

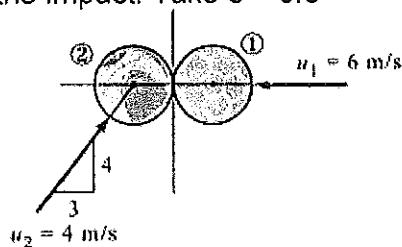
$$\underline{v_1 = 100 \text{ km/h}}$$



- b Explain merits and demerits of friction. 5  
 c If Cylinder A is given an initial downwards speed of 2 m/s. Determine the speed of each cylinder when  $t = 3 \text{ s}$ . Neglect the mass of the pulley. 10



- Q.5 a Two identical balls of 120 gm collide when they are moving with velocity perpendicular to each other as shown in figure. Assume that the line of impact is in the direction of motion of ball 2; determine the velocity of ball 1 and 2 completely after the impact. Take  $e = 0.8$  10



- Q.5 b i) Compare Newton's second law with D'Alembert's principle 2  
 ii) State Law of Conservation of Momentum Principle. 3  
 iii) Define work, energy, power, break power and mechanical efficiency. 5





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[Central Technological Institute, Maharashtra State]  
**Matunga, Mumbai-400 019**

SEMESTER EXAMINATION  
SEMESTER & PROGRAM  
TIME ALLOWED  
COURSE (CourseCode) :

*ESE Dec 2014*  
*Sem I F.Y.B.tech.*  
*3 HRS.*  
*Engg. Mechanics*

DATE OF EXAM      *8-12-14*  
TIME                  *9.30 to 12.30 p.m.*  
MARKS                *100*

- Instructions    1 All questions are compulsory.  
                  2 Figures to the right indicate full marks.  
                  3 Assume suitable data wherever necessary.

- Q-1**   a With help of example explain stable, unstable, determinate and indeterminate truss.      04  
      b Derive impulse momentum equation      04  
      c Give the application of flywheel      04  
      d With help of the example give the limitation of law of transmissibility      04  
      e Why it is necessary to have more weight of gun than that of the bullet      04

- Q-2**   a Find the support reaction of the structure shown in fig. 2a. Use virtual work method.      10

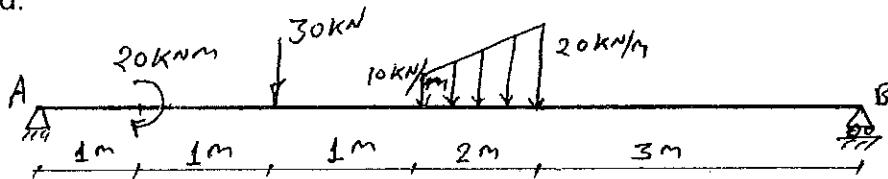


Fig. 2a

- b Find the reactions at the contact surfaces for the smooth spheres as shown in fig. 2b. also find the minimum angle of sloping surface for the stability of spheres      10

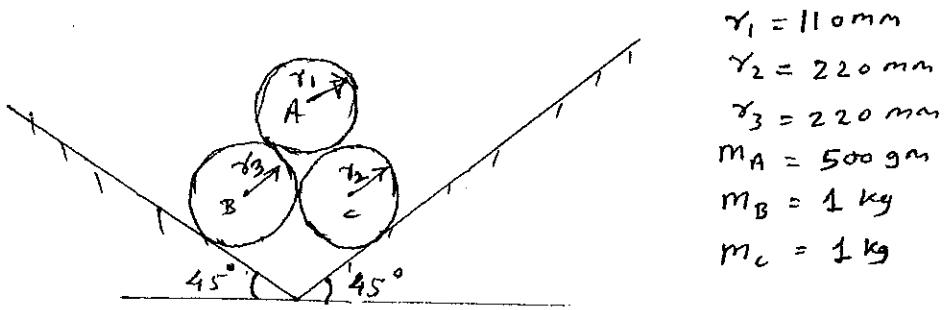


Fig. 2b

- Q-3**   a Find the forces in member of the truss shown in fig.3a. Use method of joints.      10

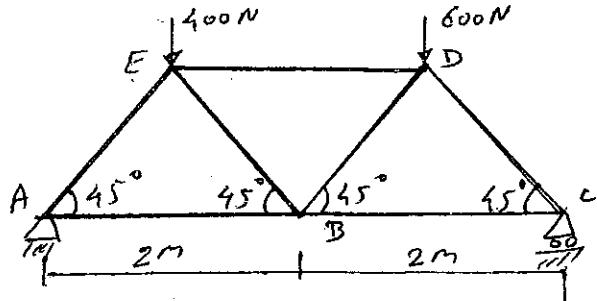


Fig. 3a.

- b A car of mass 3400kg is to be lowered down an inclined ground by a rope that is wrapped around a tree. If the wheels are free to roll find minimum number of turns the rope should be wrapped around the tree to lower the car at constant speed. Take  $\mu_k = 0.3$  and  $\mu_s = 0.35$  between rope and tree ? refer fig. 3b

05

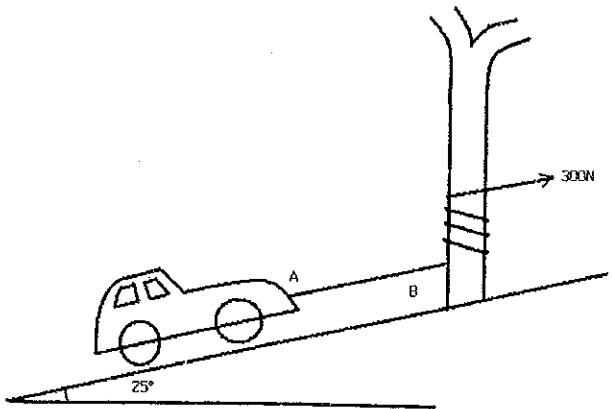


Fig. 3b

- c Determine the stretch in spring AC and AB for equilibrium of the 2kg block. 05  
The springs are shown in the equilibrium position. Refer fig. 3c

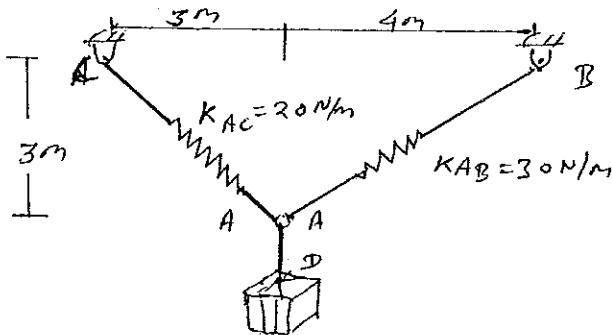


Fig. 3c.

- Q-4 a The snowmobile is traveling at 10 m/s as shown in Fig 4.a. When it leaves embankment at A, determine (a) the time of flight from A to B (b) the speed at which it strikes the ground at B and c) range R 10

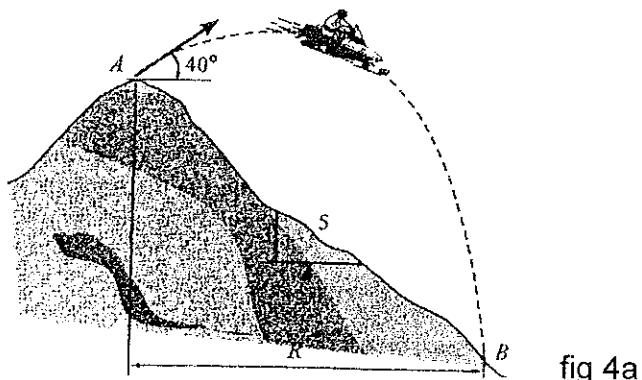


fig 4a

- b A pulley and two loads are connected by inextensible cords as shown in Fig 4b. Load A has a constant acceleration of  $0.3 \text{ m/s}^2$  and initial velocity of  $0.24 \text{ m/s}$  both directed upwards. Determine (a) the number of revolutions executed by the pulley in 4 sec. ( b) the velocity and the displacement of load B after 4 sec. and (c) the acceleration of point D on the rim of the pulley at  $t=0$  10



VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

SEMESTER EXAMINATION: November 2011

DATE OF EXAM: 07/12/2011

SEMESTER & PROGRAM: FYBTech Sem-I

TIME: 10am to 1pm

TIME ALLOWED:

3 HRS.

MARKS: 100

COURSE (CourseCode) : Computer Programming

Instructions:

1. All questions are compulsory.
2. Clarity of programs is essential.
3. All sub-questions must be written together.

Q.1 Do as directed. (All sub-questions must be written together.)

(a) Fill in the blanks. 5

- i) If a class is derived in protected mode then the protected and public members of base class becomes \_\_\_\_\_ in derived class.
- ii) When string is stored in char array, \_\_\_\_\_ character is used in following byte.
- iii) When there is local variable and global variable within program with same name, \_\_\_\_\_ variable gets preference within function.
- iv) When argument is sent by reference call statement always contains a \_\_\_\_\_.
- v) Static member function can access only \_\_\_\_\_ data members of the class.

(b) State true or false giving reason. Credit will be given only with correct 5 reason.

- i) If we replace a class keyword by struct in OOP then program will run in the same way.
- ii) The two declarations int area(float); and void area(float); are overloaded functions.
- iii) Function returning structure variable can be called in output statement.
- iv) Static data member is created along with other data members for each object.
- v) Operator overloading is example of run time polymorphism.

(c) What is the output of following codes? Support your answer either by 10 calculation or by justification.

```
i) #include<iostream.h>
int x=10;
void f(int*,int);
void main()
{
    int a=22,b=44;
    f(&a,&b);
    cout<<endl<<a<<'\'t'<<b<<'\'t'<<x;
}
```

```
void f(int* p, int x)
{
    *p=100;
    p=&x;
    cout<<x<<'\'t'<<*p;
}
```

PTO

```

ii) #include<iostream.h>
class example
{
protected:
    static int a;
    int b;
public:
    example(int n=0){a++;b=n;}
    example(int m,int n) {a=m,b=n;}
    void display()
    {cout<<endl<<a<<'t'<<b;}
    int value() {return a;}
};

```

```

int example::a;
void main()
{
example x;
cout<<x.value();
example y(10);
y.display();
example z(20,100);
z.display();
}

```

**Q.2 (a) Attempt any two (All sub-questions must be written together.)**

**20**

- What are the similarities in constructors and destructors compared to other member functions. Differentiate between them in tabular format.
- What are storage classes. Give one programming example to demonstrate the same.
- Explain all types of inheritance.

**Q.3 (a) Attempt any four (All sub-questions must be written together.)**

**20**

- State the differences between function overloading and function overriding.
- What is this pointer? Where it is used.
- Explain the concept of default arguments with programming example.
- WAP to reverse a given string.
- Explain all bitwise operators.

**Q.4 (a) Attempt any two (All sub-questions must be written together.)**

**20**

(a) Write a complete program for following main() function where 'dist' is a class having data members 'ft' and 'inch':

```

void main()
{
    dist d1,d2,d3;
    d1.input();d2.input();
    if(d1==d2)
        cout<<"Two distances are same";
    d1+=d2;//add d2 in d1
    d3=d1++/*Assign d1 to d3 and then
               increment members by 1*/
    d3.display();
}

```

- (b) WAP to input title & author for n books and output them in order of title.  
(c) WAP to multiply two rectangular matrices after applying condition.

**Q.5** Write a OOP to input and sort an integer array. Provide menu driven operations for output, searching, insertion of new element..and deletion of existing element.

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# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

MATUNGA, MUMBAI- 400019

|                      |   |                      |              |   |              |
|----------------------|---|----------------------|--------------|---|--------------|
| SEMESTER EXAMINATION | : | Nov 2014             | DATE OF EXAM | : | 3/12/14      |
| SEMESTER & PROGRAM   | : | II F.Y.BTech         | MARKS        | : | 100          |
| TIME ALLOWED         | : | 3 HRS.               | TIME         | : | 9:30 - 12:30 |
| COURSE (Course Code) | : | Computer Programming |              |   |              |

- Instructions**
- 1 Read the Questions carefully.
  - 2 All questions are compulsory.
  - 3 All questions carry equal marks.
  - 4 Figures to the right indicate full marks.
  - 5 All sub-questions must be written together.

| Q. 1 | Answer any FOUR of the following  | 20M |
|------|---|-----|
| 1    | Explain aggregation with suitable code.   |     |
| 2    | Write C++ Program To Find first N Prime Numbers.  |     |
| 3    | What is array? Write a program to accept integers from user and print only those elements which are greater than average.   |     |
| 4    | Write short note on constructor and destructor.   |     |
| 5    | Explain polymorphism with detail description of function and operator overloading concepts.   |     |
| 6    | <b>Write the output of the following program:</b><br><pre># include &lt;iostream.h&gt; int func(int &amp;x, int y = 10) { if (x%y == 0) return ++x; else return y--; }  void main() { int p=20, q=23; q=func (p,q); cout &lt;&lt; p &lt;&lt; " " &lt;&lt; " " &lt;&lt; q &lt;&lt; endl; p=func (q); cout &lt;&lt; p &lt;&lt; " " &lt;&lt; " " &lt;&lt; q &lt;&lt; endl; q=func (p); cout &lt;&lt; p &lt;&lt; " " &lt;&lt; " " &lt;&lt; q &lt;&lt; endl; }</pre> |     |
| Q. 2 | Answer the following  |     |
| 1    | What is recursive function? How it is different from normal function?<br>Write a C++ program for find factorial of number using function recursion.   | 10M |
| 2    | Explain with example what is abstract class and virtual function.   | 10M |

|                       |  |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
|-----------------------|--|------------|--------------------------|-------|---------------|-----------------------|-------------------------------------|---------|---|----------|--|-----------|----------------------------|------------|--|-----------|--|---------------|---|------------|
| <b>Q. 3</b>           | <b>Answer any TWO of the following</b>   |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| 1                     | <p>Write a C++ Program that computes and displays the charges for patient's hospital stay. First, the program should ask if the patient was admitted as an in-patient or out-patient. If the patient was an in-patient , the following data should be entered:</p> <ol style="list-style-type: none"> <li>1.The number of days spent in the hospital</li> <li>2.The daily rate</li> <li>3.Hospital medication charges</li> <li>4.Charges for hospital Services (Lab tests, etc.)</li> </ol> <p>The program should ask for the following data if the patient was an out-patient:</p> <ol style="list-style-type: none"> <li>1. Charges for hospital services (Lab tests, etc.)</li> <li>2.Hospital medication charges</li> </ol> <p>The program should use two overloaded functions to calculate the total charges. One of the functions should accept arguments for the in-patient data, while the other function accepts arguments for out-patient information. Both functions should return the total charges.</p> | <b>10M</b> |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| 2                     | <p>Define a class batsman with the following specifications:</p> <p>Private members:</p> <table> <tr> <td>bcode</td> <td>4 digits code number</td> </tr> <tr> <td>bname</td> <td>20 characters</td> </tr> <tr> <td>innings, notout, runs</td> <td>integer type</td> </tr> <tr> <td>batavg</td> <td>(it is calculated according to the formula) :</td> </tr> <tr> <td>batavg</td> <td>=runs/(innings-notout)</td> </tr> <tr> <td>calcavg()</td> <td>Function to compute batavg</td> </tr> </table> <p>Public members:</p> <table> <tr> <td>readdata()</td> <td>Function to accept value from bcode, name, innings, notout and invoke the function</td> </tr> <tr> <td>calcavg()</td> <td></td> </tr> <tr> <td>displaydata()</td> <td>Function to display the data members on the screen.</td> </tr> </table>  | bcode      | 4 digits code number     | bname | 20 characters | innings, notout, runs | integer type                        | batavg  | (it is calculated according to the formula) : | batavg   | =runs/(innings-notout)                                     | calcavg() | Function to compute batavg | readdata() | Function to accept value from bcode, name, innings, notout and invoke the function | calcavg() |  | displaydata() | Function to display the data members on the screen. | <b>10M</b> |
| bcode                 | 4 digits code number   |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| bname                 | 20 characters  |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| innings, notout, runs | integer type   |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| batavg                | (it is calculated according to the formula) :  |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| batavg                | =runs/(innings-notout)   |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| calcavg()             | Function to compute batavg   |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| readdata()            | Function to accept value from bcode, name, innings, notout and invoke the function   |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| calcavg()             |  |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| displaydata()         | Function to display the data members on the screen.  |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| 3                     | <p>Define a class REPORT with the following specification:</p> <p>Private members :</p> <table> <tr> <td>adno</td> <td>4 digit admission number</td> </tr> <tr> <td>name</td> <td>20 characters</td> </tr> <tr> <td>marks</td> <td>an array of 5 floating point values</td> </tr> <tr> <td>average</td> <td>average marks obtained</td> </tr> <tr> <td>GETAVG()</td> <td>a function to compute the average obtained in five subject</td> </tr> </table> <p>Public members:</p>   | adno       | 4 digit admission number | name  | 20 characters | marks                 | an array of 5 floating point values | average | average marks obtained                        | GETAVG() | a function to compute the average obtained in five subject |           |                            |            |  |           |  |               |   |            |
| adno                  | 4 digit admission number   |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| name                  | 20 characters  |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| marks                 | an array of 5 floating point values  |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| average               | average marks obtained   |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |
| GETAVG()              | a function to compute the average obtained in five subject   |            |                          |       |               |                       |                                     |         |   |          |  |           |                            |            |  |           |  |               |   |            |

|             |          |  |            |
|-------------|----------|--|------------|
|             |          | READINFO() function to accept values for adno, name, marks. Invoke the function GETAVG()<br>DISPLAYINFO() function to display all data members of report on the screen.<br>You should give function definitions.   |            |
| <b>Q.4</b>  |          | <b>Answer the following.</b>   |            |
|             | <b>1</b> | Explain inheritance and give detail description of all types of inheritance with block diagram representation.   | <b>10M</b> |
|             | <b>2</b> | Write a C++ Program to implement following hierarchy.  | <b>10M</b> |
|             |          | <pre> graph TD     Father[Father] --- Line1[ ]     Mother[Mother] --- Line1     Line1 --- MySelf[MySelf]     Line1 --- Mysister[Mysister]   </pre>   |            |
| <b>Q. 5</b> | <b>1</b> | A leading travel agency has decided to develop application package to help its customers in planning tours. The agency provides services like air, railway, luxury, coach, hotel booking etc. Many a times customers do not have idea of availability of transport services to a particular destination. The agency also gives advice regarding economical planning of vacation/tour. Given the tour constraints like number of days, affordable cost & places to visit the software should present alternative tour plans . Alternatively the software may be just used for querying to know availability of transport services, hotels etc. Besides these main objectives the software should also have facilities for billing & accounting for the agency. You are appointed as a consultant to develop implementation strategy for the <i>automated tourist system</i> .<br><br>Construct Class Diagram. | <b>10M</b> |
|             | <b>2</b> | Construct Use Case Diagram And Pseudo code for travel agency explained in Question 5.1.  | <b>10M</b> |
|             |          |  |            |

9



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

|                      |                           |              |                          |
|----------------------|---------------------------|--------------|--------------------------|
| SEMESTER EXAMINATION | May 2009                  | DATE OF EXAM | 7 <sup>th</sup> May 2009 |
| SEMESTER & COURSE    | H F Y B Tech              | TIME         | 10.30 a.m. To 1.30 p.m.  |
| TIME ALLOWED         | 3 HRS.                    | MARKS        | 100                      |
| SUBJECT :            | COMPUTER PROGRAMMING - II |              |                          |

**Instructions :**

1. All questions carry equal marks
2. Figures to the right indicate full marks
- 3.

**Q.1 A. Solve any five**

10

1. What are the main underlying concepts of object orientation?
2. The size of a char array that declared to store string should be one larger than the number of characters in the string. Why?
3. What is the application of the scope resolution operator '::' in C++?
4. Will the inline function be compiled as the inline function always? Justify.
5. How does an inline function differ from a preprocessor macro? Define a way other than using the keyword inline to make a function inline.
6. What is a dangling pointer?
7. What is the file mode? Describe the various file mode options available.

**Q.1 B. Solve the followings as per the directions given**

2x5

1. Choose the correct answer and justify.

1

```
class A
{
    int a,b;
    A() : a(0)
    {b=0;}
};
```

If you create obj of this class as A.obj;

- a) b will be initialized before a
- b) a will be initialized before b
- c) both will be initialized together
- d) none of these.

2. What is '>>' in C++

- a) right shift operator and insertion operator depend upon the use
- b) right shift operator and extraction operator depend upon the context use
- c) right shift operator and insertion/extraction operator depend upon the use
- d) none of these

3. Write statements using seekg() to achieve the following

- a) To move the pointer by 'n' positions backward from current position.
- b) To go to the beginning after an operation is over
- c) To go backward by 'n' bytes from the end
- d) To go to byte number 'n' in the file
- e) None of these

SC

Q.4.(a) i) Prove that  $\int_0^{2a} x\sqrt{2ax - x^2} dx = \frac{\pi a^3}{2}$

ii) Evaluate  $\iint_R ye^{x^3} dxdy$ ,  $R$  is a triangle having sides  $y = 2x, x = 1$  and  $y = 0$ . (8)

(b) Prove that  $\beta(m, n) = \int_0^1 \frac{x^{m-1} + x^{n-1}}{(1+x)^{m+n}} dx$  and hence evaluate  $\int_0^1 \frac{x^2 + x^3}{(1+x)^7} dx$ . (6)

(c) Evaluate  $\iint_R r^3 drd\theta$  over the area included between the circles

$$r = 2\sin\theta \text{ and } r = 2\cos\theta \quad (6)$$

OR

(c) Verify the Leibnitz rule for differentiation under the integral sign  $\int_a^{a^2} \log(ax) dx$  (6)

Q.5.(a) Solve  $(D^2 - 2D)y = e^x \cos x$ . By using

i) Method of variation of parameter.

ii) Method of undetermined coefficient.

Do the solution differ by Two different Method? (8)

(b) Evaluate  $\int_0^\infty \int_0^\infty \int_0^\infty \frac{dxdydz}{(1+x^2+y^2+z^2)^2}$  Using Spherical polar coordinate. (6)

(c) The density at any point of the cardiode  $r = a(1 + \cos\theta)$  varies as the square of its distance from its axis, Find its mass. (6)

OR

(c) i) Change the order of integration  $\int_0^1 \int_{x^2}^{\sqrt{2-x^2}} f(x, y) dy dx$  (6)

ii) Solve  $yzp + xzq + zxy = 0$ .

← X → X ←

X

**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
**MATUNGA, MUMBAI- 400019**

SEMESTER EXAMINATION : APRIL 2014 DATE OF EXAM : 23/04/2014  
SEMESTER & PROGRAM : II F.Y.BTech MARKS : 100  
TIME ALLOWED : 3 HRS. TIME : 9:30 - 12:30  
COURSE (Course Code) : Computer Programming - CO 0001

**Instructions**

- 1 Read the Questions carefully.
- 2 Answer any 5 questions.
- 3 All questions carry equals marks.
- 4 Figures to the right indicate full marks.
- 5 All sub-questions must be written together.

**Q. 1 Answer any FOUR of the following**

20M

- 1 Explain run-time error, logical error and syntax error with an example.
- 2 Create a Structure Employee and consists of Employee details such as Empno, Name, Salary. Write a program to display the employee list in the sorted order of their salary.
- 3 Compare between entry controlled and exit controlled loop. Explain with an example each.
- 4 What is structure? Compare between structure and class.
- 5 What is polymorphism? Explain different type of polymorphism.
- 6 Write a program to copy the content of one FILE to another FILE.

**Q. 2 Answer any TWO of the following**

20M

- 1 Write a C++ program for multiplying matrix of any dimension.
- 2 Library related activities like borrowing books, returning books or viewing the available books at the library is currently done manually (paper based work) in most of the libraries. The student has to go to the Library and check the available books at the Library. Students check the list of books available and borrow the books if the book is available. Then the librarian makes manual entry on the Library card issued to the student and allows the member to check out the book. The searching of booking and maintaining the records become difficult due to lack of a database.

Online Library Management System involves using Online Library Management System for searching book, issuing book, and returning book. Online Library Management System has a login and registration interface. User can login to the system and view or get book details. The System allows to search the book on the basis of Author name, Book ID, Book Name. Users of the System are Students and Staff. Librarian acts as Administrator and he manages and has control over the System. Privileges regarding Issue book, renew book, view book status, update book status are allowed to Librarian. Users are allowed with the privileges as searching book, and viewing book status. System assigns User ID to the User, and if new book added to the Repository then the book is assigned book ID. If

book is available in the Library and Number of books issued to the User does not cross the Maximum limit then it is issued to the requesting User. On returning the book by the user, system checks the due date of the book. If due date is crossed then fine is calculated by the System and user pays fine to the Librarian.

- a. Write class diagram for the complete system and user-login,
  - b. Give the algorithm for searching book in library.
- 3 Define a class String that could work as a user-defined string type. Include constructors that will enable us to create an uninitialized string S1; and also to initialize an object with a string constant at the time of creation like: String S2 ("GOOD MORNING!");  
Include a function that adds two strings to make a third string. The statement S2=S1 will copy one string to another string should also present.  
Write a program to do the following task:
- a. Create objects with string constants.
  - b. Concatenate two strings and display the same.

**Q. 3 Answer any TWO of the following** 20M

- 1 Write a program to arrange the numbers in ascending order using bubble sort technique
- 2 The program consists of 3 classes namely person, student and exam. Here the class person is the base class, student is the intermediate base class and exam is the derived class. The student class inherits the properties of the person class whereas the exam class inherits the properties of the student class (directly) and properties of the person class (indirectly)
- 3 Explain different types of operator with an example.

**Q.4 Answer the following** 20M

- 1 Explain single-level and hybrid inheritance with an example.
- 2 Write a C++ program that makes use of a static member variable to keep track of the number of objects (of a particular class type) that are in existence. And even show difference when we use static counter and normal counter (i.e. counter is set to 0 when particular object is destroyed using normal counter).

**Q. 5 Answer the following** 20M

- 1 Write a program to sort a list of strings into alphabetical order using an array of pointers. Write a function called sort pointer to which length of the string and array of pointer parameter is given.
- 2 What is file? Explain different stream classes with an example program.

# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

MATUNGA, MUMBAI- 400019

|                      |                      |              |                           |
|----------------------|----------------------|--------------|---------------------------|
| SEMESTER EXAMINATION | MAY 2013             | DATE OF EXAM | 24 <sup>th</sup> May 2013 |
| SEMESTER & PROGRAM   | I.F.Y.BTech          | MARKS        | 100                       |
| TIME ALLOWED         | 3 HRS.               | TIME         | 9:30am to 12:30pm         |
| COURSE (Course Code) | Computer Programming |              |                           |

- Instructions**
- 1 Read the Questions carefully.
  - 2 All questions are compulsory.
  - 3 All questions carry equals marks.
  - 4 Figures to the right indicate full marks.
  - 5 All sub-questions must be STRICTLY written together.

**Q. 1** Answer any **FIVE** of the following questions.

- (A) Explain the steps involved in the execution of a program using system programming [4M]  
(B) Write a C++ program for the multiplication of two matrices of the 3x3 order. [4M]  
(C) Explain the difference between do-while loop and while loop. [4M]  
(D) Write a C++ program to sort the elements of array in ascending order using Bubble Sort. [4M]  
(E) Explain prefix and postfix Incrementer with an example. [4M]  
(F) WAP to convert a decimal number to its binary equivalent using recursive function. [4M]  
(G) Explain the following concepts with suitable illustrations:  
(a) Persistence [4M] (b) Polymorphism

**Q. 2** Answer any **TWO** of following questions.

- (A) Explain the following concepts with the help of suitable programs. [10M]  
(a) Pass by value (b) Pass by reference  
(B) What is operator overloading? Write a C++ program to read two matrices and add them using operator overloading. [10M]  
(C) Construct the class diagram for the following case study. Clearly specify [10M]  
class names, attributes and its methods.

The rental company (Private or government) rents or sells the vehicles. Each branch of the car rental company owns cars & offers car sales. Customers make rental-booking reservations by providing information link the category of the cars & rental periods. Booking clerk of the bank branch office may validate the customer for the reservation of the vehicle to rent or sell him depending upon his/her credit. The Branch Manager may purchase/sell cars & may produce the Booking Report. Customers may have experienced bad situations during their rental periods. A black list is built to include customers who had frequent bad experiences. Customer's sub-types are black list customers & frequent travelers. The cars are sold to clients who keep an account with the company. Accounts can be of 2 types: loans & Credit card accounts. Each Account can be operated upon by means of one or more transactions. Transactions also comprise 2 types:

Branch & Adjustment transactions. We take the account car rental company branches providing services like rental bookings & car deliveries. Branches are characterized in a simplified way by their street address & their location in the town. Towns, in which also, the Customers live, lie in the Counters. Towns & Countries are recorded with their names & populations. Branches own a set of Cars characterized by chassis number & equipment Category. Customers ask for the Bookings of the cars in a Certain Category & Certain time Period. After the start date, bookings are associated with the Car, which has been delivered to the Customers. The Director of head Office of the bank maintains the Car groups; Set rates & assign branches to the service departments. The Clerk of the Service Department accepts Service of the car for its maintenance. A department manager schedule the service of the Car to maintain the Service History.

**Q.3** Answer any TWO of following questions.

- (A) Define structure within structure consisting of the following elements: [10M]
- (I) Employee code
  - (II) Employee name
  - (III) Employee salary
  - (IV) Employee date\_of\_joining
- Write a C++ program to read at least 10 records and display them in alphabetical order.
- (B) What is a destructor? What are the rules governing the declaration of a destructor? Explain with the help of a suitable programming example. [10M]
- (C) Create a class publication that stores the title and price of a publication. Create other class sales that hold an array of 3 floats so that it can record the sales of a particular publication for the last 3 months. From these two classes, derive a new class book that holds pages of integer type. Each of these classes should have the member functions ReadData() and DisplayData(). From the publication and sales classes, derive the tape class which adds playing time in minutes. Create another class pamphlet from publication which has no features of its own. Derive a class notice from pamphlet class having data members char whom[20] and member functions ReadData() and DisplayData(). Assume required data members and member functions and clearly specify each.  
Construct the skeletal Class diagram to represent the inheritance hierarchy, hence write a C++ program for the required facilities.

**Q.4** Answer the following questions.

- (A) (I) What are friend classes and friend functions? Explain with suitable C++ program. [10M]
- (II) Write an Object Oriented C++ program to create the payslip for  $n$  employees, with the following data read from the keyboard:

|                        |                      |                     |
|------------------------|----------------------|---------------------|
| <i>Employee number</i> | <i>Employee name</i> | <i>Designation</i>  |
| <i>Basic pay</i>       | <i>LIC deduction</i> | <i>PF deduction</i> |

The DA is 40% and HRA is 25% of the basic pay. Gross Salary and Net

Salary are formulated as

$$\text{Gross} = \text{basic} + \text{DA} + \text{HRA}$$

$$\text{Net} = \text{Gross} - \text{deductions}$$

The payslip should be displayed as:

| Emp_no. | Emp_name | Basic | DA | HRA | LIC | PF | Gross | Net |
|---------|----------|-------|----|-----|-----|----|-------|-----|
|---------|----------|-------|----|-----|-----|----|-------|-----|

OR

- (A) Write an Object Oriented C++ program for Shop Management to meet the requirements given.

[20M]

The motor parts shop deals with a large number of motor parts of various manufacturers and different vehicle types. Some of the motor parts are very small and some are of reasonably large size. The shop owner stocks different parts in wall-mounted, numbered racks. The shop owner maintains as small an inventory for each item as is reasonable with a view to reducing inventory overheads. The one important problem that the shop owner faces is to be able to order an item as soon as quantity in the inventory falls below a threshold value. The shop owner wants to stock parts to be able to sustain selling for about one week. Calculate the threshold value for each item. The software must be able to calculate the average daily sale of each part for one week. At the end of each day the shop owner would request the computer to generate the items to be ordered. The computer should print out the part number, the quantity required and the address of the vendor supplying the part.

Q. 5

Answer the following questions.

- (A) Develop an object oriented C++ program to create a library information system with the following information read from the keyboard.

[20M]

|                   |
|-------------------|
| Accession number  |
| Title of the book |
| Publisher's name  |

|                     |
|---------------------|
| Name of the author  |
| Year of publication |
| Cost of the book    |

Design a base class with data members accession number name of the author and title of the book. Another base class consists of data members: year of publication and publisher's name. The derived class consists of cost of the book.

Using file handling concepts, write a C++ program for the following requirements:

- (i) Build a master file
- (ii) Insert an entry of the new book
- (iii) Delete old entry of the book
- (iv) Modify the entry if the wrong entry is made
- (v) Search for a particular record



**Veermata Jijabai Technological Institute**  
Matunga, Mumbai - 400 019

**End-Semester Test**

**Class : FY(Btech) Semester : I**

**Subject : COMPUTER PROGRAMMING**

D. 29-12-2010

**Marks: 100**

**Duration: 3hrs**

2:00 pm to 5:00 pm

**Instructions:**

1. All questions are compulsory.
2. Clarity of programs is essential.

**Q.1. Do as directed. (All sub-questions must be written together.)**

**(a) Fill in the blanks.**

- i) When there are several return statements within function body, function terminates at \_\_\_\_\_ return statement.
- ii) Private data is hidden in class. This principle of OOP is called as \_\_\_\_\_.
- iii) Struct is same as class, except that members are \_\_\_\_\_ by default.
- iv) When member of one class is the object of other class, it is called as \_\_\_\_\_.
- v) In multipath inheritance, to avoid duplicate copy of base class members, the intermediate base classes are declared as \_\_\_\_\_.

**(b) State true or false giving reason. Credit will be given only with correct reason. 5**

- i) When break statement is used in nested loops control comes out of both loops.
- ii) When two dimensional array is sent to function, argument in definition contains size in second [ ].
- iii) Friend function can be defined in class.
- iv) In copy constructor is always sent by reference.
- v) Protected members are accessible to objects of the same class.

**(c) What is the output of following codes? If code is not executable, state errors. 10**

```
i) #include<iostream.h>
int& sample(int b, int& a, int* p)
{
    a=a==b;
    cout<<p[2]<<'\'t'<<*(++p);
    return a;
}
void main()
{
    int a=10,b=20, A[]={2,4,6,8,10};
    if(sample(a,b,A)) cout<<'\n'<<A[0]<<'\'t'<<A[4];
    else cout<<'\n'<<a<<'\'t'<<b;
}
```

PTO

4/3

```

ii) #include<iostream.h>
class sample
{
private:
    int a;
protected:
    int b;
public:
    sample(int m,int n)
        {a=m;b=n;}
    void display()
        {cout<<endl<<a;}
};

class example : public sample
{
private:
    static int d;
public:
    example(int m,int n=0):sample(m,n)
        {d+=10;}
    void display()
        {cout<<endl<<b<<'t'<<d;}
};

int example::d;
void main()
{
    example x(100,200);x.display();
    example y(50);y.display();
    sample z(150,300);z.display();
}

```

**Q.2 (a) Attempt any two (All sub-questions must be written together.)**

8

- i) Explain bitwise shift operators << and >> giving one example each.
- ii) Explain switch statement as a difference from nested if else.
- iii) What is output of following program. Convert while loop into do while loop for same output and rewrite the program:

```

#include<iostream.h>
void main()
{
    int x=10,y=10;
    while(x>0)
        cout<<(x-=3)<<'t';
        y+=x;
    cout<<x<<'t'<<y;
}

```

**(b) Attempt any two**

12

- i) WAP to delete characters in string from position p to q (p<q)
- iii) WAP to output first 25 fibonacci numbers using recursive function.
- ii) WAP to output following number pyramid using single for loop for output of one line:

```

          0
          1   1
         2   0   2
        3   1   1   3

```

**Q.3 (a) Attempt any one (All sub-questions must be written together.)**

4

- i) What is run time polymorphism.
- ii) What is hybrid inheritance.

2/3

**(b) Attempt any two**

- What is friend function? When operator function is used as friend function? WAP to add members of two objects belonging to two different classes using friend function.
- What is sending argument by reference? Explain with programming example, how it is used in C and C++.
- For following class, define constructors and destructors:

class matrix

```
{
private:
    int **A,m,n;
public:
    matrix(int,int);
    matrix(matrix&);
    void input();
    void output();
    ~matrix();
};
```

**Q.4**

20

**Attempt any two (All sub-questions must be written together.)**

- (a)** What is constructor overloading? Write a class program for following: `main()` function:

```
void main()
{
    timex t1(5,30,50),t2(6,40);
    timex t3;
    t3=t1+t2;
    t1.display(); t3.display();
}
```

- 'timex' is class keeping time in hr, min and sec.
- The output should be as follows:  
12:10:50  
12:10:50

- (b)** Write a class for following string operations:  
Input, output, string copy, string concatenation and string length.  
Do not use standard functions for last three operations.

- (c)** WAP to input name, code no and salary for n employees and output them in order of salary. Include a function for searching the employee on the basis of name.

**Q.5**

20

- Write a OOP to carryout following operations on square matrix:  
Input, output, transpose, multiplication, checking for symmetry, interchanging two given rows, sum of diagonal elements.

\*\*\*\*\*

3/3





**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra state ]  
Matunga, Mumbai-400019

SEMESTER EXAMINATION APRIL 2015

SEMESTER & COURSE II SEM.FYBTECH

SUBJECT(Code): Applied Chemistry- II (CH1021T)

DATE OF EXAM: 24/04/2015

TIME ALLOWED 3 HRS

MAX MARKS : 100

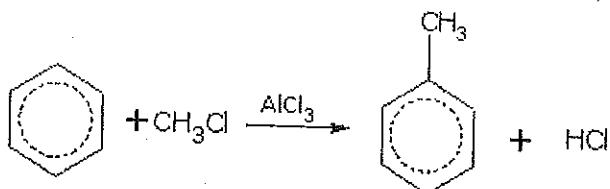
Instructions:

1. All questions are compulsory.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary.
5. Illustrate your answers with neat sketches wherever necessary.

{Atomic weights: H=1, C=12, N=14, O=16, S=32, Cl=35.5, Al=27}

- Q.1 (a) Rewrite following statements by *filling in the blanks.* (10)
- i) Two mild steel pieces connected by soldering corrosion occurs at .....
  - ii) .....are the most widely used coals in the world.
  - iii) In .....battery, anode is intermetallic compound.
  - iv) The core of a fiber optic cable is made of .....
  - v) Liquid crystal state is also referred as .....state.
  - vi) .....types of composites replaces asbestos in automotive brakes and clutches.
  - vii) .....is an example of 2-D nano material.
  - viii) Addition of I<sub>2</sub> in conjugated polymers give..... polymers.
  - ix) In Bhopal gas tragedy .....principle of green chemistry was violated.
  - x) Mixture of amino acids is separated by.....technique.
- (b) Answer the following in *short.* (10)
- i) Write the Principle of Green Chemistry applied in "Synthesis of Indigo from L-Tryptophane in place of Aniline".
  - ii) Write any two structural features necessary for formation of LCP.
  - iii) Arrange following petroleum fractions in order of their increasing boiling points - Diesel, kerosene, LPG, lubricating oil.
  - iv) Why an UV Visible spectrum is always broad.
  - v) Which method of synthesis of nanomaterials is better Top-down or Bottom-up & why?
- Q.2 Answer the following:
- (a) Draw a neat labeled diagram of the cathodic coating showing the coating metal broken at some part. Compare chemical and electrochemical corrosion. (6)
  - (b) Following data is obtained in a bomb calorimeter, Mass of fuel=0.85 g, Mass of water =2000 g, water equivalent of calorimeter = 540 g difference in temperature =1.9° C, Cooling correction = 0.041°C, fuse wire correction = 3.8 cals, acid correction = 48.8 cals. Calculate the N.C.V. of fuel if it contains 3.6% hydrogen. (4)
  - (c) What are CNTs? Explain any one electrical & one mechanical property of a material when it approaches nanoscale. (5)
  - (d) Write the principle of spectroscopy? Draw neat labeled diagram of uv-visible double beam spectrophotometer. (5)

- Q.3** Answer the following:
- Discuss construction & working of a NiCd battery. What are the advantages of NiMH battery? (6)
  - When the Lead is present in sulphuric acid medium the rate of corrosion decreases. State True or false and justify your statement. By electrolytic method Ag is deposited on a metallic vessel of surface area 900 cm<sup>2</sup> by passing a current of 0.1 A for 6 hours. Calculate the thickness of Ag deposited. (Atomic mass of Ag = 107.92 amu and density of Ag = 10.5 g/cm<sup>3</sup>) (4)
  - Compare thermal cracking and catalytic cracking. (5)
  - What are the applications of glass based optical fibres? Classify conducting polymers with e.g. (5)
- Q.4** Answer the following:
- Draw a neat labeled diagram of fractionating column in petroleum refining. 2.5 g of coal was taken in a silica crucible and heated in oven at 110° C for 1 hour. The weight after heating was 2.368 g. Next the crucible was covered with lid & was strongly heated for 7 minutes at 950° C. the residue weighed 1.75 g. The crucible was then heated without cover till constant weight was obtained. The last residue weighed 0.95 g. Calculate the % results of analysis. (6)
  - Define R<sub>f</sub> value. Give its significance. Write any two applications of TLC. (4)
  - Compare glass fibre and aramid fibre reinforced composites. Write any two applications of composites. (5)
  - Compare galvanic and inter granular corrosion (5)
- Q.5** Answer the following:
- What is aviation gasoline? State any two methods to improve octane rating of gasoline. (6)  
3.2 g of coal in Kjeldahl's experiment evolved NH<sub>3</sub> which was absorbed in 40 mL of 0.5 N H<sub>2</sub>SO<sub>4</sub>. After absorption the excess acid required 16 mL of 0.5 N KOH for complete neutralization. 2.5 g of coal sample in quantitative analysis gave 0.42 g BaSO<sub>4</sub>. Calculate % of N and S in the sample.
  - Write the reactions involved in working of Li-ion battery. (4)
  - With any three examples justify the selection of materials reduces the corrosion Name and give one example for the ingredient of paint which gives the protective function to the paint. (5)
  - What is 'Atom Economy'? How is that significant? (5)  
Calculate % Atom economy for toluene in following reaction,





**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
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Mumbai, Mumbai-400 019

**SEMESTER EXAMINATION**

**SEMESTER & PROGRAM**

F.Y.B. Tech. 1<sup>st</sup> Sem.

**DATE OF EXAM**

30 - 03-2014

**TIME ALLOWED**

3 HRS

**TIME**

9.30 a.m. - 1.30 p.m.

**COURSE (Course Code)**

**APPLIED CHEMISTRY-II (CH0002)**

**MARKS**

100

**Instructions**

1. All questions carry equal marks.
2. Figures to the right indicate full marks.
3. Draw neat and labeled sketches wherever required.

**Q.1. Attempt the following:**

(10)

- a) Why a metallic surface corrodes but a glass surface do not? State the types of metal oxide film formed with one example.
- b) Write the composition & properties of the alloy used for making bearings, gears and springs. Why stainless steel shows good corrosion resistance?
- c) TEL is always used along with ethylene di-bromide as anti-knocking agents. Cracking is done for straight run gasoline. Justify the reason for the above.
- d) A sample of coal was analyzed as follows. 1.00g of an air-dried coal sample was weighed in a silica crucible. After heating for 1 hr at 105-110°C, the dry coal residue weighed 0.985g. The crucible was covered with a vented lid and then heated strongly for exactly 7 min's at 950±20°C. The residue weighed 0.800g. The crucible was then heated strongly in air, until a constant weight was obtained. The last residue was found to weigh 0.100g. Calculate the percentage results of the above analysis.
- e) Why nano materials show the characteristic properties? Write the characteristic structure of fullerenes.

**Q.2.**

- a) Draw a neat and labeled diagram of the fractionating tower for refining of petroleum. Tabulate the distilled fractions obtained and their corresponding boiling temperatures.

(10)

Calculate the gross and net calorific value of coal having the following compositions: carbon = 70.5%, hydrogen = 4.9%, sulphur = 0.6%, nitrogen = 2% and ash = 4%, assuming that latent heat of steam = 600 cals/g.

- b) How solar energy can be utilized as an alternate source of energy. Discuss the current status of harnessing solar energy for power generation in India.

(10)

**OR**

State four limitations of harnessing hydro energy. Discuss the current status of harnessing wind energy for power generation in India.

- c) Draw two poor designs leading to corrosion of metals and the corresponding good designs to minimize the problem. Justify your selection.  
Justify the following statement:

(10)

- (i) Faster corrosion of impure metal than pure metal.
- (ii) Fast rusting of iron in saline water than in ordinary water

- d) How electrochemical series differ from galvanic series? A metallic piece weighing 200 g to be plated with 5% of its weight with gold. If the strength of

(10)

current is 200 amps, how long will it take to deposit the required amount of gold? Atomic weights of gold and hydrogen are 197.1 & 1.008 respectively, and ECE of hydrogen =  $0.1044 \times 10^{-4}$  g/c.c.

- Q.3. a) With the help of a diagram and reactions, describe the working of a lithium-ion battery. How does it differ from nickel based battery? (06)
- b) State the types of carbon steel with their composition. What are solder alloys? Write their composition and properties. (04)
- c) Draw a neat and labeled diagram of the cross-sectional view of the bomb calorimeter. While determining the calorific value of a fuel by bomb calorimeter, what necessary corrections should be made? (06)
- On burning 0.996g of coal in a bomb calorimeter, the temperature of 2490 g of water rose by  $2.592^{\circ}\text{C}$ . The weight of the bomb calorimeter apparatus was 3900 g and the mean specific heat of the apparatus was 0.099 cal/g. If the fuel contained 6% of hydrogen, calculate its lower calorific value assuming 587 cal/g as the latent heat of steam. (06)
- d) What are the limitations of fossil fuels? State two advantages and two limitations of wind energy as an alternative source. (04)
- Q.4. a) What is knocking of gasoline engine? How is it measured quantitatively? Why are two different scales required to measure knocking in diesel and gasoline engines? (06)
- b) What are the causes and sources of water pollution? (04)
- 25 mL of sewage water sample was refluxed with 10 mL of 0.25N  $\text{K}_2\text{Cr}_2\text{O}_7$  solution in presence of dil.  $\text{H}_2\text{SO}_4$ . The unreacted dichromate required 5.5 mL of 0.1 N FAS solution. 10 mL of same  $\text{K}_2\text{Cr}_2\text{O}_7$  solution & 25 mL of distilled water under same condition as the sample required 26 mL of FAS of 0.1 N. Calculate COD of sample. (06)
- c) What are the four major components of paints? Give their functions and one example of each. (06)
- 1.56g of the coal was kjeldahlized and  $\text{NH}_3$  gas thus was absorbed in 50mL of 0.1N  $\text{H}_2\text{SO}_4$ . After absorption the excess acid required 6.25mL of 0.1N NaOH for exact neutralization. Calculate the percentage of N in the coal sample. (06)
- d) Explain the sources and effects of radioactive pollution. What steps can be taken to minimize their effects. (04)

**OR**

What are the environmental hazards due to the different components of e-waste? How can e-waste pollution be controlled?

- Q.5. Differentiate between any four of the following (20)
- a) Primary cell vs. secondary cell.
- b) Renewable and Non-Renewable energy
- c) Brass and Bronze
- d) Octane rating vs. cetane rating
- e) Gross calorific value vs. Net calorific value



## VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

SEMESTER EXAMINATION

SEMESTER & PROGRAM

TIME ALLOWED

COURSE (Course Code)

ESE, MAY/2013

F.Y.B. Tech. II Sem.

3 HRS.

APPLIED CHEMISTRY-II (CH0002)

DATE OF EXAM

17/05/2013

TIME 9.30 a.m. to 12.30 p.m.

MARKS

100

Instructions 1. All questions carry equal marks.

2. Figures to the right indicate full marks.

3. Draw neat and labeled sketches wherever required.

Q 1. Attempt the following:

(20)

- How does dust accumulation on a metal surface lead to increased rate of corrosion? How can we prevent it?
- What is single electrode potential? Calculate the electrode potential of the  $\text{Sn}^{2+} + 2e \rightarrow \text{Sn}$  when  $[\text{Sn}^{2+}] = 0.5\text{M}$ . ( $E^{\circ}_{\text{Sn}^{2+}/\text{Sn}} = -0.14\text{V}$ )
- What are the chemical reactions causing acid rains? What are the effects of acid rain?
- A sample of coal was analyzed as follows: Exactly 2.5 g was weighed in a sintered crucible. After heating for 1 h at 110 °C, the residue weighed 2.415 g. The crucible was next covered with a vented lid and strongly heated for exactly 7 minutes at 950 ± 20 °C. The residue weighed 1.528 g. The crucible was then heated without the cover, until a constant weight was obtained. The last residue was found to weigh 0.245 g. Calculate the percentage results of the above analysis.
- What are carbon nanotubes? State their types and justify their applications as catalysts.

Q 2. a) Draw a neat and labeled two-step diagram for Kjeldahl's method of nitrogen estimation in coal. A gas has the following composition by volume:  $\text{H}_2 = 22\%$ ,  $\text{CH}_4 = 4\%$ ,  $\text{CO} = 20\%$ ,  $\text{CO}_2 = 6\%$ ,  $\text{O}_2 = 3\%$  and  $\text{N}_2 = 45\%$ . Calculate 1) the minimum amount of oxygen required theoretically for complete combustion for 1 m<sup>3</sup> of the gas; 2) the volume of air required if 25% excess is used for combustion of 1 m<sup>3</sup> of the gas, 3) the corresponding weight of air. Molar mass of air = 28.94.

(06)

- b) State four limitations of geothermal energy. Discuss the current status of harnessing wind energy for power generation in India.

OR

What are the requirements of a fuel element in a nuclear reactor? What are the functions of control rods?

- c) Illustrate the reactions involved in differential aeration corrosion with reference to iron metal. Why is stainless steel not used to build sea-going ships?

(04)

(06)

- d) Following results were obtained by conductance measurements of potassium sulphate using the cell with cell constant 0.2281. The observed conductance of the potassium sulphate solution is  $3 \times 10^{-3}$  mho. The equivalent conductance of the solution is 140 mho  $\text{cm}^2$  eqvt $^{-1}$ . Calculate the specific conductance and the concentration of the potassium sulphate solution. (04)

- Q 3. a) With the help of a diagram and reactions, describe the working of a  $\text{H}_2\text{-O}_2$  fuel cell. How does it differ from a battery? (06)  
b) State the types of carbon steel with their composition. Write the properties and applications of duralumin. (04)

OR

State the properties and composition of stainless steel. What are solder alloys? Write their composition and properties.

- c) Draw a neat and labeled diagram of the fractionating tower for refining of petroleum. Tabulate the distilled fractions obtained and their corresponding boiling temperatures. (06)

On burning 0.996g of coal in a bomb calorimeter, the temperature of 2490 g of water rose by  $2.592^\circ\text{C}$ . The weight of the bomb calorimeter apparatus was 3900 g and the mean specific heat of the apparatus was 0.099 cal/ $^\circ\text{Cg}$ . If the fuel contained 6% of hydrogen, calculate its lower calorific value assuming 587 cal/g as the latent heat of steam.

- d) What are the environmental hazards due to the different components of e-waste? How can e-waste pollution be controlled? (04)

- Q 4. a) What is knocking? How is it measured quantitatively? Why are two different scales required to measure knocking in diesel and gasoline engines? (06)  
b) What are the different applications of nanomaterials in medicine and energy sciences? (04)  
c) What are the four major components of paints? Give their functions and one example of each. A zinc screw in a steel sheet will undergo extensive corrosion. On the other hand, when a steel screw is used in a zinc sheet, either of them will undergo negligible corrosion. Justify. (06)  
d) What are the limitations of fossil fuels? How can solar energy be utilized for generation of power? (04)

- Q 5. Differentiate between any four of the following (20)  
a) Electrochemical series vs. Galvanic series  
b) Nuclear fission vs. Nuclear fusion  
c) Anodic coating vs. Cathodic coating  
d) C.O.D. vs. B.O.D.  
e) Dry cell vs. Li-ion cell  
f) Diesel vs. Gasoline



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**Matunga, Mumbai-400 019**

|                      |                                     |              |                                |
|----------------------|-------------------------------------|--------------|--------------------------------|
| SEMESTER EXAMINATION | Nov./ Dec - 2005                    | DATE OF EXAM | 20 <sup>th</sup> December 2005 |
| SEMESTER & COURSE    | H / F. Y.B. Tech.                   | TIME         | 10.00 a.m. To 12.00 p.m.       |
| TIME ALLOWED         | 2 HRS.                              | MARKS        | 75                             |
| SUBJECT              | ENGINEERING CHEMISTRY – II (CH-201) |              |                                |

1. Question No. 1 is compulsory.
2. Answer any Four out of the remaining Six questions.
3. All questions carry 15 marks.
4. Figures to the right indicate marks assigned to the questions.  
[Atomic weights: H=1, C=12, N = 14, O=16, ].

**Q.1.** Attempt any Five. [15]

- [i] Why do metals corrode? What are its disadvantages?
- [ii] What is calorific value of a fuel? What is the difference between Gross & Net calorific value?
- [iii] Highlight the advantages of Aluminium as an engineering material.
- [iv] What are the advantages of adhesives over other joining methods?
- [v] What are the consequences of the depletion of ozone layer in the atmosphere?
- [vi] How does Galvanising protect iron from rusting?
- [vii] List out the tests in the ultimate analysis of coal.

**Q.2.** a. What is the basic difference between steel & alloy steels? What are their main uses? [05]

b. How are metals protected against corrosion by surface coatings? [05]

c. What are the major effects of CO, SO<sub>2</sub>, NO, Hydrocarbons & Particulates on human health? [05]

**Q.3.** a. Explain Pitting corrosion. What is its effect on the corroded metal? [05]

b. Discuss the setting & hardening of Portland cement. [05]

c. How does each of the following contribute as a source of energy – wind, tidal, geothermal, water & solar energy? [05]

**Q.4.** a. Explain the term Octane value. Why does gasoline used in internal combustion engine contain tetraethyl lead & ethylene? [05]

b. Discuss the principles involved in the operation of Trickling filters. What are the advantages & limitations of the process? [05]

c. Write a note on sacrificial anodic protection of controlling corrosion. [05]

**Q.5.** a. What are the types of Cement? Mention the difference between them? [05]

b. How do brasses differ from bronzes? What are their uses? [05]

c. A sample of coal was found to have the following percentage composition by weight: C = 75%, H = 5.2%, O = 12.1%, N = 3.2%, & ash = 4.5%. Calculate Gross & Net calorific value of a coal sample using Dulong's formula. [05]

**Q.6.** a. Give the composition of LPG & Coal gas. What are the advantages of gaseous fuels? [05]

b. What is electro-chemical corrosion? Discuss the factors influencing rate of corrosion. [05]

c. Discuss the applications & limitations of bonding by adhesives. [05]

**Q.7.** Differentiate between [15]

- [a] Galvanising & Tining.
- [b] Solder alloys & Nickel alloys.
- [c] Thermal & Catalytic cracking.



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|   |   |                      |   |
|---|---|----------------------|---|
| SEMESTER EXAMINATION<br>SEMESTER & COURSE | <i>May - 2006</i><br><i>H - F.Y.B.Tech.</i><br><i>(CIVIL / MECH. /</i><br><i>PROD / TEXTILE /</i><br><i>ELECT. / ETRX /</i><br><i>COMP / IT) (Old</i><br><i>Course)</i> | DATE OF EXAM<br>TIME | <i>2<sup>nd</sup> June 2006</i><br><i>10.00 a.m. To 12.00 pm.</i> |
| TIME ALLOWED<br>SUBJECT :                 | 2 HRS.<br><i>ENGINEERING CHEMISTRY - II (EE-201)</i>  | MARKS                | 75  |

1. Question No. 1 is compulsory.
2. Answer any Four out of the remaining Six questions.
3. All questions carry 15 marks.
4. Figures to the right indicate marks assigned to the questions.  
[Atomic weights: H=1, C=12, N = 14, O=16, ].

[15]

- Q.1. Attempt any Five.
- [i] What is ranking of Coals?
  - [ii] What is the position of copper in the galvanic series? How does it affect its corrosion?
  - [iii] Name two adhesives with their uses.
  - [iv] Explain the term Smog.
  - [v] What are cements? What are their different types?
  - [vi] How does duralumin differ from aluminum? What are its uses?
  - [vii] How do wind & water act as a source of energy?
- Q.2. a. Discuss the factors affecting Atmospheric corrosion. [05]
- b. What are anti-knocking agents? How they help in the performance of petrol & diesel? [05]
- c. Highlight the difference between Cast iron, Wrought iron & Steel. [05]
- Q.3. a. Give the chemical composition of cements. What are the raw materials required for the manufacture of cements? [05]
- b. How do brasses differ from bronzes? What are their uses? [05]
- c. How is coal gas produced? Draw a neat diagram. [05]
- Q.4. a. Explain Green house effect. [05]
- b. What is soil corrosion? What are its effects? [05]
- c. What are alloy steels? What are their uses? [05]
- Q.5. a. Calculate the Gross calorific value of a coal sample having the following composition: C = 80%, H = 7%, O = 3%, S = 3.5%, N = 2.1% and ash = 4.4%. [05]
- b. Explain the importance of proper selection of material design as a corrosion control measure. [05]
- c. What is engine knock? Explain the mechanisms of knocking in IC spark ignition engines. How can it be prevented? [05]
- Q.6. a. How do metal & paint coatings protect metallic structures from corrosion? Discuss the components of paints. [05]
- b. What is cracking? Why is it carried out? Write the reactions involved in cracking process. [05]
- c. Explain the setting & hardening of cements. [05]
- Q.7. Differentiate between [Any three]  
[a] Octane & Cetane numbers.  
[b] Atmospheric & Wet corrosion.  
[c] Natural Gas & LPG.  
[d] Galvanising & Tinning.



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**Matunga, Mumbai-400 019**

|                      |   |              |                                |
|----------------------|---|--------------|--------------------------------|
| SEMESTER EXAMINATION | <i>May / June - 2006</i>                  | DATE OF EXAM | <i>8<sup>th</sup> May 2006</i> |
| SEMESTER & COURSE    | <i>IIT F.Y.B.Tech</i>                     | TIME         | <i>2.30 p.m. To 4.30 p.m.</i>  |
| TIME ALLOWED         | <i>2 HRS.</i>                             | MARKS        | <i>75</i>                      |
| SUBJECT              | <i>ENGINEERING CHEMISTRY - II(100012)</i> |              |                                |

- Instructions
- 1) Question No -1 is Compulsory.
  - 2) Answer any Four of the remaining Six Questions.
  - 3) All Questions carry 15 Marks.

Atomic Weights :- H = 1, C = 12, N = 14, O = 16

**A**ttempt any five

- Q-1**
- i. How do different coatings protect metallic structures? List out different types of coatings in use.
  - ii. Why is net calorific value less than gross calorific value? State the units of calorific value.
  - iii. What are fuel cells? Mention two characteristics of fuel cells.
  - iv. Name three petro- chemicals with their industrial applications.
  - v. What is e-waste? How does it cause pollution?
  - vi. What are solder alloys? Why are they important?
  - vii. Iron corrodes faster than aluminium under atmospheric conditions. Justify.
- Q-2**
- a) What are different stages of coalification of wood to Anthracite? Why should coal be analysed?
  - b) Explain how the nature of corrosion product and humidity influence the rate of corrosion?
  - c) Why are ores concentrated? Discuss froth flotation and electromagnetic methods of ore concentration. Which ores are suitable for these methods?
- Q-3**
- a) Explain knocking in IC spark ignition engine. What are consequences of knocking? What is unleaded petrol and what are its advantages?
  - b) Citing examples, stating the effects discuss the water-line and pitting corrosion.
  - c) What causes acid rain? State the harmful effects of acid rains.
- Q-4**
- a) What is a Battery cell? Describe its construction. Mention its applications.
  - b) Calculate the gross and the net calorific value of a coal sample having following composition by weight.  
 $C = 75\%$ ,  $H = 5.2\%$ ,  $O = 12.1\%$ ,  $N = 3.2\%$  & ash =  $4.5\%$
  - c) What are the advantages of alloy making? Describe the various types of carbon steels with their uses.
- Q-5**
- a) How does galvanising differ from tinning? What are the merits and demerits of each?
  - b) Describe methods to convert solar energy into other forms of energy. How do wind and water act as sources of power?
  - c) What is significance of COD measurement? Calculate the COD of the following sewage water sample  
25ml of sewage sample was refluxed with 10ml of 0.25 N potassium dichromate solution in presence of dilute sulfuric acid, silver sulfate and mercury sulfate. The unreacted dichromate required 6.5ml of ferrous ammonium sulfate.  
10ml of the same dichromate solution and 25ml of distilled water, under the same conditions as the sample, required 27ml of 0.1 N of ferrous ammonium sulfate.
- Q-6**
- a) Enlist various gaseous fuels and explain with a neat schematic diagram the production and purification of coal gas.
  - b) With a block diagram explain effective treatment of municipal solid waste.
  - c) Why does petroleum require refining? Name the various primary products with their composition and their uses.
- Q-7**
- Differentiate between (any three)
    - i. Dry and Wet corrosion
    - ii. Gasoline and Diesel fuel
    - iii. Conductors and Electrolytes
    - iv. Thermal and Catalytic cracking
    - v. Proximate and Ultimate analysis of coal

—X—



# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State],

Matunga, Mumbai-400 019

|                      |                                    |              |                       |
|----------------------|------------------------------------|--------------|-----------------------|
| SEMESTER EXAMINATION | JUNE 2005                          | DATE OF EXAM | 15/06/2005            |
| SEMESTER & COURSE    | F.Y.B.TECH (Sem - II)              | TIME         | 11.00 A.M TO 1.00 P.M |
| TIME ALLOWED         | 2 HRS.                             | MARKS        | 75                    |
| SUBJECT :            | Engineering Physics – II / PH- 201 |              |                       |



- Instructions: 1. Question No.1 is compulsory and answer any four out of remaining six.  
 2. All questions carry equal marks.  
 3. Figures to the right indicate full marks.

|      |  |                  |
|------|--|------------------|
| Q.1  | Answer any five  | 15               |
| 1)   | Explain the origin of continuous x-rays and derive the equation for $\lambda_{\min}$ , the cut off wavelength.   |                  |
| 2)   | In the Newton's rings experiment using reflected light, derive the equation for radius of curvature of the plano-convex lens used.   |                  |
| 3)   | Explain the term 'chain reaction'.   |                  |
| 4)   | Give one example each for producing (i) Haidinger fringes (ii) Fizeau fringes. What is the special feature of (i) & (ii)   |                  |
| 5)   | Explain why two level pumping scheme is not possible in the production of lasers.  |                  |
| 6)   | Light containing 3 wavelengths, $\lambda_1, \lambda_2, \lambda_3$ is incident on a diffraction grating (transmission type) normally. Show by ray diagram, the position of the spectral lines, given $\lambda_1 > \lambda_2 > \lambda_3$ . Label the diagram.   |                  |
| 7)   | i) Give four advantages of communication through optical fibers<br>ii) Give any two applications of holography.  |                  |
| Q. 2 | a) Explain the concept of holography. With a neat diagram, explain the construction of a hologram and the reconstruction of the image of the object from the hologram.<br>b) Explain the different regions in which nuclear detectors works when applied voltage between electrodes is varied.   | 8<br>7           |
| Q. 3 | a) Derive the condition for bright and dark fringes in reflected light using a wedge shaped film.<br>b) What are anti-reflection coatings? What material is commonly used on lenses to function as antireflection coatings? If the material of the lens has refractive index 1.6, what should the refractive index of the coating? What should be the minimum thickness of the coating if light used has wavelength 5500 Å.<br>c) A plane transmission grating having 4500 lines/cm is used to obtain a diffraction pattern in the 2 <sup>nd</sup> order. Find the angular separation of the 2 lines of wavelengths 4290 Å and 6030 Å.   | 7<br>4<br>4      |
| Q.4  | a) The radiation from x-ray tube operated at 50 kV is diffracted by a cubic KCl crystal of molecular mass 74.6 amu and density $1.99 \times 10^3$ kg/m <sup>3</sup> . Calculate (i) short wavelength limit from the tube and (ii) glancing angle for first order reflection from the principle planes of the crystal for that wavelength.<br>b) State and explain Moseley's law.<br>c) Describe the construction and working of nuclear reactor.   | 4<br>5<br>6      |
| Q.5  | a) Define the following:<br>i) Population inversion<br>ii) Metastable state<br>iii) Active centers<br>iv) Lasing levels.<br>b) What is nuclear fission? Explain proton – proton and carbon – nitrogen cycle.   | 8<br>7           |
| Q.6  | a) i) What is numerical aperture? Derive the equation for numerical aperture for a given optical fiber.<br>ii) What are modes of propagation? How are optical fibers classified, based on the mode of propagation.<br>b) Discuss the distribution of intensity in a single slit diffraction pattern, using vector polygon method / phasor diagram method.  | 5<br>3<br>7      |
| Q.7  | a) i) What is the maximum number of orders possible using a diffraction grating with 300 lines/cm and light of wavelength 6000 Å.<br>ii) How does the wavelength and width of the rulings on the grating affect the width of the spectral lines produced by the grating? Discuss.<br>b) In Fraunhofer diffraction pattern due to a single slit of width 0.1mm, the slit is illuminated by light of wavelength 5893 Å. Calculate the separation between the central maximum and first minimum. What is the width of the central maximum? The focal length of the lens used is 100 cm.<br>c) The sum of the refractive indices of the core and cladding is 2.89 and their difference is 0.03. Find the numerical aperture for the given optical fiber. Find the acceptance angle and the fractional refractive index change. | 2<br>4<br>5<br>4 |

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**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

SEMESTER EXAMINATION    *May 2014*      DATE OF EXAM : *25/04/2014*  
SEMESTER & PROGRAM    *I.I.Y.E.Tech*      TIME : *9:30 AM to 12:30 PM*  
TIME ALLOWED            *3 HRS.*                MARKS            *100*  
COURSE (CourseCode) :    Applied Physics-II(PH0001)

- Instructions
1. All questions carry equal marks.
  2. Figures to the right indicate full marks.
  3. Assume suitable data wherever necessary.
  4. All sub questions of a main question should be attempted together.

- Q.1** a. Describe two conditions to be satisfied for an anti-reflection coating.      0.4  
b. Distinguish between adiabatic and isothermal process. Show that for an adiabatic change in a perfect gas,  $PV^\gamma = \text{Constant}$       0.4  
c. Prove that the space-time equation is invariant under Lorentz transformation      0.4  
d. Two particles are travelling in opposite directions with speed  $0.9c$  relative to laboratory. What is their relative speed?      0.4  
e. Calculate under what pressure ice freezes at 272 K if the change in volume when 1 kg of water freezes is  $91 \times 10^{-6} \text{ m}^3$ . Given latent heat of ice =  $3.36 \times 10^5 \text{ J/kg}$ .      0.4

- Q.2** a. The diameter of the  $10^{\text{th}}$  dark ring is 5 mm when light of wavelength 550 nm is used in Newton's rings. If the space between the lens and the glass plate is filled with a liquid of refractive index 1.25 what will be the diameter of  $10^{\text{th}}$  dark ring?      0.5

**OR**

Deduce the missing orders for a double slit Fraunhofer diffraction pattern, if the slit widths are 0.16 mm and they are 0.8 mm apart.

- b. With neat diagram, discuss the Fraunhofer diffraction at Single slit and deduce an expression for resultant intensity.      0.5  
c. Describe and examine the formation of Newton's ring in reflected monochromatic light. Prove, in reflected light I) The diameter of a dark ring is proportional to the square root of the natural number, and II) diameter of bright ring is proportional to the square root of the odd numbers.      0.5  
d. A Newton's ring set up is used with a source emitting two wavelengths  $\lambda_1 = 600 \text{ nm}$  and  $\lambda_2 = 450 \text{ nm}$ . It is found that the  $n^{\text{th}}$  dark ring due to 600 nm coincides with  $(n+2)^{\text{th}}$  dark ring due to 450 nm. If the radius of curvature of the lens is 90 cm find the diameter of  $n^{\text{th}}$  dark ring of 600 nm.      0.5

- Q.3** a. Explain briefly with necessary equations how to determine the diameter of a thin wire using wedge shaped air film.      0.5

**OR**

Obtain conditions for maxima and minima due to interference of reflected light in thin films of uniform thickness. Why the film should be thin?

- b. What are anti-reflection coatings? Explain their principal and applications. **05**
- c. State first law of thermodynamics. Derive an equation for the change in entropy in terms of  
1) Temperature and volume 2) Temperature and pressure. **05**
- d. A quantity of dry air at  $27^{\circ}\text{C}$  is compressed (i) slowly and (ii) suddenly to one third of its volume. Find the change in temperature in each case, assuming  $\gamma = 1.4$ . **05**
- Q.4** a. State and prove Carnot's theorem **05**
- b. State the two statements of second law of thermodynamics and prove equivalence of both the statements. **05**

**OR**

What is compression ratio? Discuss with necessary theory the construction and working of Spark Ignition engine. Derive an expression for its efficiency.

- c. One kg of water at 273K is brought into contact with heat reservoir at 373K. When water has reached 373K, find the entropy change of water, hot reservoir and of the universe. If water is heated from 273K to 373K by first bringing it in contact with a reservoir at 323K and then a reservoir at 373K what will be the entropy change of universe? **05**
- d. State two postulates of special theory of relativity. Deduce an expression for the variation of mass with velocity. **05**
- Q.5** a. What was the objective of conducting Michelson-Morley experiment? Describe the experiment with neat diagram. **05**
- b. What do you mean by mass energy equivalence? Obtain Einstein's mass-energy relation. Hence derive relation between momentum and energy for relativistic particle. **05**
- c. A spaceship Enterprise moving at  $0.99c$  away from the earth launches a spaceship Picard back towards the earth with a speed relative to enterprise of  $0.6c$ . What speed do we see the Picard moving on the earth? If instead the Picard was launched away from the enterprise in the same direction as its motion what would be the answer.? **05**
- d. Derive Galilean transformation equations for space, time and velocity coordinates. Also write the inverse transformation equations. **05**

**OR**

What is the length of a 1 m stick moving parallel to its length when its mass is 1.5 times of its rest mass?



# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

|                    |              |              |                     |
|--------------------|--------------|--------------|---------------------|
| EXAMINATION        | April 2015   | DATE OF EXAM | 27/4/2015           |
| SEMESTER & PROGRAM | II & FYBTECH | TIME         | 9:30 AM to 12:30 PM |
| TIME ALLOWED       | 3 HRS.       | MARKS        | 100                 |

COURSE CODE & COURSE: Applied Physics-II (PH1021T)

- Instructions
1. All questions carry equal marks.
  2. Figures to the right indicate full marks.
  3. Assume suitable data wherever necessary.
  4. All sub questions of a main question should be attempted together.

- Q.1**
- What is polarization of light? Explain different types of polarization. 04
  - Explain the concept of arbitrary thermometer in designing a new temperature scale. 04
  - Explain velocity addition theorem and prove that the addition of velocity of light to the velocity of light merely produces the velocity of light. 04
  - An electron moves with a speed of  $0.8c$ . Calculate its rest energy, total energy and kinetic energy. 04
  - Efficiency of a Carnot engine is 50%. If temperature of sink decreases by  $100^{\circ}\text{C}$  efficiency goes up to 70%. Calculate the source temperature of Carnot engine. 04
- Q.2**
- With proper diagram calculate the path difference for reflected rays in wedge shaped film & hence obtain the condition for constructive and destructive interference with monochromatic light. 05
  - What is the maximum number of orders of diffraction observed for wavelength of (i)  $7200\text{\AA}$  (ii)  $5000\text{\AA}$  & (iii)  $4200\text{\AA}$  for a diffraction grating having 6000 lines/cm ? 05
  - In Newton's rings experiment the diameter of  $7^{\text{th}}$  dark ring is 3.4 mm  
1. Calculate the diameter of  $16^{\text{th}}$  dark ring ( $\mu=1$ ).  
2. If a small amount of liquid of refractive index 1.3 is filled between the lens and glass plate, calculate the radius of  $7^{\text{th}}$  and  $16^{\text{th}}$  bright rings. 05
  - Obtain the expression for diameter of  $n^{\text{th}}$  dark and bright rings in the case of Newton's ring experiment in reflected light. 05
- Q.3**
- Explain in detail "Anti reflection coatings". 05
  - Explain in details fraunhofer diffraction due to double slit, draw resultant intensity distribution. 05
  - Describe Carnot's cycle and obtain an expression for the efficiency of an ideal heat engine in terms of temperatures. 05
  - One gram molecule of a monoatomic perfect gas at  $27^{\circ}\text{C}$  is adiabatically compressed in a reversible process from an initial pressure of 1 atmosphere to a final pressure of 50 atmospheres. Calculate the resulting difference in temperature. ( $\gamma = 5/3$ ). 05
- Q.4**
- Establish the Clausius-Clapeyron's Latent heat equation and explain the effect of pressure on boiling point of a liquid and melting point of a solid. 05
  - Differentiate between Diesel engine and Otto Engine. 05
  - One kg of ice at  $-5^{\circ}\text{C}$  is exposed to the atmosphere which is at  $20^{\circ}\text{C}$ . The ice melts and comes into thermal equilibrium with the atmosphere. Determine the entropy increase of the universe. What is the minimum amount of work necessary to convert the water back into ice at  $-5^{\circ}\text{C}$ . (specific heat of ice is  $2.09 \text{ J/g K}$ , latent heat of ice is  $333.3 \text{ J/g}$ ) 05

- d. Write Einstein's postulates of special theory of relativity. Derive Einstein's mass-energy relation. 05
- Q.5 a. Describe the Michelson-Morley experiment and explain physical significance of its negative results. 05
- b. Two rockets of rest length  $L_0$  are approaching the earth from opposite directions at velocities  $+c/2$  and  $-c/2$ . How long does one of them appear to the other? 05
- c. What is Max Planck's Quantum hypothesis? Derive an expression for Heisenberg's Uncertainty Principle for time and position. 05
- d. Derive Galilean transformation equations. Also prove the invariance in Galilean transformations.. 05



# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

|                    |              |              |                     |
|--------------------|--------------|--------------|---------------------|
| EXAMINATION        | April 2015   | DATE OF EXAM | 27/04/15            |
| SEMESTER & PROGRAM | II & FYBTECH | TIME         | 9.30 am to 12.30 pm |
| TIME ALLOWED       | 3 HRS.       | MARKS        | 100                 |

COURSE CODE & COURSE: Applied Physics-II (PH1021T)

- Instructions
1. All questions carry equal marks.
  2. Figures to the right indicate full marks.
  3. Assume suitable data wherever necessary.
  4. All sub questions of a main question should be attempted together.

- Q.1**
- What is polarization of light? Explain different types of polarization. 04
  - Explain the concept of arbitrary thermometer in designing a new temperature scale. 04
  - Explain velocity addition theorem and prove that the addition of velocity of light to the velocity of light merely produces the velocity of light. 04
  - An electron moves with a speed of  $0.8c$ . Calculate its rest energy, total energy and kinetic energy. 04
  - Efficiency of a Carnot engine is 50%. If temperature of sink decreases by  $100^{\circ}\text{C}$  efficiency goes up to 70%. Calculate the source temperature of Carnot engine. 04
- Q.2**
- With proper diagram calculate the path difference for reflected rays in wedge shaped film & hence obtain the condition for constructive and destructive interference with monochromatic light. 05
  - What is the maximum number of orders of diffraction observed for wavelength of (i)  $7200\text{\AA}$  (ii)  $5000\text{\AA}$  & (iii)  $4200\text{\AA}$  for a diffraction grating having 6000 lines/cm ? 05
  - In Newton's rings experiment the diameter of  $7^{\text{th}}$  dark ring is 3.4 mm
    - Calculate the diameter of  $16^{\text{th}}$  dark ring ( $\mu=1$ ). 05
    - If a small amount of liquid of refractive index 1.3 is filled between the lens and glass plate, calculate the radius of  $7^{\text{th}}$  and  $16^{\text{th}}$  bright rings. 05
  - Obtain the expression for diameter of  $n^{\text{th}}$  dark and bright rings in the case of Newton's ring experiment in reflected light. 05
- Q.3**
- Explain in detail "Anti reflection coatings". 05
  - Explain in details fraunhofer diffraction due to double slit, draw resultant intensity distribution. 05
  - Describe Carnot's cycle and obtain an expression for the efficiency of an ideal heat engine in terms of temperatures. 05
  - One gram molecule of a monoatomic perfect gas at  $27^{\circ}\text{C}$  is adiabatically compressed in a reversible process from an initial pressure of 1 atmosphere to a final pressure of 50 atmospheres. Calculate the resulting difference in temperature. ( $\gamma = 5/3$ ). 05
- Q.4**
- Establish the Clausius-Clapeyron's Latent heat equation and explain the effect of pressure on boiling point of a liquid and melting point of a solid. 05
  - Differentiate between Diesel engine and Otto Engine. 05
  - One kg of ice at  $-5^{\circ}\text{C}$  is exposed to the atmosphere which is at  $20^{\circ}\text{C}$ . The ice melts and comes into thermal equilibrium with the atmosphere. Determine the entropy increase of the universe. What is the minimum amount of work necessary to convert the water back into ice at  $-5^{\circ}\text{C}$ . (specific heat of ice is 2.09 J/g K, latent heat of ice is 333.3 J/g) 05

- d. Write Einstein's postulates of special theory of relativity. Derive Einstein's mass-energy relation. **05**
- Q.5**
- a. Describe the Michelson-Morley experiment and explain physical significance of its negative results. **05**
  - b. Two rockets of rest length  $L_0$  are approaching the earth from opposite directions at velocities  $+c/2$  and  $-c/2$ . How long does one of them appear to the other? **05**
  - c. What is Max Planck's Quantum hypothesis? Derive an expression for Heisenberg's Uncertainty Principle for time and position. **05**
  - d. Derive Galilean transformation equations. Also prove the invariance in Galilean transformations. **05**



# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

EXAMINATION  
SEMESTER & PROGRAM  
TIME ALLOWED  
COURSE CODE & COURSE:

April 2015  
II & FYBTECH  
3 HRS.

Applied Physics-II (PH1021T)

DATE OF EXAM 20/05/2015  
TIME 9:30 AM - 12:30 PM  
MARKS 100

- Instructions
1. All questions carry equal marks
  2. Figures to the right indicate full marks.
  3. Assume suitable data where ever necessary.
  4. All sub questions of a main question should be attempted together.
- Q.1**
- What is anti-reflection coating? Explain with its two conditions 04
  - Show that  $PV^Y = \text{Constant}$  for an adiabatic change in a perfect gas 04
  - The length of mercury column in a liquid thermometer is 6.0 cm when in contact with water at its triple point; Calculate
    - Temperature when the length of mercury column is 7.0 cm. 04
    - Length of mercury column at steam point (373.15 K). 04
  - Derive an expression for phase and group velocity for relativistic and non-relativistic particle. 04
  - Derive the Energy-Momentum equation in special theory of relativity. 04
- Q.2**
- With a neat labeled diagram derive the conditions for constructive and destructive interference for parallel thin films in the reflected light. 05
  - White light is reflected from an oil film of thickness 0.01 mm and refractive index 1.4 at an angle of  $45^\circ$  to the vertical. Calculate the number of dark bands seen between wavelengths 4000 Å and 5000 Å. 05
  - A diffraction grating used at normal incidence gives a line for a wavelength 6000 Å in a certain order which is superimposed on the other line of the wavelength 4500 Å of the next order. If the angle of diffraction is  $33^\circ$  then how many lines per inch are on the grating? 05
  - How to measure the wavelength of given source and refractive index of the given liquid using Newton's rings set-up 05
- Q.3**
- Derive an expression for principal maxima in case of a diffraction grating. 05
  - Show that light waves represented by equations  $E_1 = iE_x \cos(\omega t - kz)$  &  $E_2 = iE_y \cos(\omega t - kz + \theta)$  generally give rise to an elliptically polarized wave that can become linearly and circularly polarized wave under special conditions 05
  - Explain working of Refrigerator with the help of reversed Carnot cycle. Write the expression for its COP. 05
  - Calculate the change in melting point of 1 gm of ice when it is subjected to a pressure of 100 atmospheres. Density of ice =  $0.917 \text{ g/cm}^3$  and latent heat of ice = 336 J/g. 05
- Q.4**
- Describe Spark ignition engine with neat P-V diagram and hence derive an expression for its efficiency 05
  - State the two statements of second law of thermodynamics and prove equivalence of both the statements. 05
  - One kg of water at 273K is brought into contact with heat reservoir at 373K. When water has reached 373K, find the entropy change of water, hot reservoir and of the universe. If water is heated from 273K to 373K by first bringing it in contact with a reservoir at 323K and then a reservoir at 373K what will be the entropy change of universe? 05

- d. State two postulates of special theory of relativity. Deduce an expression for the variation of mass with velocity. 05
- Q.5**
- a. What was the objective of conducting Michelson-Morley experiment? 05  
Describe the experiment with neat diagram.
  - b. What is De Broglie Hypothesis of matter waves? State and derive Bohr's quantization rule. 05
  - c. A muon has a lifetime of  $2 \mu\text{sec}$  in its rest frame. It is created 100 km above the earth and move towards it at a speed of  $2.97 \times 10^8 \text{ m/s}$ . At what altitude does it decay? According to muon how far did it travel in its brief time? 05
  - d. Derive Lorentz transformation equations for space, time and velocity coordinates. Also write the inverse transformation equations. 05



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
**Matunga, Mumbai-400 019**

SEMESTER EXAMINATION *May 2014* DATE OF EXAM : *25/04/2014*  
SEMESTER & PROGRAM *I.I.F.Y.B.Tech* TIME : *9:30 AM to 12:30 PM*  
TIME ALLOWED *3 HRS.* MARKS *100*  
COURSE (CourseCode) : *Applied Physics-II(PH0001)*

- Instructions
1. All questions carry equal marks.
  2. Figures to the right indicate full marks.
  3. Assume suitable data where ever necessary.
  4. All sub questions of a main question should be attempted together.

- Q.1**
- Describe two conditions to be satisfied for an anti-reflection coating. **04**
  - Distinguish between adiabatic and isothermal process. Show that for an adiabatic change in a perfect gas,  $PV^\gamma = Constant$  **04**
  - Prove that the space-time equation is invariant under Lorentz transformation **04**
  - Two particles are travelling in opposite directions with speed  $0.9c$  relative to laboratory. What is their relative speed? **04**
  - Calculate under what pressure ice freezes at 272 K if the change in volume when 1 kg of water freezes is  $91 \times 10^{-6} \text{ m}^3$ . Given latent heat of ice =  $3.36 \times 10^5 \text{ J/kg}$ . **04**

- Q.2**
- The diameter of the  $10^{\text{th}}$  dark ring is 5 mm when light of wavelength 550 nm is used in Newton's rings. If the space between the lens and the glass plate is filled with a liquid of refractive index 1.25 what will be the diameter of  $10^{\text{th}}$  dark ring? **05**

**OR**

Deduce the missing orders for a double slit Fraunhofer diffraction pattern, if the slit widths are 0.16 mm and they are 0.8 mm apart.

- With neat diagram, discuss the Fraunhofer diffraction at Single slit and deduce an expression for resultant intensity. **05**
  - Describe and examine the formation of Newton's ring in reflected monochromatic light. Prove, in reflected light I) The diameter of a dark ring is proportional to the square root of the natural number, and II) diameter of bright ring is proportional to the square root of the odd numbers. **05**
  - A Newton's ring set up is used with a source emitting two wavelengths  $\lambda_1 = 600 \text{ nm}$  and  $\lambda_2 = 450 \text{ nm}$ . It is found that the  $n^{\text{th}}$  dark ring due to 600 nm coincides with  $(n+2)^{\text{th}}$  dark ring due to 450 nm. If the radius of curvature of the lens is 90 cm find the diameter of  $n^{\text{th}}$  dark ring of 600 nm. **05**
- Q.3**
- Explain briefly with necessary equations how to determine the diameter of a thin wire using wedge shaped air film. **05**

**OR**

Obtain conditions for maxima and minima due to interference of reflected light in thin films of uniform thickness. Why the film should be thin?

- b. What are anti-reflection coatings? Explain their principal and applications. 05
- c. State first law of thermodynamics. Derive an equation for the change in entropy in terms of  
1) Temperature and volume 2) Temperature and pressure. 05
- d. A quantity of dry air at  $27^{\circ}\text{C}$  is compressed (i) slowly and (ii) suddenly to one third of its volume. Find the change in temperature in each case, assuming  $\gamma = 1.4$ . 05
- Q.4** a. State and prove Carnot's theorem 05
- b. State the two statements of second law of thermodynamics and prove equivalence of both the statements. 05

**OR**

What is compression ratio? Discuss with necessary theory the construction and working of Spark Ignition engine. Derive an expression for its efficiency.

- c. One kg of water at 273K is brought into contact with heat reservoir at 373K. When water has reached 373K, find the entropy change of water, hot reservoir and of the universe. If water is heated from 273K to 373K by first bringing it in contact with a reservoir at 323K and then a reservoir at 373K what will be the entropy change of universe? 05
- d. State two postulates of special theory of relativity. Deduce an expression for the variation of mass with velocity. 05
- Q.5** a. What was the objective of conducting Michelson-Morley experiment? Describe the experiment with neat diagram. 05
- b. What do you mean by mass energy equivalence? Obtain Einstein's mass-energy relation. Hence derive relation between momentum and energy for relativistic particle. 05
- c. A spaceship Enterprise moving at  $0.99c$  away from the earth launches a spaceship Picard back towards the earth with a speed relative to enterprise of  $0.6c$ . What speed do we see the Picard moving on the earth? If instead the Picard was launched away from the enterprise in the same direction as its motion what would be the answer.? 05
- d. Derive Galilean transformation equations for space, time and velocity co-ordinates. Also write the inverse transformation equations. 05

**OR**

What is the length of a 1 m stick moving parallel to its length when its mass is 1.5 times of its rest mass?



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

SEMESTER EXAMINATION *May 2013* DATE OF EXAM  
SEMESTER & PROGRAM *II.F.Y.B.Tech* TIME *09.30 to 12.30 p.m.*  
TIME ALLOWED *3 HRS.* MARKS *100*  
COURSE (Course Code) : *Applied Physics-II(PH0002)*

Instructions

1. All questions carry equal marks.
2. Figures to the right indicate full marks.
3. Assume suitable data where ever necessary.
4. All sub questions of a main question should be attempted together.

- Q.1** a. Describe the methods for obtaining plane polarized light 4  
b. Distinguish between Adiabatic and Isothermal process. Show that for an 4  
adiabatic change in a perfect gas,  $PV^\gamma = \text{constant}$   
c. Explain relativistic velocity addition theorem and prove that the addition of 4  
velocity of light to the velocity of light merely produces the velocity of light.  
d. An electron has a speed of  $3.5 \times 10^7 \text{ m/sec}$  accurate to 0.0098%. With what 4  
fundamental accuracy can we locate the position of an electron?  
e. One gram molecule of gas expands isothermally to four times of its original 4  
volume. Calculate work done and change in entropy in terms of the gas  
constant.
- Q.2** a. Newton's ring is formed in reflected light of wavelength 589.5nm with a liquid 5  
between the plane and curved surfaces. The diameter of the fifth ring is 0.3cm  
and radius of curvature of the curved surface is 100cm. Calculate the refractive  
index of the liquid when the ring is i) bright and ii) dark.
- OR
- A. light of wavelength 500nm falls on a grating normally. Two adjacent  
principal maxima occur at  $\sin\theta = 0.2$  and  $\sin\theta = 0.3$  respectively. Calculate  
the grating element, if the width of the grating surface is 2.5cm. 5
- b. What is meant by diffraction of light? Describe the features of single slit 5  
Fraunhofer diffraction pattern.
- c. Light containing two wavelengths  $\lambda_1$  and  $\lambda_2$  falls normally on a plano-convex 5  
lens of radius of curvature R resting on a glass plate. If the  $n^{\text{th}}$  dark ring due to  
 $\lambda_1$  coincides with the  $(n+1)^{\text{th}}$  dark ring due to  $\lambda_2$ , prove that radius of the  $n^{\text{th}}$   
dark ring due to  $\lambda_1$  is 
$$\sqrt{\frac{\lambda_1 \lambda_2}{\lambda_1 - \lambda_2}} R$$
- d. A soap film of refractive index 1.43 is illuminated by a white light incident at 5  
an angle of  $30^\circ$ . The refracted light is examined by a spectroscope in which the  
dark band corresponding to the wavelength 600nm is observed. Calculate  
thickness of the film.
- Q.3** a. Explain briefly the determination of diameter of the thin wire using wedge- 5  
shaped air film.  
b. What is Polarization? Derive mathematical expression for plane polarized, 5  
circularly polarized and elliptically polarized light.

**OR**

Explain Di-electric Mirrors. Can a thin film of water ( $\mu_r = 1.33$ ) formed on a window glass pane ( $\mu_g = 1.52$ ) act as a non-reflecting coating? If so, how thick should be water film.

- c. Describe Carnot's cycle and obtain an expression for the efficiency of an Ideal heat engine in terms of temperatures. 5
  - d. Find the change in entropy when 0.1kg of water at  $15^0\text{C}$  is mixed with 0.16kg of water at  $40^0\text{C}$ . (Given: Sp. heat of water =  $4200\text{J/kg.}^0\text{C}$ ) 5
- Q.4**
- a. State Second law of thermodynamics in two different ways. Are these statements equivalent to each other? Justify your answer. 5
  - b. Describe with necessary theory, the construction and working of Diesel engine. Derive an expression for its efficiency. 5
- OR**
- What is compression ratio? Discuss with necessary theory, the construction and working of Spark Ignition engine. Derive an expression for its efficiency.
- c. Calculate under what pressure ice freezes at 272K if the change in specific volume when 1 Kg of water freezes is  $91 \times 10^{-6} \text{ m}^3$ . (Latent heat of ice =  $3.36 \times 10^5 \text{ J.Kg}^{-1}$ ) 5
  - d. What do you mean by Mass Energy Equivalence? Obtain Einstein's Mass-Energy relation. 5

- Q.5**
- a. In a Michelson-Morley Experiment, the distance of semi-silvered plate from either of the mirrors is 25.90m. The wavelength of the light used is 589nm. i) Calculate the time lag between the two beams reaching the plate after reflection, ii) After the apparatus is rotated through  $90^0$ , what is the total time lag?, iii) Determine the no. of fringes shifted assuming velocity of the earth to be  $3 \times 10^4 \text{ m/s}$ . 5
  - b. When a positron and an electron annihilate, what is the wavelength of two photons emitted 5
  - c. Describe the Davisson-Germer experiment to demonstrate the wave character of electrons. Explain its significance. 5
  - d. State de-Broglie hypothesis of matter waves. For a particle of mass  $m_0$  and kinetic energy  $k$ , show that de-Broglie wavelength is given by  

$$\lambda = hc / \{k(k + 2m_0c^2)\}^{1/2}$$
 5

**OR**

Define Dispersive medium, Non dispersive medium, phase velocity  $v_p$ , group velocity  $v_g$ , of a wave packet. Prove that for a relativistic particle,  $v_p v_g = c^2$ .



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
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**Matunga, Mumbai-400 019**

SEMESTER EXAMINATION : *May 2014* DATE OF EXAM : *25/04/2014*  
SEMESTER & PROGRAM : *H.F.Y.B.Tech* TIME : *9:30 AM to 12:30 PM*  
TIME ALLOWED : *3 HRS.* MARKS : *100*  
COURSE (CourseCode) : *Applied Physics-II(PH0001)*

- Instructions
1. All questions carry equal marks.
  2. Figures to the right indicate full marks.
  3. Assume suitable data where ever necessary.
  4. All sub questions of a main question should be attempted together.

- Q.1** a. Describe two conditions to be satisfied for an anti-reflection coating. 0.4  
b. Distinguish between adiabatic and isothermal process. Show that for an adiabatic change in a perfect gas,  $PV^\gamma = \text{Constant}$ . 0.4  
c. Prove that the space-time equation is invariant under Lorentz transformation 0.4  
d. Two particles are travelling in opposite directions with speed  $0.9c$  relative to laboratory. What is their relative speed? 0.4  
e. Calculate under what pressure ice freezes at 272 K, if the change in volume when 1 kg of water freezes is  $91 \times 10^{-6} \text{ m}^3$ . Given latent heat of ice =  $3.36 \times 10^5 \text{ J/kg}$ . 0.4

- Q.2** a. The diameter of the  $10^{\text{th}}$  dark ring is 5 mm when light of wavelength 550 nm is used in Newton's rings. If the space between the lens and the glass plate is filled with a liquid of refractive index 1.25 what will be the diameter of  $10^{\text{th}}$  dark ring? 0.5

**OR**

Deduce the missing orders for a double slit Fraunhofer diffraction pattern, if the slit widths are 0.16 mm and they are 0.8 mm apart.

- b. With neat diagram, discuss the Fraunhofer diffraction at Single slit and deduce an expression for resultant intensity. 0.5  
c. Describe and examine the formation of Newton's ring in reflected monochromatic light. Prove, in reflected light I) The diameter of a dark ring is proportional to the square root of the natural number, and II) diameter of bright ring is proportional to the square root of the odd numbers. 0.5  
d. A Newton's ring set up is used with a source emitting two wavelengths  $\lambda_1 = 600 \text{ nm}$  and  $\lambda_2 = 450 \text{ nm}$ . It is found that the  $n^{\text{th}}$  dark ring due to 600 nm coincides with  $(n+2)^{\text{th}}$  dark ring due to 450 nm. If the radius of curvature of the lens is 90 cm find the diameter of  $n^{\text{th}}$  dark ring of 600 nm. 0.5

- Q.3** a. Explain briefly with necessary equations how to determine the diameter of a thin wire using wedge shaped air film. 0.5

**OR**

Obtain conditions for maxima and minima due to interference of reflected light in thin films of uniform thickness. Why the film should be thin?

- b. What are anti-reflection coatings? Explain their principal and applications. 05
- c. State first law of thermodynamics. Derive an equation for the change in entropy in terms of 05  
 1) Temperature and volume 2) Temperature and pressure.
- d. A quantity of dry air at  $27^{\circ}\text{C}$  is compressed (i) slowly and (ii) suddenly to one third of its volume. Find the change in temperature in each case, assuming  $\gamma = 1.4$ . 05
- Q.4 a. State and prove Carnot's theorem 05
- b. State the two statements of second law of thermodynamics and prove equivalence of both the statements. 05

**OR**

What is compression ratio? Discuss with necessary theory the construction and working of Spark Ignition engine. Derive an expression for its efficiency.

- c. One kg of water at 273K is brought into contact with heat reservoir at 373K. 05  
 When water has reached 373K, find the entropy change of water, hot reservoir and of the universe. If water is heated from 273K to 373K by first bringing it in contact with a reservoir at 323K and then a reservoir at 373K, what will be the entropy change of universe?
- d. State two postulates of special theory of relativity. Deduce an expression for the variation of mass with velocity. 05

- Q.5 a. What was the objective of conducting Michelson-Morley experiment? 05  
 Describe the experiment with neat diagram.
- b. What do you mean by mass energy equivalence? Obtain Einstein's mass-energy relation. Hence derive relation between momentum and energy for relativistic particle. 05
- c. A spaceship Enterprise moving at  $0.99c$  away from the earth launches a spaceship Picard back towards the earth with a speed relative to enterprise of  $0.6c$ . What speed do we see the Picard moving on the earth? If instead the Picard was launched away from the enterprise in the same direction as its motion what would be the answer.? 05
- d. Derive Galilean transformation equations for space, time and velocity coordinates. Also write the inverse transformation equations. 05

**OR**

What is the length of a 1 m stick moving parallel to its length when its mass is 1.5 times of its rest mass?



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|                      |                                   |              |                           |
|----------------------|-----------------------------------|--------------|---------------------------|
| SEMESTER EXAMINATION | April / May 2008                  | DATE OF EXAM | 10 <sup>th</sup> May 2008 |
| SEMESTER & COURSE    | II-F. Y. B. Tech. (All Branches)) | TIME         | 10.00 a.m. To 12.00 p.m.  |
| TIME ALLOWED         | 2 HRS.                            | MARKS        | 70                        |
| SUBJECT :            | ENGINEERING PHYSICS-II            |              |                           |

Instructions : 1. All Questions are Compulsory.

2. Figures to the right indicate full marks.

3. Assume suitable data where ever necessary.

- Q.1 a. An excessively thin film appears black in reflected system, explain. 02  
b. What is the linear width of central maxima and secondary maxima in single slit diffraction. 02  
c. Mention two basic difference between 2D photography and 3D holography. 02  
d. Draw neat labeled diagram of G.M. Tube. 02  
e. Explain the meaning of K $\alpha$  and M $\beta$  lines in characteristic X-Rays. 02
- Q.2 a. Derive the formula for path difference between the reflected light rays in wedge shaped film. Which type of interference fringes are formed. 05  
b. White light is incident on a soap film at an angle of  $\sin^{-1}(4/5)$  and the reflected light is observed with a spectroscope. It is found that two consecutive dark bands corresponding to wavelengths  $6.1 \times 10^{-5}$  and  $6.0 \times 10^{-5}$  cm. If the refractive index of the film be 4/3, calculate the thickness of the film. 04  
c. Graphically Explain the formation of Diffraction spectra in single slit, double slit and multiple diffraction grating. (No derivation). 06
- Q.3 a. In single slit Fraunhofer Diffraction, prove that the width of central maxima is twice the width of secondary maxima. 06  
b. What is index profile? Explain the classification of optical fibers on the basis of index profile with diagram. State the relation between the maximum number of modes and V number. 06  
c. Compute the maximum radius allowed for a fiber having core index 1.47 and cladding index 1.46. The fiber is to support only one mode at a wavelength of 1300nm. 03
- Q.4 a. Explain the formation of continuous and characteristic X-rays 05
- OR
- b. Describe Laue diffraction in a transmission and back-reflection mode. 05  
c. X-rays of unknown wavelength give 1<sup>st</sup> order Bragg's reflection at glancing angle of 22° with (111) planes of Cu. (1). Find the wavelength of X-rays, if the lattice constant for Cu is 3.615Å. (2). Now the crystal is rotated by a certain angle and the detector is also rotated by the corresponding angle to observe the 2<sup>nd</sup> order spectrum. What will be the position of the detector in degree to get 2<sup>nd</sup> order spectrum. 05  
c. With neat diagram, explain the construction and working of Ruby LASER. 05
- OR
- b. With neat diagram, explain the construction and working of He – Ne LASER. 05
- Q.5 a. Explain in brief, the working principle of G.M. Counter. 05
- OR
- b. What is the difference between Integration type and Non-Integration type Ionization chamber. 05  
c. A city requires 100MW of electrical power on an average. This is to be supplied by a nuclear reactor of efficiency 20% using U<sup>235</sup> as a fuel. Calculate the amount of fuel required for one day operation. Energy released per fission of U<sup>235</sup> = 200 MeV. 05  
c. Explain with neat diagram, the construction of hologram and reconstruction of the image from the hologram. 05
- OR
- c. With neat diagram, explain the lasing action based on optical resonator. 05





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TIME : 9:30 a.m– 12:30 pm      End Semester Examination      TIME ALLOWED : 3Hrs.  
 SEMESTER & PROGRAM : II    F.Y.B.Tech (I.T./Comp/Extc/EI/Ec/Prod/Mech/Civil/Textile)  
 Course : Mathematics For Engineers – II ( MA1021S)      DATE : 22/04/15  
 Marks :100

**Instructions**   1. All questions are compulsory.  
 2. Answers to individual question must be grouped and written together.

- Q.1.** (a) State and Prove the Duplication Formula      (4)  
 (b) Trace the curve with full justification  $(2a - x)y^2 = x^3$ .      (4)  
 (c) Solve  $(y^2 e^{xy^2} + 4x^3)dx + (2xye^{xy^2} - 3y^2)dy = 0$       (4)  
 (d) Prove that  $\frac{d}{dx}(\operatorname{erfc}(ax)) = \frac{-2a}{\sqrt{\pi}} e^{-a^2 x^2}$  and hence prove that  

$$\int_0^t \operatorname{erfc}(ax)dx = t\operatorname{erfc}(at) - \frac{1}{a\sqrt{\pi}} [e^{-a^2 t^2} - 1].$$
      (4)
- (e) Solve  $(D^2 + 4)y = 4\sin 3x$ . By using the method of undetermined coefficients.      (4)
- Q.2.** (a) i) prove that  $\frac{d}{da} \left[ \int_0^{a^2} \tan^{-1} \frac{x}{a} dx \right] = 2a \tan^{-1} a - \frac{1}{2} \log(a^2 + 1).$       (4)  
 (ii) Prove that  $\int_0^1 \frac{x^a - x^b}{\log x} dx = \log \left( \frac{a+1}{b+1} \right)$       (4)  
 (b) Change the order of integration are given by  $\int_0^2 \int_{\sqrt{4-x^2}}^{8-2x} f(x, y) dy dx$       (6)  
 (c) Solve  $(3x + 2)^2 \frac{d^2 y}{dx^2} + 3(3x + 2) \frac{dy}{dx} - 36y = 3x^2 + 4x + 1.$       (6)
- Q.3.** (a) i) show that the perimeter of  $r^2 = a^2 \cos 2\theta$  is  $\frac{a}{\sqrt{2\pi}} \left( \frac{1}{4} \right)^2$       (4)  
 ii) Find the area of cardioide  $r = a(1 + \cos\theta)$  using double integral.      (4)  
 (b) Evaluate  $\iiint_v (x^2 y^2 + y^2 z^2 + z^2 x^2) dx dy dz$  over the volume of the sphere  

$$x^2 + y^2 + z^2 = a^2$$
      (6)  
 (c) The charge Q of a condenser, capacity C, discharged in a circuit of resistance R and self- inductance L satisfies the differential equation  $L \frac{d^2 Q}{dt^2} + R \frac{dQ}{dt} + \frac{Q}{C} = 0.$   
 Solve the equation with initial conditions that  $Q = Q_0$  and  $\frac{dQ}{dt} = 0$  when  $t = 0$  and  $CR^2 < 4L.$       (6)
- Q.4.** (a) i) Solve  $\frac{dy}{dx} + \frac{z}{x} \log z = \frac{z}{x^2} (\log z)^2$       (4)  
 ii) The equation of motion of a body falling under gravity is given by  

$$\frac{dv}{dt} = g - kv^2$$
. Find the velocity and distance travelled as a function of time.  
 Given = 0 at  $t = 0.$       (4)
- (b) Change to polar co-ordinate evaluate  $\int_0^a \int_{\sqrt{ax-x^2}}^{\sqrt{a^2-x^2}} \frac{dy dx}{\sqrt{a^2-x^2-y^2}}.$       (6)  
 (c) Solve  $\frac{d^2 y}{dx^2} + 3 \frac{dy}{dx} + 2y = xe^{-x} \sin x$       (4)
- Q.5.** (a) Solve  $(D^2 - 2D + 2)y = e^x \tan x.$   
 By Using the Method of Variation of Parameter .      (8)  
 (b) Prove that  $\int_0^1 \frac{x^{p-1}(1-x)^{q-1}}{(a+bx)^{p+q}} dx = \frac{\beta(p,q)}{(a+b)^p a^q}$       (6)  
 (c) Solve  $\left( \frac{y}{x} \sec y - \tan y \right) dx + (\sec y \log x - x) dy = 0.$       (6)



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TIME : 9:30 a.m– 12:30 pm      End Semester Examination      TIME ALLOWED : 3Hrs.  
 SEMESTER & PROGRAM : II      F.Y.B.Tech (I.T./Comp/Extc/EI/Ec/Prod/Mech/Civil/Textile)      DATE : 18/05/2015  
 Course : Mathematics For Engineers – II ( MA1021S )      Marks :100

**Instructions**    1. All questions are compulsory.  
 2. Answers to individual question must be grouped and written together.

Q.1. (a) Prove that  $\int_0^\infty x^2 e^{-x^4} dx \int_0^\infty e^{-x^4} dx = \frac{\pi}{8\sqrt{2}}$       (4)

(b) Trace the curve with full justification  $r = a(1 + \cos\theta)$       (4)

(c) Solve  $\frac{dy}{dx} = \frac{tany - 2xy - y}{x^2 - xtan^2y + sec^2y}$       (4)

(d) Prove that  $\frac{d}{dx}(\operatorname{erfc}(ax)) = \frac{-2a}{\sqrt{\pi}} e^{-a^2 x^2}$  and hence prove that  

$$\int_0^t \operatorname{erfc}(ax) dx = t \operatorname{erfc}(at) - \frac{1}{a\sqrt{\pi}} [e^{-a^2 t^2} - 1].$$
      (4)

(e) Solve  $(D^2 - 2D)y = e^x \cos x$ . By using the method of undetermined coefficients. (4)

Q.2. (a) i) Prove that  $\frac{d}{d\alpha} \left[ \int_\alpha^\infty \frac{x^2 \sin ax}{x} dx \right] = \frac{3 \sin a^3 - 2 \sin a^2}{a}$ .

ii) prove that  $\int_0^\infty \frac{e^x - e^{-ax}}{x \sec x} dx = \frac{1}{2} \log \left( \frac{a^2 + 1}{2} \right)$       ( $a > 0$ )

(b) Evaluate  $\iint_R (x^2 + y^2) dx dy$  over the area enclosed by the curves  
 $y = 4x, x + y = 3, y = 0, y = 2$ .      (6)

(c) Solve  $\frac{d^2y}{dx^2} + \frac{1}{x} \frac{dy}{dx} = 2 + 5 \log x$       (6)

Q.3.(a) i) Find the perimeter of the one loop of the curve  $9ay^2 = x(x - 3a)^2$       (4)

ii) Find the area bounded by the circle  $x^2 + y^2 = 10$  and the parabola  $y^2 = 9x$  in the first quadrant .      (4)

(b) Evaluate  $\int_0^\infty \int_0^\infty \int_0^\infty \frac{dxdydz}{(1+x^2+y^2+z^2)^2}$  using spherical polar co-ordinates.      (6)

(c) A body executes damped forced vibration and its differential equations is  

$$\frac{d^2x}{dt^2} + 2k \frac{dx}{dt} + b^2 x = e^{-kt} \sin \omega t.$$

Solve the equation for case i)  $\omega^2 \neq b^2 - k^2$ , ii)  $\omega^2 = b^2 - k^2$ .      (6)

Q.4.(a) i) Solve  $xy(1 + xy^2) \frac{dy}{dx} = 1$ .      (4)

ii) In a circuit containing inductance L, resistance R, and voltage E, the current i is given by  $L \frac{di}{dt} + Ri = E$ . Find the current i at time t if at  $t = 0$ ,  $i = 0$ , and  $L, R, E$ , are constant.      (4)

(b) Using the transformation  $u = \frac{x^2 + y^2}{x}$  and  $v = \frac{x^2 + y^2}{y}$ . Evaluate  $\iint \frac{(x^2 + y^2)^2}{x^2 y^2} dx dy$   
 Over the area common to the circle  $x^2 + y^2 = ax$ ,  $x^2 + y^2 = by$ .      (6)

(c) Solve  $\frac{d^2y}{dx^2} + 2y = x^2 e^{3x} + e^x \cos 2x$ .      (6)

Q.5.(a) Solve  $(D^2 + 9)y = \frac{1}{1 + \sin 3x}$ . By Using the Method of Variation of Parameter.      (8)

(b) Prove that  $\int_0^1 \frac{x^{p-1} (1-x)^{q-1}}{(a+bx)^{p+q}} dx = \frac{\beta(p,q)}{(a+b)^p a^q}$ .      (6)

(c) Solve  $ydx - xdy + \log x dx = 0$ .      (6)





**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
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TIME : 9:30 a.m- 12:30 pm      End Semester Examination  
SEMESTER & PROGRAM : I      F.Y.B.Tech (I.T./Comp/Extc/EI/Ec/Prod/Mech/Civil/Textile)

TIME ALLOWED : 3Hrs.

Course : Mathematics For Engineers - I

DATE : 26/11/2014  
Marks : 100

Instructions 3. All questions are compulsory.

4. Answers to individual question must be grouped and written together.

Q.1.(a) If  $u = \tan^{-1} \frac{x}{y}$  where  $x = 2t$  and  $y = 1 - t^2$ , prove that  $\frac{du}{dt} = \frac{2}{1+t^2}$ . (4)

(b) Prove that if  $a < 1, b < 1$  and  $a < b$  then  $\frac{b-a}{\sqrt{1-a^2}} < \sin^{-1} b - \sin^{-1} a < \frac{b-a}{\sqrt{1-b^2}}$ .  
And hence Show that  $\frac{\pi}{6} - \frac{1}{2\sqrt{3}} < \sin^{-1} \frac{1}{4} < \frac{\pi}{6} - \frac{1}{\sqrt{15}}$ . (4)

(c) Prove that  $e^{x \cos x} = 1 + x + \frac{x^2}{2} - \frac{x^3}{3} - \frac{11x^4}{24} + \dots$  (4)

(d) Evaluate  $\lim_{x \rightarrow 0} \frac{e^{x \sin x} - \cosh(x\sqrt{2})}{x^4}$ . (4)

(e) Considering only the principal value, if  $(1 + i \tan \alpha)^{1+i \tan \beta}$  is real, Prove that  
Its value is  $(\sec \alpha)^{\sec^2 \beta}$ .

Q.2. (a) Find the  $n^{\text{th}}$  root of unity then prove that: (4)

i) Continued product of all the  $n^{\text{th}}$  roots of unity is  $(-1)^{n-1}$ .  
ii) Sum of the cube roots of unity is zero.

(b) If  $y = \frac{1}{x^2+x+1}$ , prove that  $y_n = 2 \frac{(-1)^n}{\sqrt{3}} \frac{(n!)}{r^{n+1}} \sin(n+1)$ . (6)

(c) Find the non singular matrix P and Q such that 'PAQ' is in the normal form where

$$A = \begin{bmatrix} 1 & -1 & -1 \\ 1 & 1 & 1 \\ 3 & 1 & 1 \end{bmatrix} \quad (6)$$

Q.3.(a) Show that the vectors  $X_1, X_2, X_3$  are linearly independent and vector  $X_4$  depends upon them, where  $X_1 = [1, 2, 4]$ ,  $X_2 = [2, -1, 3]$ ,  $X_3 = [0, 1, 2]$ ,  $X_4 = [-3, 7, 2]$ . (8)

(b) If  $x = \sqrt{vw}$ ,  $y = \sqrt{wu}$ ,  $z = \sqrt{uv}$  and  $\varphi$  is a function of  $x, y$  and  $z$  then prove that  
 $x \frac{\partial \varphi}{\partial x} + y \frac{\partial \varphi}{\partial y} + z \frac{\partial \varphi}{\partial z} = u \frac{\partial \varphi}{\partial u} + v \frac{\partial \varphi}{\partial v} + w \frac{\partial \varphi}{\partial w}$ . (6)

(c) Using De-Moivre's Theorem  $\cos^8 \theta + \sin^8 \theta = \frac{1}{64} [\cos 8\theta + 28 \cos 4\theta + 35]$ . (6)

Q.4.(a) i) State and prove Euler's theorem on homogenous function of two variable. (4)

ii) If  $u = \frac{x^2 y^2 z^2}{x^2 + y^2 + z^2} + \cos^{-1} \left( \frac{x+y+z}{\sqrt{x+y+z}} \right)$ , find the value of  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}$ . (4)

(b) Show that the equation (6)

$x + 2y - z = 3$ ;  $3x - y + 2z = 1$ ;  $2x - 2y + 3z = 2$ ;  $x - y + z = -1$ ;  
are consistent and hence obtain the solution.

(c) If  $x = \sin \theta$ ,  $y = \sin 2\theta$ , prove that (6)

$$(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 - 4)y_n = 0. \quad (6)$$

Q.5.(a) i) Discuss the maxima or minima of  $x^3 y^2 (1 - x - y)$ . (4)

ii) In calculating the volume of right circular cone, error of 2% and 1% are made in measuring the height and base radius respectively. Find the percentage error in calculating volume. (4)

(b) If  $\tan(\alpha + i\beta) = e^{i\theta}$  then prove that i)  $\alpha = \frac{n\pi}{2} + \frac{\pi}{4}$ , ii)  $\beta = \frac{1}{2} \log \left( \tan \left( \frac{\pi}{4} + \frac{\theta}{2} \right) \right)$ . (6)

(c) If  $u = \log[x^3 + y^3 + z^3 - 3xyz]$  then show that

$$\left( \frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z} \right)^2 u = -\frac{9}{(x+y+z)^2}. \quad (6)$$

4c



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SEMESTER EXAMINATION Nov. 2010  
SEMESTER & PROGRAM F.Y.B.Tech sem I  
TIME ALLOWED 3 HRS.  
COURSE (MA0001) : Applied Mathematics I

DATE OF EXAM 24-12-2010  
TIME 2 p.m. - 5 p.m.  
MARKS 100

- N.B. 1) All questions carry equal marks  
2) Figures to the right indicate full marks.  
3) Answers to the individual question must be grouped and written together.

- Q.1) a) If  $5 \sinh x - 5 = \cosh x$ , find  $\tanh x$ .  
b) Discuss the convergence of the following series:

$$\frac{x}{1.3} + \frac{x^2}{2.4} + \frac{x^3}{3.5} + \dots$$

- c) Find the least positive integer  $n$  for which  $\left(\frac{61-2}{2i+1}\right)^n$  is  
i) natural number ii) purely imaginary number.

- d) Using the theory of approximation find approximate value of  
$$\sqrt{(0.98)^3 + (2.01)^2 + (1.94)^2}$$

e) Evaluate :  $\lim_{x \rightarrow 0} \left( \frac{1}{\sin^2 x} - \frac{1}{x^2} \right)$  [20]

- Q.2) a) i) Find the  $n$  th derivative of  $\frac{x}{1+3x+2x^2}$

ii) If  $z = x^2 \tan^{-1}(y/x) - y^2 \tan^{-1}(x/y)$ , prove that  $\frac{\partial^2 z}{\partial y \partial x} = \frac{x^2 - y^2}{x^2 + y^2}$  [8]

b) If  $\tan(\theta + i\varphi) = \tan \alpha + i \sec \alpha$ , prove that  
$$e^{i\varphi} = \pm \cot\left(\frac{\alpha}{2}\right) \quad \text{and} \quad 2\theta = n\pi + \frac{\pi}{2} + \alpha$$
 [6]

c) If  $y = (x + \sqrt{1+x^2})^m$ , prove that  
$$(1+x^2)y_{n+2} + (2n+1)x y_{n+1} + (n^2 - m^2)y_n = 0$$
. Hence find  $y_n(0)$

- Q.3) a) State and prove Euler's theorem for homogeneous function of two variables.

Hence or otherwise prove that  $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = \sin 4u - \sin 2u$

Where  $u = \tan^{-1}(ax^2 + 2bxy + cy^2)$  [8]

- b) Find the three numbers of which the sum is 12 and the product is maximum. [6]

- c) State True/False with proper justification.:

i) If the curves  $f(x, y) = 0$  and  $g(x, y) = 0$  touch each other, then at the point of contact  $f_x g_y - f_y g_x = 0$

ii)  $[\vec{a} \times \vec{b} \cdot \vec{b} \times \vec{c} \cdot \vec{c} \times \vec{a}] = 4$ , if  $[\vec{a} \cdot \vec{b} \cdot \vec{c}] = 2$ .

iii) Modulus of  $(1+i)^t$  is  $\frac{\pi}{4}$

iv) Expansion of  $e^x$  is valid for all real values of  $x$

[6]

1/2  
P.T.O.

Q.4) a) Prove that  $\log(1 + \sin x) = x - x^2/2 + x^3/6 - x^4/12 + \dots$

Hence or otherwise find the expansion of  $\log(\sec x)$  [8]

b) If  $c$  is a real and nonzero and  $(1+ic)^5$  is real show that  $c = \pm\sqrt{5} \pm 2\sqrt{5}$   
OR

b) If  $u = \tan^{-1}\left(\frac{\cos x}{\sinhy}\right)$  and  $v = \tanh^{-1}\left(\frac{\sin x}{\cosh y}\right)$ , prove that  
 $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ ,  $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$  Hence show that  $u_{xx} + u_{yy} = 0$  [6]

c)  $F = F(x, y, z)$ ,  $x = u + v + w$ ,  $y = uv + vw + wu$  and  $z = uvw$ .  
Prove that  $u \frac{\partial F}{\partial u} + v \frac{\partial F}{\partial v} + w \frac{\partial F}{\partial w} = x \frac{\partial F}{\partial x} + 2y \frac{\partial F}{\partial y} + 3z \frac{\partial F}{\partial z}$  [6]

Q. 5 ) a ) i). Using the method of Lagranges' undetermined multipliers ,find  
Stationary points of  $3x + 5y + z - x^2 - y^2 - z^2$ , when

$$x + y + z = 6.$$

ii) The area of a triangle is calculated from the formula  $A = \frac{1}{2}bc \sin A$   
Error of 1%, 2% and 3% respectively are made in measuring  
b, c, A. If the correct value of A is  $\frac{\pi}{4}$ , find the % error in the  
calculated  $A$  [8]

b) Solve the equation  $1 + x + x^2 + x^3 + x^4 = 0$ . Also find the  
product of all these roots. [6]

OR

b) Prove that  $\cos^{-1}(e^{i\theta}) = \sin^{-1}(\sqrt{\sin \theta}) + i \log[\sqrt{\sin \theta} + \sqrt{1 + \sin \theta}]$

c) For  $\vec{r} = (3t - t^3)\hat{i} + 3t^2\hat{j} + (3t + t^3)\hat{k}$ , find

i)  $\left| \frac{d\vec{r}}{dt} \times \frac{d^2\vec{r}}{dt^2} \right|$  and  $[\vec{r} \cdot \vec{r} \cdot \vec{r}]$  [6]

3/2

**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
Matunga, Mumbai – 400 019  
[Autonomous]

**Sem. & Programme                    I F.Y.B.Tech (All Branches)                    Duration: 03 Hours**  
**Course Code & Course                Applied Mathematics – I (MA-0001)                Max.Marks: 100**  
**Date of Exam: 19-11-2012**

**Instructions :** 1. All Question is compulsory..  
2. Figures to the right indicate full marks.  
3. to the All questions carry equal marks  
4. Answers individual question must be grouped and written together.

Q.1 Answers the Following (20)

(a) A particle moves along a plane curve such that its linear velocity is perpendicular to the radius vector. Show that the path of the particle is a circle. (4)

(c) Evaluate  $\lim_{x \rightarrow 0} \left( \frac{1+2^x}{2} \right)^{\csc x}$ . (4)

(d) If  $u = f(x^2 - y^2, y^2 - z^2, z^2 - x^2)$ , Prove that  $\frac{1}{z} \frac{\partial u}{\partial z} + \frac{1}{x} \frac{\partial u}{\partial x} + \frac{1}{y} \frac{\partial u}{\partial y} = 0$  (4)  
(e) Prove that  $\tanh \log \sqrt{5} + \tanh \log \sqrt{7} = \frac{17}{12}$  (4)

Q.2 (a) Find  $n^{\text{th}}$  derivative of  $y = \frac{1}{ax+b}$  and hence determine  $n^{\text{th}}$  derivative of the following function : i)  $u = \frac{2x^3-3x^2-4x-5}{2x^2-7x+3}$  ii)  $v = \log\left(\frac{4x^2-6x+9}{x+3}\right)$ . (8)

(b) If  $z = f(x, y)$  where  $x = e^u + e^{-v}$  and  $y = e^u - e^{-v}$ , then prove that

$$\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} = x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y}$$

(c) Separate into real and Imaginary parts of  $\cos^{-1}\left(\frac{3i}{4}\right)$

$$\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y}$$

(c) Separate into real and Imaginary parts of  $\cos^{-1}\left(\frac{3i}{4}\right)$ .

Q.3.(a) State the Euler's theorem for homogenous function of three variables .Verify Euler's

(a) State the Euler's theorem for homogeneous functions. Then prove the theorem for  $u = x^2 \tan^{-1} \left( \frac{y}{x} \right) - y^2 \tan^{-1} \left( \frac{x}{y} \right)$  and show that  $\frac{\partial^2 u}{\partial x \partial y} = \frac{x^2 - y^2}{x^2 + y^2}$ .

(b) Considering only the principal values .Prove that the real part of  $(1 + i\sqrt{3})^{(1+i\sqrt{3})}$  is

$$2e^{-\frac{\pi}{\sqrt{3}}} \left( \cos \frac{\pi}{2} + \sqrt{3} \log 2 \right) \quad (6)$$

(c) Expand  $f(x) = x^5 - x^4 + x^3 - x^2 + x - 1$  in power of  $(x - 1)$  and hence find  $f(0.99)$

Q.4.(a) i) If  $x = \cos\theta + i\sin\theta$ ,  $y = \cos\varphi + i\sin\varphi$  then prove that

$$\frac{x-y}{x+y} = i \tan\left(\frac{\theta-\varphi}{2}\right) \quad (6)$$

ii) If  $x + iy = \sqrt{\frac{a+ib}{c+id}}$ , prove that  $(x^2 + y^2)^2 = \frac{a^2+b^2}{c^2+d^2}$  (2)

(b) If  $y = (\log(x + \sqrt{1 + x^2}))^2$  Prove that  $y_{n+2}(0) = -n^2 y_n(0)$ . (6)

(c) Show that  $e^{x \sin x} = 1 + x^2 + \frac{x^4}{3} + \frac{x^6}{120} + \dots \dots \dots$  (6)

OR

(c) Find the extreme value of  $u = x^3 + 3xy^2 - 3x^2 - 3y^2 + 7$ , if any. (6)

Q.5.(a)i) Prove that  $\frac{b-a}{\sqrt{1-a^2}} < \sin^{-1}b - \sin^{-1}a < \frac{b-a}{\sqrt{1-b^2}}$  where  $a < 1, b < 1$  and  $a < b$ . deduce

that  $\frac{\pi}{6} - \frac{1}{2\sqrt{3}} < \sin^{-1}\left(\frac{1}{4}\right) < \frac{\pi}{6} - \frac{1}{\sqrt{15}}$ . (6)

ii) Prove that  $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right) = \frac{1}{2}\left(x - \frac{x^3}{3} + \frac{x^5}{5} - \dots \dots \dots \dots \dots\right)$  (2)

(b) If  $\bar{a} = \sin\theta i + \cos\theta j + \theta k$ ;  $\bar{b} = \cos\theta i - \sin\theta j - 3k$ ;  $\bar{c} = 2i + 3j - k$  find

$$\frac{d}{dt} [\bar{a} \times (\bar{b} \times \bar{c})] \text{ at } \theta = \frac{\pi}{2} \quad (6)$$

(c) If  $u = \sin^{-1}(x - y)$  where  $x = 3t, y = 4t^3$ , show that  $\frac{du}{dt} = \frac{3}{\sqrt{1-t^2}}$  (6)

OR

(c) Find the value of  $a, b, c$  so that  $\lim_{x \rightarrow 0} \frac{ae^x - b \cos x + ce^{-x}}{x \sin x} = 2$ . (6)

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE  
Matunga, Mumbai - 400 019  
[Autonomous]

End Semester Examination

Sem. & Programme      1F.Y.B.Tech (All Branches)  
Course Code & Course      Applied Mathematics - 1 (MA-0001)      Duration: 03 Hours  
Max.Marks: 100

Date of Exam: 28-11-2011

Time: 10 to 1

- Instructions:**
1. All Questions are compulsory.
  2. Figures to the right indicate full marks.
  3. All questions carry equal marks.
  4. Answers to the individual question must be grouped and written together. (20)

Q.1 Answers the Following

- (a) Define scalar product of four vectors  $\vec{a}, \vec{b}, \vec{c}, \vec{d}$  and derive Lagrange's identity. Hence prove that  $(\vec{b} \times \vec{c}) \cdot (\vec{a} \times \vec{d}) + (\vec{c} \times \vec{d}) \cdot (\vec{b} \times \vec{a}) + (\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d}) = 0$  (4)
- (b) If  $y = e^{ax} \sin bx$ , find  $y_n$  where  $u = e^{ax} \sin bx \cos x$  (4)
- (c) Evaluate  $\lim_{x \rightarrow 0} (1 + x \sin x)^{\frac{\cos x}{x^2}}$ . (4)
- (d) Verify Euler's theorem for  $u = x^2 y \cos \left(\frac{x}{y}\right)$ . (4)
- (e) Find  $\tanh x$  if  $5 \sinhx - \cosh x = 5$ . (4)

Q.2 (a) Prove that  $\frac{b-a}{\sqrt{1-a^2}} \leq \sin^{-1} b - \sin^{-1} a \leq \frac{b-a}{\sqrt{1-b^2}}$  where  $b < 1, a < 1$  and  $a < b$ .

Hence, deduce that  $\frac{\pi}{6} + \frac{\sqrt{3}}{6} \leq \sin^{-1} \frac{3}{5} \leq \frac{\pi}{6} + \frac{1}{3}$ . (6)

- (b) If  $u = \sin^{-1}(x-y)$  where  $x = 3t, y = 4t^3$ , show that  $\frac{du}{dt} = \frac{3}{\sqrt{1-t^2}}$ . (6)
- (c) Find the expansion for  $\log(1+x)$  Hence or otherwise find expansion for i)  $\tanh^{-1} x$  ii)  $\log(1-x+x^2)$  and evaluate  $\lim_{x \rightarrow 0} \left[ \frac{2x-x^2+2\log(1-x+x^2)}{x^2 \sin x} \right]$ . (8)

Q.3. (a) Prove that  $(1+i \tan \alpha)^{(1+i \tan \beta)}$  can have real values, one of them is. (6)

$(\sec \alpha)^{\sec^2 \beta}$  considering only principal value.

- (b) By finding two different ways the nth derivative of  $x^{2n}$ , prove that;
- $$1 + \frac{n^2}{1^2} + \frac{n^2(n-1)^2}{2^2 \cdot 2^2} + \frac{n^2(n-1)^2(n-2)^2}{3^2 \cdot 2^2 \cdot 3^2} + \dots = \frac{(2n)!}{(n!)^2} \quad (6)$$

- (c) If  $z = f(x, y), x = e^u \cos v, y = e^u \sin v$ , prove that i)  $x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = e^{2u} \frac{\partial z}{\partial v}$ , ii)  $\left(\frac{\partial z}{\partial u}\right)^2 + \left(\frac{\partial z}{\partial v}\right)^2 = e^{2u} \left[\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2\right]$ . (8)

Q.4. (a) Prove that  $\sin^{-1}(e^{i\theta}) = \cos^{-1} \sqrt{\sin \theta} + i \log(\sqrt{\sin \theta} + \sqrt{1+\sin \theta})$ . (6)

- (b) Find the stationary values of  $\sin x, \sin y, \sin(x+y)$ .

OR

- (b) If  $y = \sin 2\theta$  and  $x = \sin \theta$  then prove that (6)
- $$(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2-4)y_n = 0$$

(c) State and prove Euler's theorem for function of three variables and verify Euler's theorem (8)

$$\text{If } u = \frac{x+y+z}{\sqrt{x+y+z}}$$

Q.5. (a) If  $\vec{a} = \sin t \hat{i} + \cos t \hat{j} + t \hat{k}; \vec{b} = \cos t \hat{i} - \sin t \hat{j} - 3 \hat{k}; \vec{c} = 2\hat{i} + 3\hat{j} - \hat{k}$  find (6)

$$\frac{d}{dt} [\vec{a} \times (\vec{b} \times \vec{c})] \Big|_{at=0} \quad (6)$$

(b) If  $x_r = \operatorname{cls} \left(\frac{\pi}{2r}\right)$ , show that  $\lim_{n \rightarrow \infty} x_1, x_2, x_3, x_4, \dots, x_n = -1$  (6)

(c) i) Test the convergence of (4)

$$\frac{x}{1 \cdot x} + \frac{x^2}{2 \cdot x} + \frac{x^3}{3 \cdot x} + \dots \quad x > 0. \quad (4)$$

ii) Find the approximate value of  $[(3.82)^2 + 2(2.1)^3]^{\frac{1}{3}}$  (4)

OR (4)

(c) i) Find the locus represented by  $|z-3| + |z+3| = 10$ . (4)

ii) Solve  $16x^4 - 8x^3 + 4x^2 - 2x + 1 = 0$ . (4)



SC



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
**[Central Technological Institute, Maharashtra State]**  
**Matunga, Mumbai-400 019**

**EXAMINATION** **ESE** **DATE OF EXAM - 5<sup>th</sup> May 2015**  
**SEMESTER & PROGRAM** **FY BTECH** **TIME 9:30 am to 12:30 p.m.**  
**TIME ALLOWED** **3 HRS** **MARKS 100 Marks**  
**COURSE (Course Code)** **Computer Programming and Problem Solving (CO 0001)**

- Instructions:**
1. Figures in right indicate full marks.
  2. Assume suitable data wherever necessary
  3. All questions are compulsory

**Q.1 a. What is the output of the programs given below? State the reason. (04)**

|   |  |
|---|--|
| <b>i)</b> <pre>#include&lt;stdio.h&gt; void main() {     int i;     double a=5.2;     char *ptr;     ptr=(char *)&amp;a;     for(i=0;i&lt;=7;i++)         printf("%d ",*ptr++); }</pre> | <b>ii)</b> <pre>#include&lt;stdio.h&gt; int main() {     int fun(int);     int i=3;     fun(i=fun(fun(i)));     printf("%d\n",i);     return 0; } Int fun(int i) {     i++;     return( i ); }</pre> |
|---|--|

**b. Rewrite the following program after removing errors(if any). Underline the corrected part and write output. (06)**

|  |   |
|--|---|
| <b>i)</b> <pre>#include &lt;iostream.h&gt; struct Pixels {     int Color, Style; } void ShowPoint(Pixels P) {     cout&lt;&lt;P.Color,P.Style&lt;&lt;endl; } void main() {     Pixels Point1=(5,3);     ShowPoint(Point1);     Pixels Point2=Point1;     Color.Point1+=2;     ShowPoint(Point2); }</pre> | <b>ii)</b> <pre>#include&lt;stdio.h&gt; int main() {     char str1[]="Pune";     char str2[]="Mumbai";     char *s1= str1, *s2= str2;     while(*s1++ = *s2++);     printf("%s", str1);     printf("\n");     return 0; }</pre> |
|--|---|

**c. Write a short note on following (10)**

- i. Encapsulation
- ii. Abstraction
- iii. Null Pointer
- iv. Abstract class
- v. User-defined function

**Q.2 a. Explain in detail about Pass by Value and Pass by reference with example. (06)**  
**b. Illustrate with example concept of String Arrays and its manipulation. (07)**  
**c. What is mean by Access specifier? List various Access Specifiers and their role in inheritance (for both derivation and declaration). (07)**

**Q.3 a. Write a program to create class Student and display the information of n number of student using array of objects. Also explain significance of using array of objects in given program. (07)**

- b. Develop a flow chart, algorithm and program to accept a year as input and print if it is a leap year or not . A year is leap year if it is divisible by 4 and centennial years (years divisible by 100) are leap years only when they are also divisible by 400. (08)
- c. What are the different file open modes in C++? (05)  
 Write a function in C++ to print the count of word "the" as an independent word in a text file STORY.TXT. the content of the file STORY.TXT is "There was a monkey in the zoo. The monkey was very naughty."
- Q.4 a. Explain polymorphism and Virtual functions with example. Illustrate the difference between static & dynamic binding with example? (10)
- b. Write a program for following statement.  
 Imagine a company that markets both hardware and software. Suppose base class 'item' that stores the title of the item (a string) and its price (a float). Suppose we have another base class called 'sales' that holds an array of three floats so that it can record the sale in rupees of a particular item for the last three months. Now we derive two classes 'hwitem' (hardware item) and 'switem' (software item) from both item and sales. The hwitem class holds category of item and its original equipment manufacturer, whereas the switem class holds the type of software item and the OS under which it works. Each class has its own getdata() function and displaydata() functions to input and output data respectively.
- Q.5 a. Draw the Class diagram with descriptions of following case study:- (10)  
 Museums look after the world's cultural property and interpret it to the public. This is not ordinary property. It has a special status in international legislation and there are normally national laws to protect it. It is part of the world's natural and cultural heritage. It is also a significant component in defining cultural identity, nationally and internationally.  
 The application brings all the archives and historical collections at 'Museum', easily accessible and available to the world wide history lovers at their doorsteps. People can login to this system and become a one of the users to get information of this museum collection. Unregistered users can see limited collection of things at the museum but cannot get detailed information about some of the archives and valuable collections. Registered history students, scientists or art students can get detailed information of the archives and valuable collections. The System provides the news of the exhibitions conducted at museum. Also maintains the visitor records to calculate interest of the people towards historical collection. This system also provides shopping of valuable things. The administrator uploads the dates of exhibitions which are conducted at museum. This system also provides guidelines to plan a visit. In this it gives information about the location of museum. It also provides the idea about the transport facilities to reach museum. It gives visiting hours, entry fees of the museum. It also provides information of the facilities which are available at the museum like wheel chair, ramp and elevator. This system has introduced a course of 'Museum Management'. The course covers various aspects of collection management, exhibit designing, project implementation, communication aids and leading edge ideas in conservation practices. It also provides facilities for Exhibitions, Seminars & Educational Activities by providing hall on rent. The space can be used for lectures, seminars, temporary exhibitions and art shows in Museum Activity Centre. The System allows collection manager to track movement of objects in and out of museum or on exhibitions, maintains objects with accession numbers and detailed records. The system also welcomes donors. From the time a donor approaches your organization, system captures valuable information about the donor and item, produces documents for the transaction including a Deed of Gift and thank you letter. The System includes a Contacts database that tracks information about your contacts including membership renewals, pledges, financial gifts, and volunteer hours. Create bulk mailings and produce letters, as well as send email newsletters and membership renewal reminders through the use of Contact Lists.
- b. Draw the Use case diagram with descriptions of above case study (10)



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

**EXAMINATION** **ESE** **DATE OF EXAM** ~ 23/09/2015  
**SEMESTER & PROGRAM** **FY BTECH** **TIME**  
**TIME ALLOWED** **3 HRS** **MARKS** **100 Marks**  
**COURSE (Course Code)** **Computer Programming and Problem Solving (CO 0001)**

**Instructions:**

1. Figures in right indicate full marks.
2. Assume suitable data wherever necessary
3. All questions are compulsory

Q.1 a. What is the output of the programs given below? State the reason.

(04)

```

i)
#include<stdio.h>
int main()
{
    char t;
    char *p1= "Harder you
work", *p2;
    p2=p1;
    p1= "Luckier you get";
printf("%s %s \n", p1, p2);
    return 0;
}

ii)
#include<stdio.h>
int main()
{
    int i= 45, c;
    c=2*check(i)+check(i);
printf("%d\n", c);
return 0;
}
int check(int ch)
{
    if(ch>=45)
        return(100);
    else
        return(10);
}

```

(06)

b Rewrite the following program after removing errors(if any). Underline the corrected part and write output.

```
i) #include <iostream.h>
void main();
{
    char str[10]= 'Angel';
    str[6]= "d";
    printf("%s\n",str)
    return 0;
}

ii) #include<stdio.h>
int main()
{
    char str1[] = "Pune";
    char str2[] = "Mumbai";
    char *s1= str1, *s2= str2;
    while(*s1++ = *s2++);
    printf("%s", str1);
    printf("\n");
    return 0;
}
```

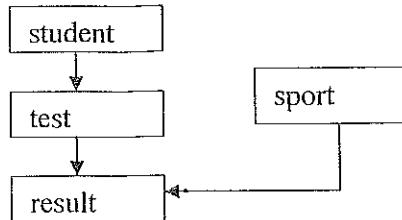
(10)

c Write a short note on followings.  
i) Data Hiding ii) Inheritance iii) Pure virtual function iv) Friend function  
v) Pointer to pointer

Q.2 a What is an array of pointers and what is pointer to an array? Explain in detail with example. (06)  
b Explain recursive function. Write a program to generate Fibonacci series using recursion with member function. (07)  
c How Constructor and Destructor are executed in multilevel inheritance with example. (07)

- Q.3 a Write a program to create class College and display the information of n number of colleges using array of objects. Also explain significance of using array of objects in given program. (07)
- b The postage for ordinary post is Rs. 2/- for the first 15 grams and Rs. 1 for each additional 10 grams. Write a program to calculate the charge of the postage for a post weighing N grams. Read the weight of N packets and display the total amount of postage. Also develop flowchart and algorithm for same. (08)
- c Explain file position pointer with examples. Write a C++ program for file handling assuming that a text file named FIRST.TXT contains some text written into it, write a function named copyupper(), that reads the file FIRST.TXT and creates a new file named SECOND.TXT contains all words from the file FIRST.TXT in uppercase. (05)

- Q.4 a Explain polymorphism and Virtual functions with example. Illustrate the difference between static & dynamic binding with example? (10)
- b consider the case of processing the student results, class 'student' should get information of student, use class 'test' for accepting subject marks and calculate total, the grades for sport is stored in separate 'sport' class. Class 'result' should contain function 'showResult' which will display grade sheet of student with all details. (10)



- Q.5 a Draw the Class diagram with descriptions of following case study:- (10)

The online Job Portal System will be an online system in which job advertisements will be displayed on the job seeker's profile according to their specialization and interests. Every job aspirant will have their own profile. Employers, educational institutes and other job agencies can also log in to the system for their purposes. Employers can publish their advertisements for as per their vacancies in which they will have to specify the qualification of the applicant, experience, skills required, and also the salary package to be offered. Educational institutions can also approach to the employers and can arrange campus placements. They also can arrange pool campus placements by inviting other educational institutions. Job aspirants will have to register or sign in to the system provide the necessary personal information. They will have to upload their resume either in document format or in PDF format else they can fill the online form. The information is to be refreshed or renewed at least once in three months.

Employers will have to log in to the system as employers. They can add or delete job advertisements. Job aspirants will be able to see the job advertisements depending upon their skills, experience, salary expectations and location. If advertisement for a job profile matching to the job aspirant's interest is up, they can apply for any job online as per their interests. They will have to upload their latest resume while applying for any job. Also they will have to update their profile information.

When they apply online for job profile, a notification will be sent to the concerned employer. If the eligibility criteria matches and the vacancy is still not filled up, the employers can invite the applicant for an interview. The invitation for interview will be sent on job applicant's profile along with the interview schedule. The employer will update the status of the vacancy if an applicant gets a job at the position of the respective job profile. As soon as the vacancy in the employer's site is filled advertisement will automatically take down from the portal.

- b) Draw the Use Case diagram with descriptions of above case study. (10)



VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

SEMESTER EXAMINATION  
SEMESTER & PROGRAM : E.Y.B.Tech.  
TIME ALLOWED : 3 HRS  
COURSE (CourseCode) : Applied Mechanics

DATE OF EXAM : 22/5/13  
TIME : 9.30 a.m. to 12.30 p.m.  
MARKS : 100

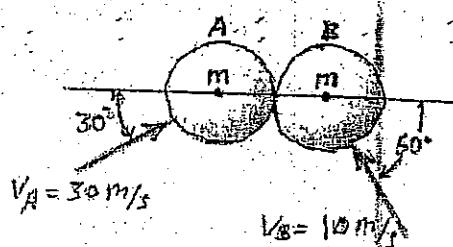
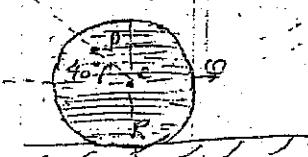
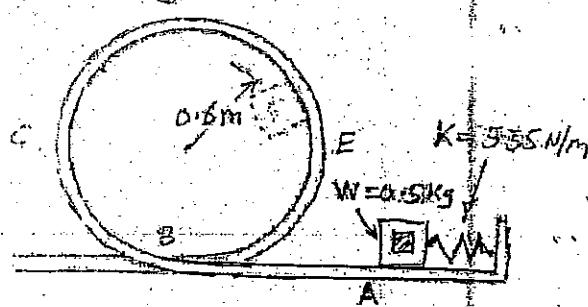
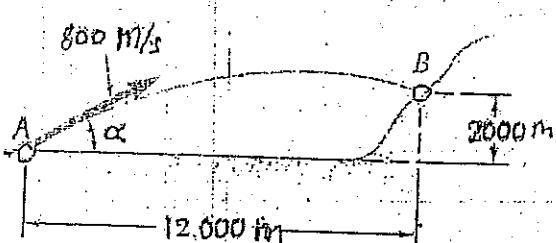
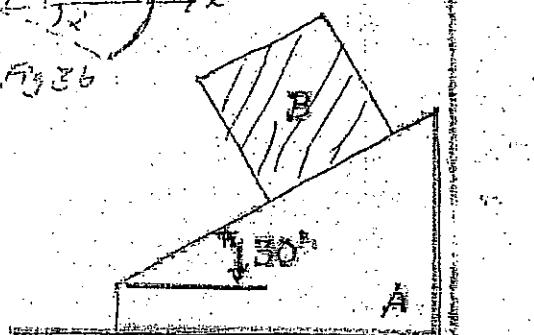
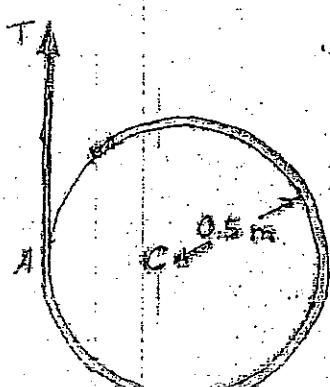
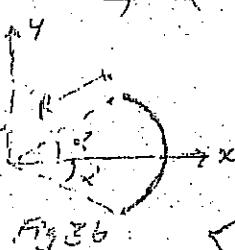
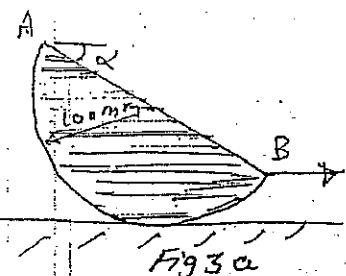
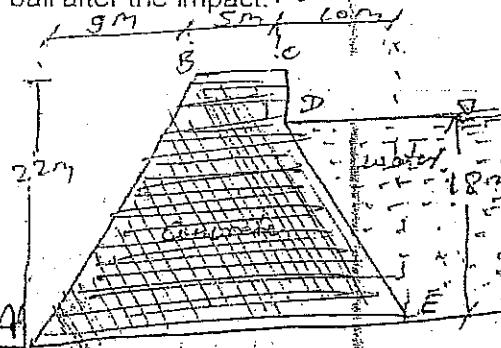
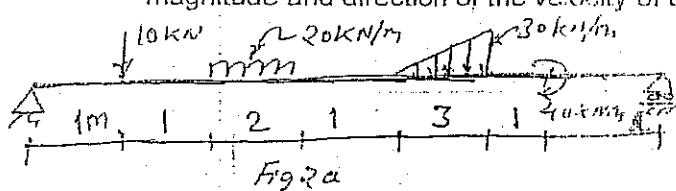
- Instructions  
1 All questions are compulsory.  
2 Figures to the right indicate full marks.  
3 Assume suitable data wherever necessary  
4 Solve any two sub-question of Q-4  
5 Solve any two sub-question of Q-5

- Q1 a Give the principle/ purpose behind using flywheel in machines. 02  
b Classify different types of force systems with neat sketches. 04  
c Explain coefficient of restitution with neat sketches 04  
d Classify different types of impact with neat sketches 04  
e Briefly explain different types of rigid body motion with neat sketches 06
- Q2 a Using virtual work method, find the reaction of the beam shown in fig. 2a 10  
b The cross section of a concrete dam is as shown in fig.2.b. Consider a 1m thick section of the dam, and determine (a) the resultant of the reaction forces exerted by the ground on the base AB of the dam, (b) the resultant of the pressure forces exerted by the water on the face BE of the dam. The specific weights of concrete and water are  $23 \text{ kN/m}^3$  and  $9.810 \text{ kN/m}^3$  respectively. 10
- Q3 a A short semicircular cylinder of radius 100 mm and weight 50N rests on horizontal surface.  $\mu_s = 0.25$  between contact faces. A force P is applied horizontally at B as shown in fig.3a. Find the angle  $\alpha$  that the flat surface will make with horizontal plane just before sliding. 10  
b Derive equation for centroid of circular arc (wire) shown in fig 3.b. 10
- Q4 a A cord is wrapped around a homogeneous disk of radius  $r = 0.5 \text{ m}$  and mass  $m = 15 \text{ kg}$ . If the cord is pulled upward with a force T of magnitude 180 N, determine (a) the acceleration of the center of the disk, (b) the angular acceleration of the disk, (c) the acceleration of the cord, (d) acceleration of point A on the disk (only equation) (e) what should be the value of T so that center of Disk has zero acceleration. 10  
b The 12 kg block B starts from rest and slides on the 30 kg wedge A, which is supported by a horizontal surface. Neglecting friction, determine (a) the acceleration of the wedge, (b) the acceleration of the block relative to the wedge. Fig 4b 10  
c A projectile is fired with an initial velocity of 800 m/s at a target B located 2000 m above the gun A and at a horizontal distance of 12,000 m neglecting air resistance, determine the value of the firing angle  $\alpha$ . Fig 4c 10
- Q5 a The 0.5kg pellet is pushed against the spring at A and released from rest. Neglecting friction, determine the smallest deflection of the spring for which the pellet will travel around the open loop ABCDE and remain at all times in contact with the loop. Fig 5a 10  
b A 0.4 m diameter wheel rolls on a horizontal plane without slip, such that its center has a velocity of 10m/s towards right. Find the angular velocity of the wheel and also velocities of point P, Q and R shown on the wheel.  
 $L(GP) = 0.15\text{m}$  Fig 5b 10

P.T.O

SC.

- c The magnitude and direction of the velocities of two identical frictionless balls before they strike each other are as shown. Assuming  $e = 0.90$ , determine the magnitude and direction of the velocity of each ball after the impact. Fig 5c





# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

SEMESTER EXAMINATION  
SEMESTER & PROGRAM  
TIME ALLOWED  
COURSE (CourseCode) : *Applied Mechanics*

April 2014 ESE  
F.Y.B.tech.  
3 HRS.

DATE OF EXAM  
TIME  
MARKS

27/05/14  
9.30am -12.30pm  
100

- Instructions    1 All questions are compulsory.  
                  2 Figures to the right indicate full marks.  
                  3 Assume suitable data wherever necessary.

- Q-1**   a Find the reaction of beam by virtual work method. Ref. Fig. 1a      04  
      b A jet plane starts from rest at  $x=0$  and is subjected to the acceleration shown in Fig. 1b Determine speed of train when it travels 60m.      04  
      c Ship A travels in the north west direction with  $V=18\text{km/hr}$  and ship B travels due east with velocity  $V= 9\text{km/hr}$ . find relative velocity of ship B w.r.t. ship A. refer Fig. 1c.      04  
      d For flat belt Derive equation  $T_2/T_1=e^{\mu\beta}$   
                Where  $\mu$ = coeff. Of friction and  $\beta$ =lap angle.      04  
      e To move a boat uniformly in given direction resultant force  $R=520\text{N}$  is required. Two men pulling with force P and Q by mean of ropes are required to do this. (ref. Fig. 1e)  
         i) Determine the force P and Q. ii) If  $\theta_1= 30$  deg. Find value of  $\theta_2$  such that the force in rope Q is minimum What is the mini force Q?      04
- Q-2**   a From the first principle derive equation for centroid of sector of a circle      04  
      b The blocks  $W_1$  and  $W_2$  are connected by horizontal rod AB are supported on rough surface as shown in Fig. 2b. Coefficient of friction for block A= 0.4 and angle of friction for block B is  $20^\circ$ . Find the smallest wt.  $W_1$  of block A for which equilibrium can exist, if  $W_2=2250\text{N}$ .      08  
      c Two sphere A and B are resting in a smooth trough as shown in Fig. 2c. Draw free body diagram of A and B with all the forces with their magnitude and direction. Radius of sphere A and B are  $r_A=250$  &  $r_B=200\text{mm}$  resp.      08
- Q-3**   a Find the moment of inertia of shaded area shown in Fig. 3a. about x axis and y axis.      08  
      b For the truss loaded as shown in Fig 3b. find the force in all the members of the truss.      12
- Q-4**   a Two guns are pointed to each other as shown in Fig. 4a. if the bullet leaves the gun with the velocity of  $350\text{m/s}$  and  $300 \text{ m/s}$  respectively, find when and where they will meet.  
**OR**  
      a Two smooth sphere 1 and 2 having mass  $m_1=2\text{kg}$  and  $m_2= 4\text{kg}$  collide with initial velocities as shown in Fig. 4a1. If coefficient of restitution for the sphere is  $e= 0.8$ , determine the velocities of each sphere after collision.      10  
      b An 8kg plunger is released from rest in the position shown in Fig. 4b. and is stopped by two nested springs. Constant of spring is given in Fig.4b. Determine maximum deflection of outer spring.      05  
      c A 1 N ball is bowled to a batsman. The velocity of ball was  $20\text{m/s}$  horizontally just before batsman hit it. After hitting it went away with a velocity of  $48\text{m/s}$  at an inclination of  $30^\circ$  with horizontal as shown in Fig. 4c. find the average force exerted on the ball by the bat if the impact lasts for 0.02 seconds.      05

- Q-5 a C is a uniform cylinder to which a rod AB is pinned at A and the other end of the rod B is moving along a vertical wall as shown in Fig. 5a. If the end B of rod is moving upward along the wall at a speed of 3.3 m/s, find the angular velocity of the cylinder assuming that the cylinder is rolling without slipping. 05
- b A car weighing 20kN goes around a curve of radius 60m banked at an angle of  $30^\circ$ . Find the frictional force acting on tyres and normal reaction on outer and inner wheels when car is traveling at 96kmph. The coefficient of friction between the tyres and the road is 0.6. Take width of wheel base  $B=1.6\text{m}$  and height of C.G. of the vehicle above road level  $h=0.8\text{m}$  05
- c A solid sphere and a thin hoop of equal masses  $m$  and radii  $R$  are connected together by a frame and are free to roll without slipping down the inclined plane as shown in Fig.5c. Neglecting the mass of the frame determine the acceleration of the system. Also calculate the force in the frame. Assume frictionless bearings. 10  
**OR**  
 c A circular ring of outer radius 1m and inner radius of 0.75m is supported on a knife edge as shown in fig. 5c1. Determine the period for small vibration, if it weighs 200N. 10

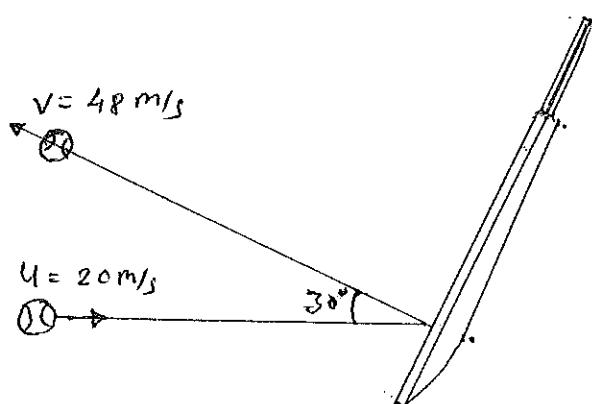


Fig 4c

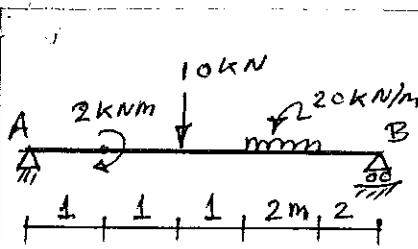


Fig. 1a

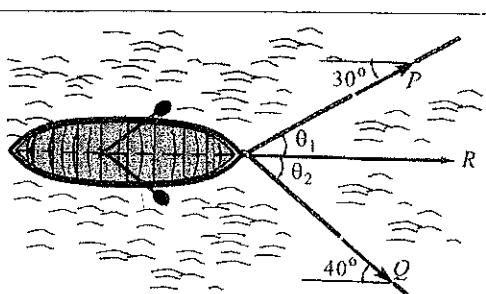


Fig. 1c

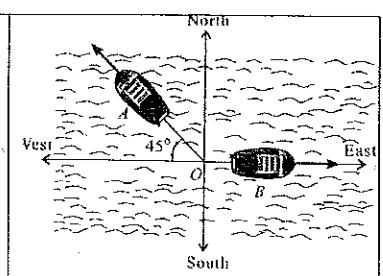


Fig. 1e

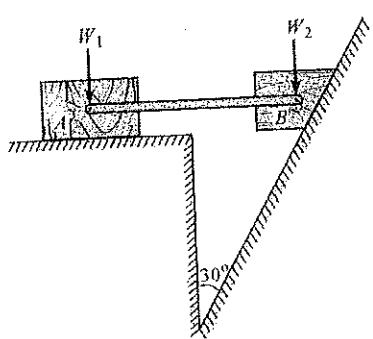


Fig. 2b.

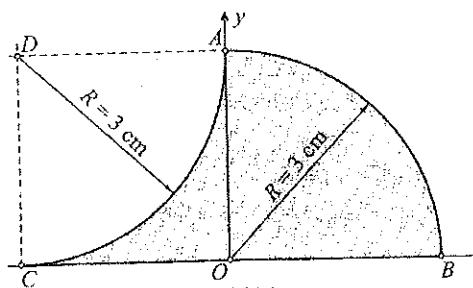


Fig. 3a.

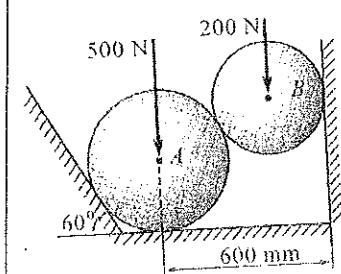


Fig. 2c.

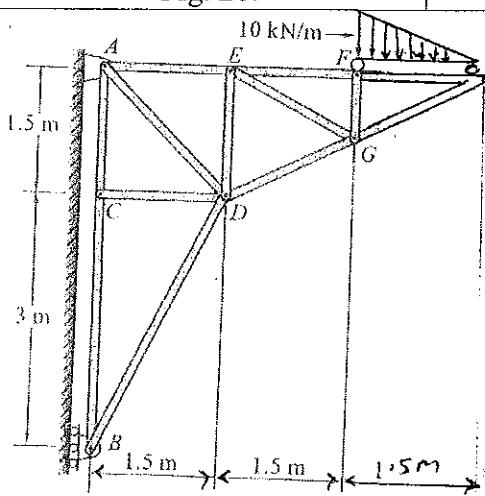


Fig. 3b

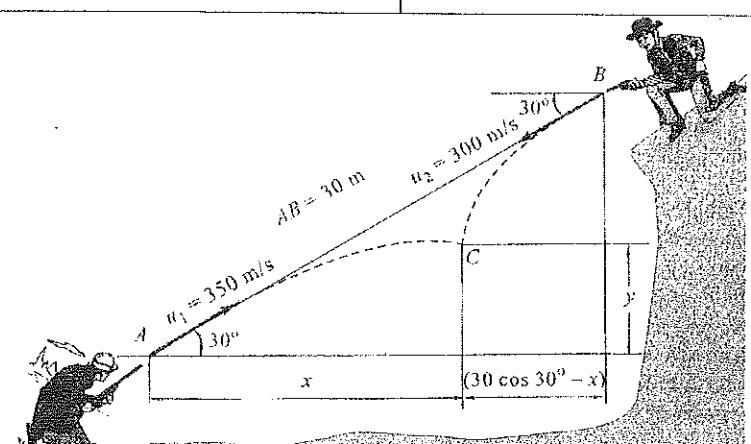


Fig. 4a.

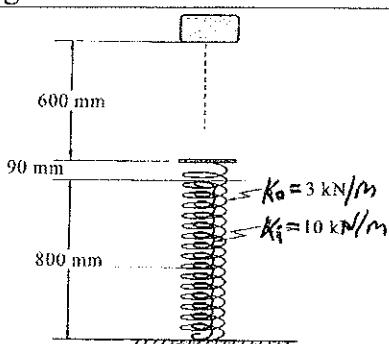


Fig. 4b

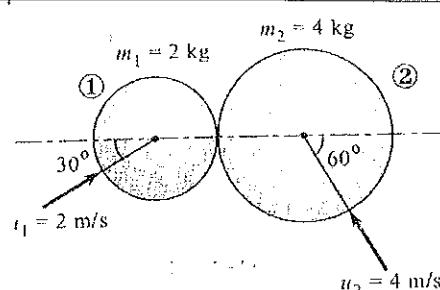


Fig. 4a1

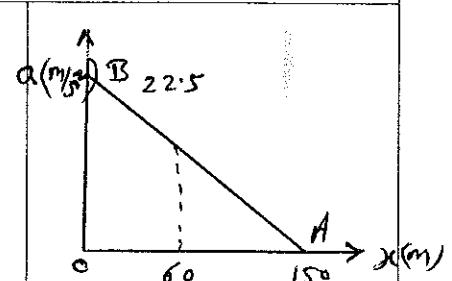


Fig. 1b

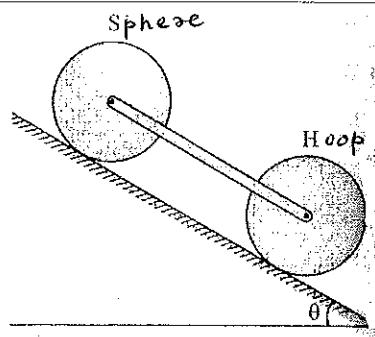


Fig. 5c

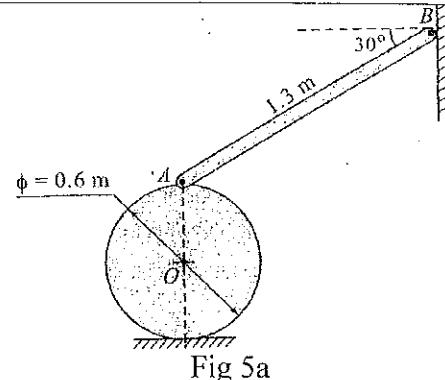


Fig. 5a

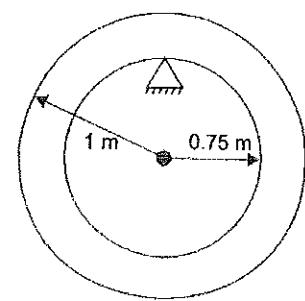


Fig. 5c1





# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

SEMESTER EXAMINATION

April 2015/ESEJ

DATE OF EXAM 21-05-2015

SEMESTER & PROGRAM

II F.Y.Btech

TIME 9.30 am to 12.30 PM

TIME ALLOWED

3 HRS.

MARKS

100

COURSE (Course Code) :

ENGINEERING MECHANICS (SE0001)

- Instructions
- All questions are compulsory.
  - Figures to the right indicate full marks.
  - Assume suitable data whenever necessary.

- Q.1 a. i) State and prove parallel axis theorem 5  
ii) State the principle of transmissibility of forces and its limitation 5
- Q.1 b. If spring BC is unstretched with  $\theta=0^\circ$  and the bell crank achieves its equilibrium position when  $\theta=15^\circ$ , determine the force F applied perpendicular to segment AD and the horizontal and vertical components of reaction at pin A. Spring BC remains in the horizontal position at all times due to the roller at C. 10

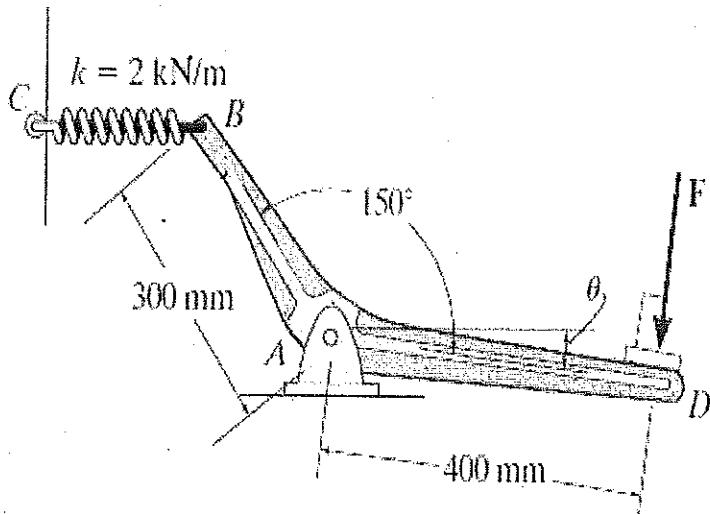


Fig. 1b

- Q.2 a. Determine the force in members JK, CJ, CD, HI, FI, and EF of the truss, and state if the members are in tension or compression, use section method. 10

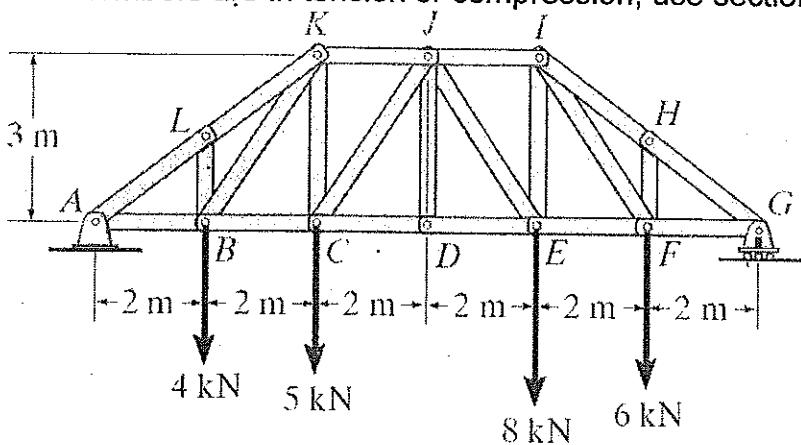


Fig. 2a

- Q.2 b. Determine the smallest vertical force P required to push the wedge between the two identical cylinders, each having a weight of W. The coefficient of static friction at all contacting surfaces is  $\mu_s = 0.3$ . 10

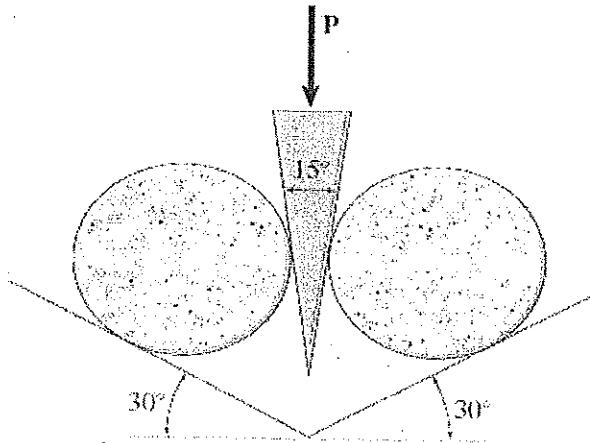
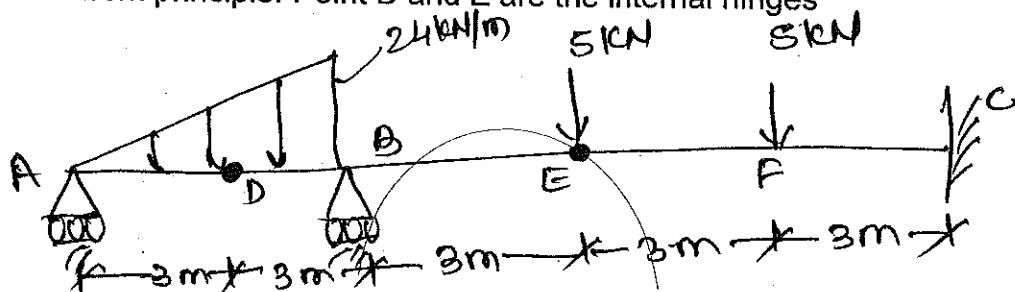


Fig. 2b

- Q3 a Find the support reactions at A, B and C for the beam shown in fig. By using virtual work principle. Point D and E are the internal hinges 10



- Q.3 b The spring in the toy gun has an unstretched length of 100 mm. It is compressed and locked in the position shown. When the trigger is pulled, the spring unstretches 12.5 mm, and the 20 g ball moves along the barrel. Determine the speed of the ball when it leaves the gun. Neglect friction. 10

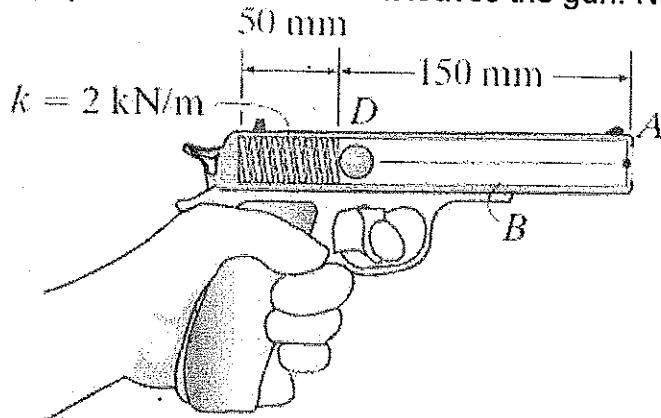


Fig. 3b

- Q.4 a A ladder AB=6m resting against a vertical wall at A and horizontal ground at B. If the end B of the ladder is pulled towards right with a constant velocity  $v_B=4\text{ m/s}$ . Find 10

- Instantaneous centre of rotation of ladder
- Angular velocity of the ladder at the instant,
- Velocity  $v_A$  of the end A of the ladder and
- Velocity component  $v_{Cx}$ ,  $v_{Cy}$  of mid point C of the ladder

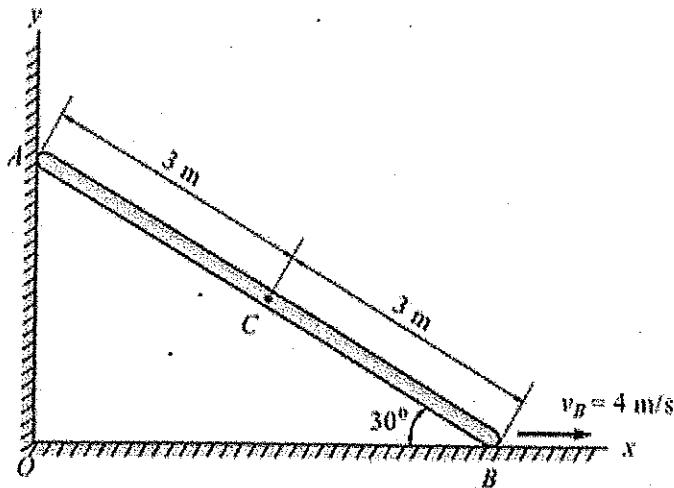


Fig. 4a

- Q.4 b The three balls each have a mass  $m$ . If A has a speed just before a direct collision with B, determine the speed of C after collision. The coefficient of restitution between each pair of balls  $e$ . Neglect the size of each ball. 10

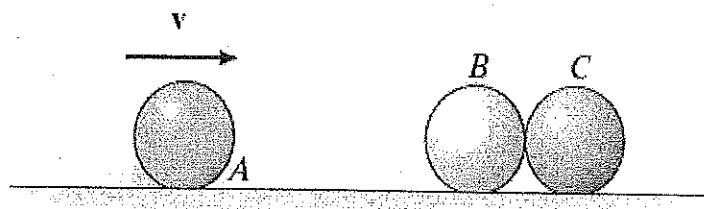


Fig. 4b

- Q.5 a The driver attempts to tow the crate using a rope that has a tensile strength of 200 kN. If the crate is originally at rest and has a weight of 500 kN, determine the greatest acceleration it can have if the coefficient of static friction between the crate and the road is  $\mu_s=0.4$ , and the coefficient of kinetic friction is  $\mu_k=0.3$ . 10

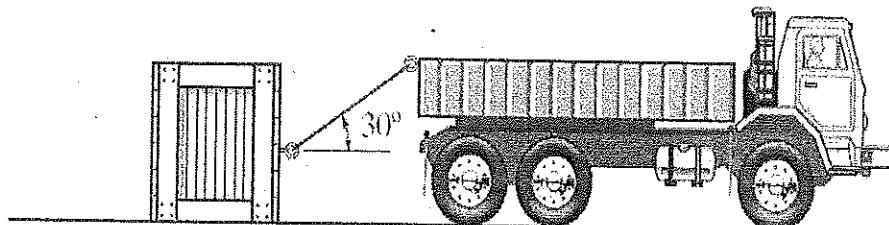


Fig. 5a

- Q.5 b i) State the principle of conservation of energy  
ii) State the principle of conservation of momentum 5  
5





# VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

Malunga, Mumbai - 400 019

[Autonomous]

## End Semester Examination

|                      |   |              |           |
|----------------------|---|--------------|-----------|
| Sem & Programme      | F.Y.B. Tech. (Batch IV& V)  | Duration     | 03 Hours  |
| Course Code & Course | Elements of Mechanical Engineering  | Max Marks    | 100       |
| Time                 | 9.30 - 12.30 P.M.   | Date of Exam | 5.12.2016 |
| Instructions         | 1. All questions carry equal marks.<br>2. Figures to the right indicate full marks.<br>3. Assume suitable data if necessary   |              |           |
| Q.1                  | (a) Describe Diesel cycle and derive the expression for its efficiency with help of PV and TS diagram. 4<br>(b) Explain surface tension and capillarity. 4<br>(c) The wall of an industrial furnace is constructed from 0.2 m thick fire clay brick having a thermal conductivity of 1.7 W/mK. Measurements made during steady state operation show temperatures of 1500 K and 1150 K. at the inner and outer surfaces of the wall respectively. What is the rate of heat loss through this wall, if it is 0.5 m X 3 m? 3<br>(d) Study the following two cases. 2<br>a. A cup of hot tea is kept on a table, to cool.<br>b. Another cup of tea at the same temperature, is kept on the same table, and stirred with a spoon.<br>Tea in which cup will cool faster? Why? 2 |              |           |
|                      | (e) If dynamic viscosity of a liquid is 0.12 Pa.s and its specific gravity is 0.79, obtain its kinematic viscosity. 2   |              |           |
| Q.2                  | (a) What are components of hydro power plant? 4<br>(b) Differentiate between SI engines and CI engines on three important accounts. 3<br>(c) Differentiate clearly between open cycle gas turbine & closed cycle gas turbine. 4<br>(d) Give classification of steam turbine. Explain Impulse & Reaction turbine briefly. 4  |              |           |
| Q.3                  | (a) Derive the expressions for the expansion work in the following cases : 4<br>a) Isothermal process<br>b) Adiabatic process<br>(b) Draw a layout of a nuclear power plant & explain its various components & their functions. 5<br>(c) List any four non-conventional energy sources & Explain why they become necessary. 3<br>(d) Explain with neat sketch working of Horizontal axis wind machine OR 3<br>Photovoltaic device.  |              |           |
| Q.4                  | (a) Explain the types of the drilling machine 10<br>(b) What are the types of the gears .Explain their characteristics 10   |              |           |
| Q.5.                 | (a) Explain the single plate clutch operation with the diagram 10<br>(b) What are the characteristics of the brake lining. List out the types of the brakes 10  |              |           |
| Q.6                  | (a) Write short note on welding ,soldering and brazing 10<br>(b) Write the types of bearings 05   |              |           |





library question paper

**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
 [Central Technological Institute, Maharashtra State]  
 Matunga, Mumbai-400 019

SEMESTER  
 EXAMINATION  
 SEMESTER &  
 PROGRAM: II  
 TIME ALLOWED  
 COURSE  
 (CourseCode)

**End Semester Examination**

F.Y.B.Tech (Semester-II)  
 (Comp/I.T/Elect/Etrx/Extc/Prod/Mech/civil/Textile)  
 3 HRS.  
 (MA0002) Applied Mathematics-II

DATE OF  
 EXAM: 28 April/2014  
 TIME: 9.30 a.m.  
 12.30 p.m.  
 MARKS: 100

**Instructions**

1. All the questions are compulsory.
2. All questions carry equal marks.
3. Figures to the right indicate full marks.
4. Answer to the individual questions must be grouped and written together.

**Q.1.(a)** Solve the following differential equation completely

$$\frac{d^2y}{dx^2} - y = xe^x \sin x \quad (5)$$

$$(b) \text{ Prove that } \int_0^a \frac{dx}{\sqrt{a^n - x^n}} = \frac{\pi}{n} \cosec \frac{\pi}{n} \quad (5)$$

$$(c) \text{ Find the volume bounded by the cylinders } y^2 = x \text{ and } y = x^2 \text{ and the planes } z = 0, x + y + z = 2. \quad (5)$$

$$(d) \text{ Prove that } \int_0^t \operatorname{erf}(ax) dx = t \operatorname{erf}(at) + \frac{1}{a\sqrt{\pi}} [e^{-a^2 t^2} - 1]. \quad (5)$$

**Q.2.(a)** i) Show that the length of an arc of that part of cardioid  $r = a(1 + \cos\theta)$  which lies on the side of the line  $4r = 3a \sec\theta$  remote from the pole is equal to  $4a$ . (4)

ii) Find the area between the parabola  $y = x^2 - 6x + 3$  and the line  $y = 2x - 9$ . (4)

(b) Assuming the validity of differentiation under integral sign, Prove that

$$\int_0^{\frac{\pi}{2}} \frac{\log(1 + \cos x \cos \alpha)}{\cos x} dx = \frac{\pi^2 - 4\alpha^2}{8} \quad (6)$$

$$(c) \text{ Change the integral } \int_0^{4a} \int_{\frac{y^2}{4a}}^y \left( \frac{x^2 - y^2}{x^2 + y^2} \right) dx dy \text{ to polar coordinate and evaluate it.} \quad (6)$$

**Q.3.(a)** Solve the following differential equation: (8)

$$i) (3x + 2)^2 \frac{d^2y}{dx^2} + 3(3x + 2) \frac{dy}{dx} - 36y = 3x^2 + 4x + 1$$

$$ii) \frac{dz}{dx} + \frac{z}{x} \log z = \frac{z}{x^2} (\log z)^2$$

$$(b) \text{ Change the order of integration and evaluate } \int_0^1 \int_{x^2}^{2-x} xy dy dx. \quad (6)$$

*SK*

(c) Evaluate  $\int_0^{\infty} \int_0^{\infty} \int_0^{\infty} \frac{dxdydz}{(1+x^2+y^2+z^2)^2}$  using spherical polar co-ordinate (6)

- Q.4.(a) i) Solve  $(3y - 2z)p + (z - 3x)q = 2x - y$  (4)  
 ii) Evaluate  $\iint_R xy dxdy$ , over the region R given by  $x^2 + y^2 - 2x = 0, y^2 = 2x, y = x$ . (4)

(b) Prove that  $\int_0^{\infty} \frac{e^{2mx} + e^{-2mx}}{(e^x + e^{-x})^{2n}} dx = \frac{1}{4} \beta(n+m, n-m)$  (6)

(c) Find the volume enclosed by the cylinder  $x^2 + y^2 = 2ax$  and  $z^2 = 2ax$  (6)

OR

(c) Verify the Leibnitz rule for differentiation under the integral sign  $\int_a^{a^2} \log(ax) dx$ . (6)

Q.5.(a) i) Solve  $(D^2 - 2D)y = e^x \sin 3x$  By using Method of undetermined coefficient. (4)

ii) Solve  $(D^2 + 4)y = \sec 2x$  by Method of variation of parameter. (4)

(b) Solve  $\frac{\partial^3 z}{\partial x^3} - 7 \frac{\partial^3 z}{\partial x \partial y^2} - 6 \frac{\partial^2 z}{\partial y^2} = \sin(x+2y) + e^{2x+y}$  (6)

(c) Find the mass of plate in the form of  $x^2 + y^2 = 2y$ . If density of any point is  $\rho = y + 1$ . (6)

OR

(c) i) Solve  $D^4 + 2D^3 + 3D^2 + 2D + 1)y = \sin 2x$  (4)

ii) Solve  $px \tan y = q + 1$  (2)



## VERMATA JIJABAI TECHNOLOGICAL INSTITUTE.

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

**SEMESTER**  
**EXAMINATION**  
**SEMESTER &**  
**PROGRAM: II**  
**TIME ALLOWED**  
**COURSE**  
**(CourseCode)**

**May - 2012**

**F.Y.B.Tech**

**(Comp/I.T/Elect/Etrx/Extc/Prod/Mech/Civil/Textile)**

**3 HRS.**

**(MA0202) Applied Mathematics-II**

|                      |                                |
|----------------------|--------------------------------|
| <b>DATE OF EXAM:</b> | <b>11-05-2012</b>              |
| <b>TIME</b>          | <b>9.30 a.m. to 12.30 p.m.</b> |
| <b>MARKS</b>         | <b>100</b>                     |

**Instructions**

1. All the questions are compulsory.
2. All questions carry equal marks.
3. Figures to the right indicate full marks.
4. Answer to the individual questions must be grouped and written together.

**Q.1.(a) Solve the following differential equation completely**

$$\frac{d^3y}{dt^3} + \frac{2d^2y}{dt^2} + \frac{dy}{dt} = e^{2t} + \sin t + t^2 \quad (5)$$

$$(b) \text{ Prove that } \int_0^\infty \frac{(e^{xt} + e^{-xt})^n}{(x^2 + a^2)^{\frac{n}{2}}} dx = \frac{1}{4} \beta \left( \frac{n}{2}, \frac{n}{2} \right) \quad (5)$$

$$(c) \text{ Find the length of the curve } \theta = \frac{1}{2} \left( r + \frac{1}{r} \right) \text{ for } r = 1 \text{ to } r = 3 \quad (5)$$

$$(d) \text{ Evaluate } \int_0^{\log 2} \int_0^x \int_0^x \log y e^{x+y+z} dz dy dx. \quad (5)$$

**Q.2.(a) Which of the following equation represent Lemniscates? Find its area and perimeter**

$$i) r^2 = a^2 \cos 2\theta \quad ii) r = a(1 + \cos \theta) \quad (3)$$

$$(b) \text{ Using D.U.L.S Show that } \int_0^{\pi} \frac{\log(1+ac \cos x)}{\cos x} dx = \pi \sin^{-1} a, 0 < a < 1. \quad (6)$$

$$(c) \text{ Change the integral } \int_0^1 \int_0^x (x+y) dy dx \text{ to polar coordinate and evaluate it} \quad (6)$$

**Q.3.(a) Solve the following differential equation:**

$$i) \frac{d^2y}{dx^2} + \frac{1}{x} \frac{dy}{dx} = 2 + 5 \log x \quad ii) (1+x+xy^2)dy + (y+y^3)dx = 0. \quad (8)$$

$$(b) \text{ Change the order of integration and evaluate } \int_0^a \int_0^y \frac{xy dx dy}{\sqrt{(a-x)(a+x)(a-y)(y-x)}} \quad (6)$$

$$(c) \text{ Evaluate } \iiint (x^2 y^2 + y^2 z^2 + z^2 x^2) dx dy dz, \text{ over the volume of the sphere}$$

(6)

$$x^2 + y^2 + z^2 = a^2$$

P.T.O.

Q.4.(a) i) Prove that  $\int_0^{2a} x\sqrt{2ax - x^2} dx = \frac{\pi a^3}{2}$

ii) Evaluate  $\iint_R ye^{x^3} dx dy$ , R is a triangle having sides  $y = 2x, x = 1$  and  $y = 0$ . (8)

(b) Prove that  $\beta(m, n) = \int_0^1 \frac{x^{m-1} (1-x)^{n-1}}{(1+x)^{m+n}} dx$  and hence evaluate  $\int_0^1 \frac{x^3 + x^2}{(1+x)^4} dx$ . (6)

(c) Evaluate  $\iint_R r^3 dr d\theta$  over the area included between the circles

$$r = 2\sin\theta \text{ and } r = 2\cos\theta \quad (6)$$

OR

(c) Verify the Leibnitz rule for differentiation under the integral sign  $\int_a^{\infty} \log(ax) dx$  (6)

Q.5.(a) Solve  $(D^2 - 2D)y = e^x \cos x$ . By using

i) Method of variation of parameter,

ii) Method of undetermined coefficient.

Do the solution differ by Two different Method? (8)

(b) Evaluate  $\int_0^{\infty} \int_0^{\infty} \int_0^{\infty} \frac{dx dy dz}{(1+x^2+y^2+z^2)^2}$  Using Spherical polar coordinate. (6)

(c) The density at any point of the cardiode  $r = a(1 + \cos\theta)$  varies as the square of its distance from its axis, Find its mass. (6)

OR

(c) i) Change the order of integration  $\int_0^1 \int_{x^2}^{\sqrt{2-x^2}} f(x, y) dy dx$  (6)

ii) Solve  $yzp + z^2 dp/dz = 0$

X



VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE  
[Central Technological Institute, Maharashtra State]  
Matunga, Mumbai-400 019

SEMESTER EXAMINATION  
SEMESTER & PROGRAM  
TIME ALLOWED  
COURSE (CourseCode) :

May 2012  
B.Tech. SEM-II  
3 HRS.

Applied Mechanics (SE0001)

DATE OF EXAM  
TIME  
MARKS

16/05/2012  
9:30 am to 12:30 pm  
100

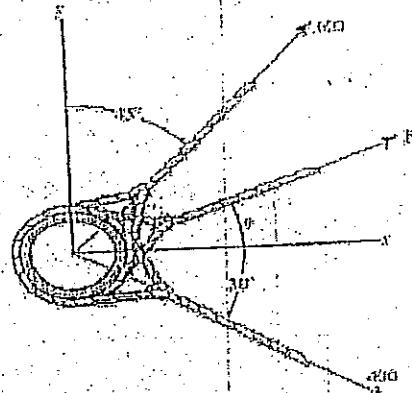
Instructions

1. All questions carry equal marks.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary and state the same in your answer.

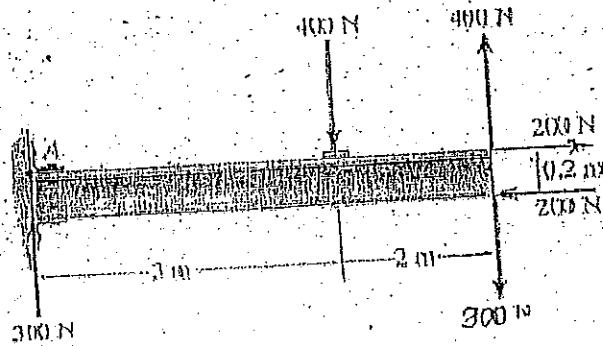
Q1. Solve any five

- Explain various force systems with neat sketches. 4
- State and derive parallel axis theorem for plane bodies. 4
- State and explain Varignon's theorem of moment. (Draw neat sketches) 4
- Explain with neat sketch:
  - i) Triangle Law of forces
  - ii) Polygon Law of forces 4
- State Newton's laws of Gravitation 4
- Prove that the angle of repose is equal to the angle of friction. (Draw neat sketches) 4
- Define the following:  
i. Friction ii. Angle of friction iii. Limiting friction iv. Cone of friction 8

- Q2. a. Three cables pull the pipe such that they create a resultant force having magnitude 900 N. If two of the cables are subjected to known forces (600 N and 400 N) as shown in figure, determine the angle of the third cable so that the magnitude of force F in this cable is minimum. What is the magnitude of F?

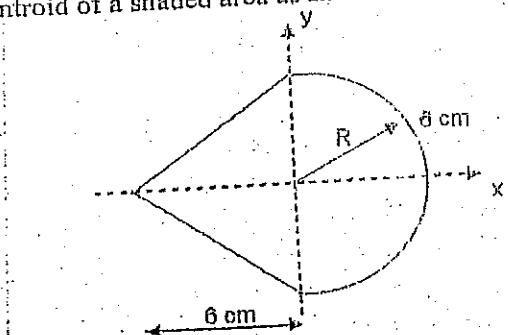


- b. Replace the loading system by an equivalent resultant force and a couple moment acting at point A. 8

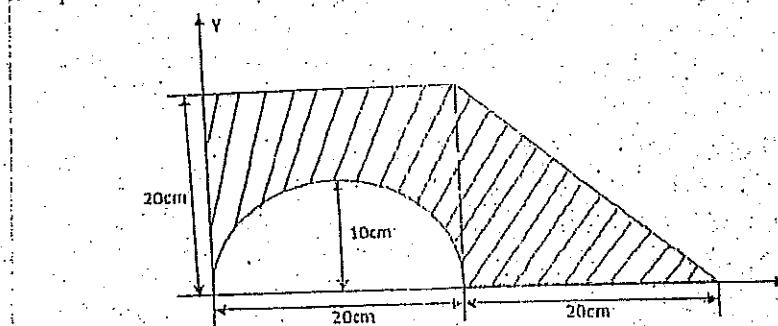


P-T-C

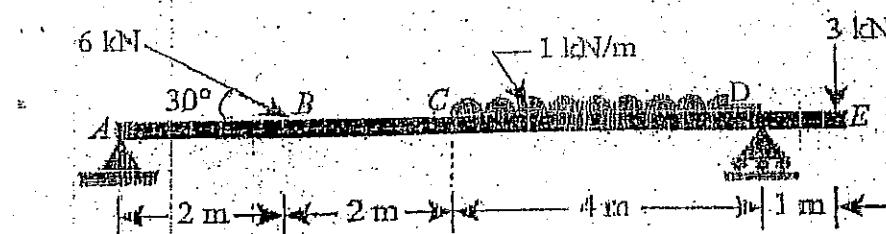
- c. Locate the centroid of a shaded area as shown in figure.



- Q3. a. Find the moment of inertia for the shaded area as shown in figure about an axis passing through CG and parallel to x - axis (horizontal axis).

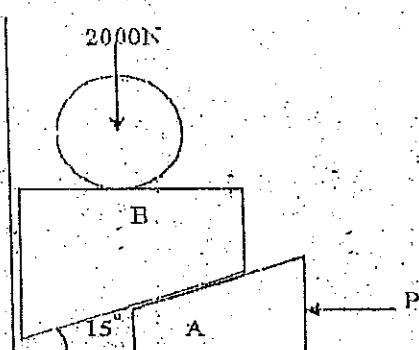


- b. Beam AE supported at A and D as shown in figure. Calculate support reaction for the given loading using principle of virtual work.



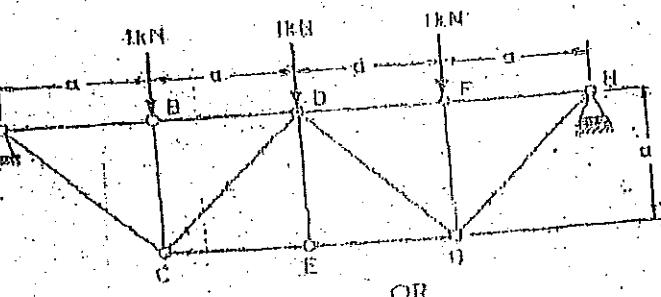
OR

- b. To raise a heavy stone block weighing 2000N the arrangement shown is used. What force P is necessary to be applied to the wedge in order to raise the block.  $\mu = 0.25$ . Neglect the weight of the wedge.



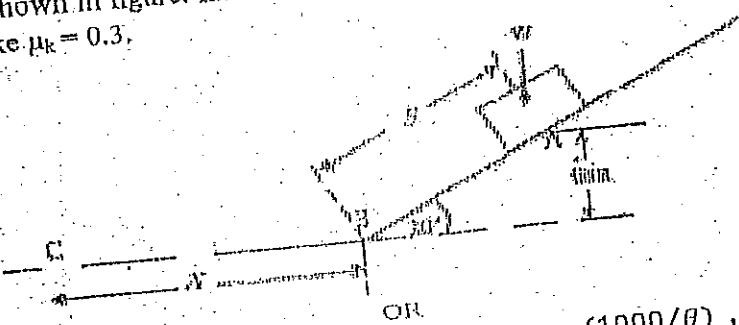
- c. Explain in detail the principle of Virtual work method. Derive the necessary expressions. 4

- Q4. a. Derive the relation for tight side and slack side tension for a rope wrapped around the drum. 5  
 b. The truss is loaded and supported as shown in figure. Find the member forces. (take  $\alpha = 3$ ) 7  
 c. OR



- b. The pitch of a single threaded screw jack is 12 mm and mean diameter of the thread is 50mm. The length of the lever is 560mm. Calculate the effort to raise a truck whose axle transfers a load of 40KN on the screw jack. What would be the effort required to lower it. Also find the torque exerted in each case. Take  $\mu = 0.165$ . 7

- c. A 30 kg crate is released from rest from position A. It travels path ABC and finally comes to rest at C as shown in figure. Find  $x$  and maximum velocity attained by the crate along the path ABC. Take  $\mu_k = 0.3$ . 8



- c. The train travels along a track having a shape of spiral,  $r = (1000/\theta)$ , where,  $\theta$  is in radians. If the angular (velocity) rate is constant  $\dot{\theta} = 0.2 \text{ rad/s}$ . Determine the radial and transverse component of its velocity and acceleration at  $\theta = 9\pi/4 \text{ rad}$ . 8

- Q5. a. The position of a particle is defined by  $x = 4t^3 - 24t + 8 \text{ m}$ . draw  $x-t$ ,  $v-t$  and  $a-t$  curves from  $t = 0 \text{ sec}$  to  $t = 5 \text{ sec}$ . OR

- a. The position of particles A and B defined in a fixed XOY frame by position vectors  $\vec{r}_A = (4t^2)\hat{i} - (10t^3)\hat{j}$  and  $\vec{r}_B = (-3t^2)\hat{i} + (3.5t^3)\hat{j}$  (position is in meters and time is in seconds). Determine  $\vec{v}_{B/A}$  and  $\vec{a}_{B/A}$  after 4 seconds and also  $\vec{v}_B$  and  $\vec{a}_B$ . 8

- b. Derive the Work-Energy Principle for kinetics of a particle.

- c. A car weighing 10,000 N running at 10m/s hold three men each weighing 700 N. The men jumps off the car from the back end gaining a relative velocity of 6 m/s with the car. Find the speed of the car if the three men jumps off i) in succession and ii) all together. 7

Sc



**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
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 Matunga, Mumbai-400 019

SEMESTER  
 EXAMINATION  
 SEMESTER &  
 PROGRAM: II  
 TIME ALLOWED  
 COURSE (CourseCode)

May - 2013

F.Y.B.Tech  
 (Comp/I.T/Elect/Etrc/Extc/Prod/Mech/civil/Textile)  
 3 HRS.

(MA0202) Applied Mathematics-II

DATE OF : 13 May 2013

EXAM:

TIME: 9.30 am to 12.30 pm

MARKS: 100

- Instructions
1. All the questions are compulsory.
  2. All questions carry equal marks.
  3. Figures to the right indicate full marks.
  4. Answer to the individual questions must be grouped and written together

Q.1.(a) Solve the following differential equation completely

$$\frac{d^2y}{dx^2} + 3 \frac{dy}{dx} + 2y = xe^{-x} \sin x \quad (5)$$

$$(b) \text{Prove that } \int_0^{2a} x\sqrt{2ax - x^2} dx = \frac{\pi a^3}{2} \quad (5)$$

$$(c) \text{Prove that } \int_0^t \text{erf}(ax) dx = t \text{erf}(at) + \frac{1}{a\sqrt{\pi}} [e^{-a^2 t^2} - 1] \quad (5)$$

$$(d) \text{Evaluate } \iiint \frac{dxdydz}{(1+x+y+z)^3} \text{ is the region bounded by } x = 0, y = 0, z = 0, x + y + z = 1 \quad (4)$$

Q.2.(a) i) Find the length of cardioid  $r = a(1 - \cos\theta)$  lying outside the circle  $r = a\cos\theta$ .  
 ii) Find by the double integration, the smaller of the areas bounded by the circle

$$x^2 + y^2 = 9 \text{ and straight line } x + y = 3. \quad (4)$$

$$(b) \text{Evaluate } \int_0^\infty e^{-ax^2} dx (a > 0) \text{ and hence prove that } \int_0^\infty e^{-ax^2} x^{2n} dx = \frac{\sqrt{\pi}(2n)!}{(2a)^{2n+1} n!} \quad (6)$$

$$(c) \text{Change the integral } \int_0^4 \int_y^{4+\sqrt{16-y^2}} \frac{dxdy}{(64+x^2+y^2)^2} \text{ to polar coordinate and evaluate it} \quad (6)$$

(8)

Q.3.(a) Solve the following differential equation:

$$i) (x+3)^2 \frac{d^2y}{dx^2} - 4(x+3) \frac{dy}{dx} + 6y = \log(x+3)$$

$$ii) xy(1+xy^2) \frac{dy}{dx} = 1.$$

$$(b) \text{Change the order of integration and evaluate } \int_0^a \int_0^x \frac{dydx}{\sqrt{(a-x)(a+y)(a-y)(x-y)}} \quad (5)$$

(c) Find the volume in the first octant bounded by the circular cylinder  $x^2 + y^2 = 2$  and the

Planes  $z = x + y, y = x, x = 0, z = 0.$

(6)

Q.4.(a) i) Solve  $(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$

ii) Evaluate  $\iint_R x^2 dx dy$ ,  $R$  is the region in the first quadrant bounded by the hyperbola  $xy = 16$  and the lines  $y = x, y = 0, x = 8$ . (4)

(b) Prove that  $\int_0^1 \frac{x^{n-1}}{(1+cx)(1-x)^n} dx = \frac{\pi}{(1+c)^n} \cosec n\pi$  ( $0 < n < 1$ ) (6)

(c) Evaluate  $\int_0^\infty \int_0^\infty \int_0^\infty \frac{dxdydz}{(1+x^2+y^2+z^2)^2}$  Using Spherical polar coordinate (6)

OR

(c) Verify the Leibnitz rule for differentiation under the integral sign  $\int_a^{a^2} \frac{1}{x+a} dx$  (6)

Q.5.(a) i) Solve  $(D^2 + 4)y = 4\sin 3x$  By using Method of undetermined coefficient. (4)

ii) Solve  $(D^3 + D)y = \sec x$  by Method of variation of parameter. (4)

(b) Solve  $\frac{\partial^2 z}{\partial x^2} + 2 \frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} = x^2 + xy + y^2$  (6)

(c) Find the mass of a lamina bounded by the curves  $y^2 = ax$  and  $x^2 = ay$  if the density at any point varies as the square of its distance from origin. (6)

OR

(c) i) Solve  $(D^4 + 2D^2 + 1)y = x^2 \sin x$  (6)

ii) Solve  $p^2 - q^2 = x - y$

**VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**  
 Matunga, Mumbai - 400 019  
 [Autonomous]

Sem. & Programme F.Y.B.Tech (All Branches)  
 Course Code & Course Applied Mathematics-I (MA-0001)

Duration: 03 Hours  
 Max.Marks: 100  
 Date of Exam: 25<sup>th</sup> NOV 2013

- Instructions:**
1. All Question is compulsory.
  2. Figures to the right indicate full marks.
  3. All questions carry equal marks
  4. Answers individual question must be grouped and written together.

**Q.1. Answer the Following:**

(a) If  $x = \cos\theta + i\sin\theta, y = \cos\phi + i\sin\phi$ , prove that  $\frac{x-y}{x+y} = i\tan\left(\frac{\theta-\phi}{2}\right)$  (20)

(b) Define scalar product of four vector  $\vec{a}, \vec{b}, \vec{c}, \vec{d}$  and derive Lagrange's identity. Hence Prove that  $(\vec{b}X\vec{c}) \cdot (\vec{a}X\vec{d}) + (\vec{c}X\vec{a}) \cdot (\vec{b}X\vec{d}) + (\vec{a}X\vec{b}) \cdot (\vec{c}X\vec{d}) = 0$ .

(c) If  $u = f(x^2 + 2yz, y^2 + 2xz)$ , prove that

$$(y^2 - zx)\frac{\partial u}{\partial x} + (x^2 - yz)\frac{\partial u}{\partial y} + (z^2 - xy)\frac{\partial u}{\partial z} = 0.$$

(d) Evaluate  $\lim_{x \rightarrow 0} \left( \frac{(2(\cosh x - 1))x^2}{x^2} \right)$

(e) Prove that the value of  $n^{\text{th}}$  differential coefficient of  $\frac{x^3}{(x^2-1)}$  for  $x = 0$  is zero if  $n$  is even and  $-n!$  if  $n$  is odd and greater than 1

**Q.2.(a)** Find the values of the constants  $a$  and  $b$  such that the substitution  $u = x + ay$  and  $v = x + by$  transform the equation  $9\frac{\partial^2 f}{\partial x^2} - 9\frac{\partial^2 f}{\partial x \partial y} + 2\frac{\partial^2 f}{\partial y^2} = 0$  into  $\frac{\partial^2 u}{\partial u \partial v} = 0$  where  $f$  is a function of  $u$  and  $v$ . (8)

(b) If  $y = \sqrt{\frac{1+x}{1-x}}$ , prove that  $y = (1-x^2)y_1$  and hence, prove that

$$(1-x^2)y_n - [2(n-1)x+1]y_{n-1} - (n-1)(n-2)y_{n-2} = 0. \quad (6)$$

(c) If  $\log \sin(x+iy) = a+ib$ , prove that i)  $2e^{2a} = \cosh 2x - \cos 2x$ . ii)  $\tanh b = \cot x \tanh y$ . (6)

**Q.3.(a)** i) Find all the roots of the equation  $z^n = (z+1)^n$  and show that the real part of all the roots is  $-\frac{1}{2}$  (6)

ii) Find all the solution of the equation  $z^4 - (1+4i)z^2 + 4i = 0$  (2)

(b) If  $z = \sin^{-1}(x-y), x = 3t, y = 4t^3$  prove that  $\frac{dz}{dt} = \frac{3}{\sqrt{1-t^2}}$ . (6)

(c) Find the expansion for the  $\tan x$  and prove that  $\log(1+\tan x) = x - \frac{x^2}{2} + \frac{2x^3}{3} - \dots$  Euler's theorem if  $\frac{x^2+y^2+z^2}{x+y+z}$ . (8)

(b) Find the extreme values of  $xy(a-x-y)$ . (6)

(c) Using the De' Moivres theorem prove that  $\cos^6\theta + \sin^6\theta = \frac{1}{8}[3\cos 4\theta + 5]$   
 Hence evaluate  $\cos^4\left(\frac{11\pi}{4}\right) + \sin^4\left(\frac{11\pi}{4}\right) - \cos^2\left(\frac{11\pi}{4}\right)\sin^2\left(\frac{11\pi}{4}\right)$ . (6)

**OR**

(c) The sides of a triangle are measured as 15 cms and 20 cms included angle being  $60^\circ$ . If the sides are measured within 1% accuracy and angle is measured within 2% accuracy, find the percentage error in determining :

i) area of the triangle, ii) the remaining side of the triangle. (6)

**Q.5.(a)** If  $\sin\theta + \sin\phi = 0 = \cos\theta + \cos\phi$ , Prove that

i)  $\cos 2\theta + \cos 2\phi = 2\cos(\theta + \phi + \pi)$ , ii)  $\sin 2\theta + \sin 2\phi = 2\sin(\theta + \phi + \pi)$  (5)

(b). If  $y = \tan^{-1}\frac{x}{a}$ , prove that  $y_n = \frac{(-1)^{n-1}(n-1)\sin^{n-1}\theta \sin n\theta}{a^n}$  where  $\theta = \tan^{-1}\frac{a}{x}$ . (5)

(c) Apply Rolle's theorem to  $f(x) = \sin x \sqrt{\cos 2x}$  in  $[0, \frac{\pi}{4}]$  and find the value of 'c' such that  $f'(c) = 0$ . Also show that  $0 < \sin x \sqrt{\cos 2x} < \frac{\sqrt{2}}{4}$  for  $0 < x < \frac{\pi}{6}$ . (5)

(d) Expand  $2x^3 + 7x^2 + x - 6$  in powers of  $(x-2)$ . (5)

**OR**

(d) Prove that  $\cos^{-1}(\tanh \log x) = \pi - 2 \left( x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \dots \dots \dots \right)$  (5)

5c



## VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

|                    |                                      |              |                      |
|--------------------|--------------------------------------|--------------|----------------------|
| END-SEMESTER EXAM  | <i>Reexam May 2015</i>               | DATE OF EXAM | <i>23/05/2015</i>    |
| SEMESTER & PROGRAM | <i>F. Y. B. Tech, Sem II</i>         | TIME         | <i>9:30 To 12:30</i> |
| TIME ALLOWED       | <i>3 HRS.</i>                        | MARKS        | <i>100</i>           |
| COURSE :           | <i>Elements of Civil Engineering</i> |              |                      |

Instructions 1. Figures to the right indicate full marks.

- |     |   |    |
|-----|---|----|
| Q.1 | a. Give the ingredients of Portland cement with their percentage contribution.                            | 04 |
|     | b. Enlist the standard tests on Cement.   | 02 |
|     | c. Define igneous and metamorphic rock. Give one example of each.   | 02 |
|     | d. Give classification of bridges.  | 02 |
|     | e. Give 4 functions of Ballast in a railway track.  | 04 |
|     | f. What are the methods of artificial seasoning of timber?  | 02 |
|     | g. Enumerate different types of plumbing traps. Draw sketch.  | 02 |
|     | h. What are ingredients of paint?   | 02 |
| Q.2 | a. Explain manufacturing process of Bricks.   | 08 |
|     | b. Mention the advantages of roadways & railways.   | 06 |
|     | c. Write the classification of stone.   | 06 |
| Q.3 | a. Define workability of concrete & describe slum cone test.  | 08 |
|     | b. Mention the factor affecting quality of good bricks & what are the characteristics of a good brick.    | 07 |
| Q.4 | a. Describe the qualities of good building stone.   | 07 |
|     | b. Draw a neat sketch of a conventional wastewater treatment plant and explain the function of each unit. | 08 |
| Q.5 | a. Draw neat sketch of bridge cross-section & define a) Abutment b) Pier c) wing wall.                    | 07 |
|     | b. Describe soundness test on cement.   | 08 |
| Q.6 | a. Define deep foundation & shallow foundation and explain their types (4 each)                           | 08 |
|     | b. Describe the classification of buildings as per National Building Code.                                | 07 |

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