

**6E7011**

Roll No. \_\_\_\_\_

[Total No. of Pages: **3**]**6E 7011****B.Tech.VI Semester (Main) Examination, May-June 2015****Mechanical Engineering****6ME1A Design of Machine Elements-II****(Common for EE, EX)****Time : 3 Hours****Maximum Marks : 80  
Min. Passing Marks : 24****Instructions to Candidates:**

*Attempt any **five** questions, selecting **one** question from **each** unit. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

*Units of quantities used/calculated must be stated clearly.*

**Unit - I**

1. a) What is stress concentration? What are its causes and what are the methods of reducing stress concentration? Discuss. (8)
- b) A machine component is subjected to two-dimensional stresses. The tensile stress in the X direction varies from 40 to 100 N/mm<sup>2</sup> while the tensile stress in the Y direction varies from 10 to 80 N/mm<sup>2</sup>. The frequency of variation of these stresses is equal. The corrected endurance limit of the component is 270 N/mm<sup>2</sup>. The ultimate tensile strength of the material of component is 660 N/mm<sup>2</sup>. Determine the factor of safety used by designer. (8)

**OR**

1. a) What is Goodman line? What is the difference between Gerber curve and Soderberg and Goodman lines? (8)
- b) A solid shaft is subjected to a bending moment of 3.46 kNm and torsional moment of 11.5 kNm. The shaft is made of C-45 steel, and factor of safety is 6. Determine the diameter of the shaft. (8)

**Unit - II**

2. a) Design a cast iron piston for a single acting four stroke engine for the following specifications:

Cylinder bore = 100 mm  
 Stroke = 120 mm  
 Maximum gas pressure = 5 N/mm<sup>2</sup>  
 Brake mean effective for = 0.65 N/mm<sup>2</sup>  
 Fuel consumption = 0.227 kg/kw/hr  
 Speed = 2200 rev/min  
 Assume suitable data.

(16)

**OR**

2. Design a connecting rod for a single cylinder four stroke diesel engine with following specifications:

Power = 7.5 kw  
 Mechanical eff = 80%  
 Weight of reciprocating parts = 20N  
 Length of connecting rod = 0.30m  
 Speed = 1500 r.p.m with a possible overspeed to 2500 r.p.m.

Assume suitable missing data.

(16)

**Unit - III**

3. a) It is required to design a helical compression spring subjected to a maximum force of 7.5 KN. The mean coil diameter should be 150mm. The spring rate is 75 N/mm. Spring is made of oil hardened and tempered steel wire with ultimate tensile strength of 1250 N/mm<sup>2</sup>. The permissible shear stress for the spring wire is 30% of the ultimate tensile strength ( $G=81370\text{N/mm}^2$ )

(10)

Calculate : i) Wire diameter and

ii) Number of active coils.

- b) What types of shear stresses are induced in the wire of helical spring? Sketch the distribution of shear stresses.

(6)

**OR**

3. a) Find the diameter of cast iron bulleys and the thickness and width of a leather belt to transmit 128.7 kw power from a shaft that is directly connected to a steam engine running at 31.4 rad/sec, to a centrifugal pump with a speed ratio at 1:3.5

(8)

- b) Determine the size of a wire rope necessary for a mine hoist carrying a load at 69.50 KN to be lifted from a depth of 225 meters. A rope speed of 7.9 m/sec. is to be attained in 10 sec. (8)

#### Unit - IV

4. Determine the proper pitch, module, face, no. of teeth and outside diameters of a pair of  $20^\circ$  involute full depth spur gears to transmit 112.5 kw, from a pinion running at 750 r.p.m. to a gear running at 140 r.p.m., The service is intermittent with light shocks. (16)

#### OR

4. Design a bevel gear drive between two shafts whose axes are at right angles. Speed of pinion shaft is 240 r.p.m. and that of the gear shaft is 120 r.p.m. pinion is to have 21 teeth of involute profile with module of 20mm and a pressure angle of  $20^\circ$  and is to be of suitable material. Gear is of cast iron power at gear shaft = 75KW. (16)

#### Unit - V

5. a) A single row deep groove ball bearing No.6002 is subjected to an axial thrust of 1000 N and a radial load at 2200N. Find the expected life that 50% of the bearings will complete under this condition. (8)
- b) Distinguish between "Hydro-dynamic bearings" and "Hydro-static bearings." (8)

#### OR

5. A journal bearing is proposed for a centrifugal pump. The diameter of the journal is 0.15m and the load on it is 40KN and its speed is 900 r.p.m. complete the design calculations for the bearing. (16)



Roll No. \_\_\_\_\_

[Total No. Of Pages : 3]

**6E7012****6E 7012****B.Tech. VI Semester(Main) Examination.May -June 2015****Mechanical Engineering****6ME2A: Newer Machining Methods****Time : 3 Hours****Maximum Marks : 80  
Min. Passing Marks : 24****Instructions to Candidates:**

*Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

**Unit - I**

1. a) Justify the need of advanced machining process in today's industries (8)
- b) Distinguish between conventional and unconventional manufacturing processes (8)

**OR**

1. a) Explain the Hybrid machining processes. (8)
- b) Explain the Magnetic abrasive finishing (MAF) processes. (8)

**Unit - II**

2. a) If suppose Ultra Sonic machining (USM) is used for drilling a hole (under the same machining conditions) in aluminium and cast Iron. Which one will have higher depth of the drilled hole and why? (8)
- b) Explain the functions of 'Horn' in USM. What do you understand by, 'transducer' And 'magnetostriction effects'? (8)

**OR**

2. a) Sketch and explain-the schematic diagram of abrasive Jet machining. Why different abrasives produce different MRR. (8)

- (b) Describe the working principle of Water Jet machining process along with its applications? (8)

### Unit - III

3. a) What are the requirements for the tool material for EDM? Discuss various tool Materials. (8)
- b) Discuss the main functions and types of dielectric fluids used in the electrical discharge machining. (8)

### OR

3. a) Discuss the principle of laser beam machining; also discuss its process capabilities and applications. (8)
- b) List the product applications of electron beam machining (EBM). Why EBM process is performed usually in vacuum chamber? Explain. (8)

### Unit-IV

4. Describe the working principle of Electro-Chemical machining (ECM) processes along with its advantages, disadvantages and applications? (16)

### OR

4. a) What are the different functions of electrolyte in ECM? List the common electrolytes used in ECM. (8)
- b) Calculate the machining rate and the electrode feed rate when iron is electrochemically machined (ECM), using copper electrode and sodium chloride solution (specific resistance = 5.0 ohm cm). The power supply data of the ECM used are:

Supply voltage = 18 V d.c.

Current = 5000 amp

A 'tool-work' gap of 0.5mm (constant) may be assumed. (8)

**Unit-V**

5. a) Distinguish between Micro-machining and Nano-machining . (8)
- b) Describe the working principle of Micro-grinding process along with its advantages? (8)

**OR**

5. a) What are the benefits and applications of laser Micromachining . (8)
- b) Write the applications of Nano-machining and Micro-machining in industry. (8)
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6E 7013

Roll No. \_\_\_\_\_

[Total No. of Pages : 2]

**6E 7013**

**B.Tech. VI Semester ( Main/ Back ) Examination, May -June 2015**

**Mechanical Engineering**

**6ME3A Mechatronics**

**Time : 3 Hours**

**Maximum Marks : 80**

**Min. Passing Marks : 24**

**Instructions to Candidates:**

*Attempt any **Five** questions, selecting **one question** from each unit. All questions carry **equal marks**. (Schematic diagrams must be shown wherever necessary. any data you feel missing suitably be assumed and stated clearly.) Units of quantities used/ calculated must be stated clearly.*

**UNIT - I**

1. a) Explain how mechatronics helps in automation of machines with the help of suitable example? (8)
- b) Write the application of Mechatronics in various disciplines. (8)

**(OR)**

1. a) Explain in detail the classification of Mechatronics system with some suitable example? (8)
- b) Describe in detail CNC machines. (8)

**UNIT - II**

2. a) What is the significance of sensor used in machines and equipments? Write and explain the classification of sensors. (8)
- b) Explain the working of temperature sensors with suitable diagrams. (8)

**(OR)**

2. a) What will be the change in resistance of an electrical resistance strain gauge with a gauge factor of 2.1 and resistance  $50\Omega$  if it is subject to a strain of 0.001? (8)
- b) Explain the principle and working of servomotors. Write its advantages and limitations. (8)

### UNIT - III

3. a) Discuss in detail with suitable examples the role of modelling in Mechatronics design. (8)  
b) What is adaptive control Design? (8)

(OR)

3. a) Describe the working and application of neural networks with suitable examples.  
b) Differentiate between continuous and Discrete - time state - space models. (8)

### UNIT - IV

4. a) Why a data acquisition system is necessary? List the important features and applications of DAS. (8)  
b) What are the various processes used in signal conditioning? (8)

(OR)

4. a) Describe operational Amplifier circuits for  
i) Inverting Amplifier  
ii) Non-inverting Amplifier  
iii) Summing Amplifier  
iv) Comparator (8)  
b) What is a data logger? List its applications. Compare it with DAS. (8)

### UNIT - V

5. What is anti - lock braking system used in cars and describe the principles of its operation (16)

(OR)

5. Compare hydraulic, electric and pneumatic robot drive systems. (16)
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<b>6E 7014</b>	Roll No. _____	[Total No. of Pages : <b>3</b> ]
	<b>6E7014</b>	
	<b>B.Tech. VI Semester (Main/Back) Examination, May-June - 2015</b> <b>Mechanical Engineering</b> <b>6ME4A Vibration Engineering</b>	

**Time : 3 Hours**

**Maximum Marks : 80**  
**Min. Passing Marks : 24**

**Instructions to Candidates:**

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination (Mentioned in form No.205)*

1. Graph paper - (No. cem)

**Unit - I**

1. a) What is meant by frequency based hearing sensitivity? What are the usual audible frequency range and frequency range of human voice? (8)
- b) What are the major sources of noise in urban environment? Explain the non-auditory effects of these on people. (8)

**OR**

1. a) A machine is subjected to the motion  $x(t) = A \cos(50t + \phi)$  mm. The initial conditions are  $x(0) = 3$  mm and  $dx/dt(0) = 1$  m/sec. Find
  - i) The constants A and  $\phi$
  - ii) Express the motion in the form  $x(t) = A_1 \cos \omega t + A_2 \sin \omega t$ , and identify constants  $A_1$  and  $A_2$ . (8)
- b) Add the following harmonic motions analytically  $x_1 = 4 \cos(\omega t + 10^\circ)$  and  $x_2 = 6 \sin(\omega t + 60^\circ)$ . Check this obtained solution graphically. (8)

## Unit - II

2. a) Derive the frequency equation for a compound pendulum. Explain the importance of centre of percussion. (8)
- b) A steel wire with young's modulus  $E = 2 \times 10^{11} \text{ N/m}^2$  is of 1.5mm diameter and is 30mm long. It is fixed at the upper end and carries a mass  $M$  kg at its lower end. Find  $M$  so that frequency of longitudinal vibration is 3 cycles/sec. (8)

OR

2. a) A mass of 1.2 kg is attached to a spring having stiffness of 4700 N/m. The mass slides on a horizontal surface, The coefficient of friction between the mass and surface being 0.1. Determine the frequency of vibrations of the system and the amplitude after two cycles if the initial amplitude is 0.3cm. Determine the final rest position. (8)
- b) A mass of 3 kg is supported on an isolator having a spring constant of 3000 N/m and viscous damping. If the amplitude of free vibration of the mass falls to one half its original value in 2 sec, determine the damping coefficient of the isolator. (8)

## Unit - III

3. a) Derive the expression for motion transmissibility and plot the curve for the same. (8)
- b) A machine 90 kg mass has a 15 kg rotor with 0.4 mm eccentricity. The mounting spring have  $k = 80 \times 10^3 \text{ N/m}$  and damping ratio  $\zeta = 0.02$ . The operating speed of machine is 600 r.p.m. and the machine is constrained to move vertically. Find the dynamic amplitude of machine. (8)

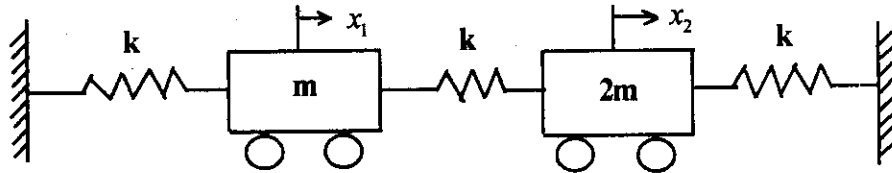
OR

3. a) A trailer has 900 kg mass when fully loaded and 300 kg when empty. The spring of the suspension is 300 kN/m. The damping ratio  $\zeta = 0.5$  when the trailer is fully loaded. It travels on the road at the 90 km/Hv. The road has sinusoidal profile with a wavelength of 5m. Determine the amplitude ratio of the trailer when it is fully loaded. (8)
- b) A mass of 200kg is suspended on a spring having a stiffness of 30,000 N/m and is acted upon by a harmonic force of 80 N at the undamped natural frequency. The damping may be considered to be viscous with a coefficient of 200 N sec/m. Calculate the amplitude of vibration of the mass and the phase difference between the force and displacement. (8)

120

### Unit - IV

4. a) Explain the principle of centrifugal pendulum absorber. Also describe with an example how such an arrangement can be utilized for an I.C engine. (8)
- b) Figure shown an undamped two degrees of freedom system. Determine the governing equation of motion for the system, The natural frequencies of the system and the normal modes of the system. (8)

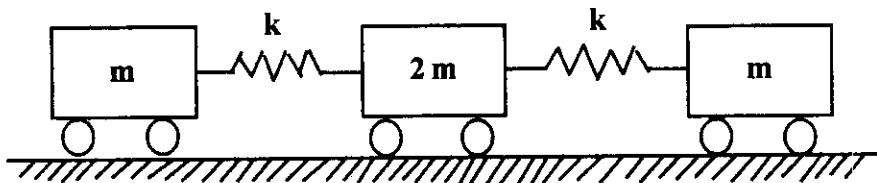


OR

4. A vertical steel shaft of 12mm diameter is held in long bearings 1 meter apart and carries at its middle a disc of mass 12 kg. The eccentricity of the centre of gravity of the disc from the centre of the rotor is 0.30mm. The modulus of elasticity for the shaft material is  $200 \text{ N/m}^2$  and the permissible stress is  $70 \text{ MN/m}^2$ , Determine:
- The critical speed of the shaft and
  - The range of speed over which it is unsafe to run the shaft. Neglect the mass of the shaft. (16)

### Unit - V

5. Determine the natural frequencies and plot the mode shapes for the three rail bogies connected through coupler spring as shown in figure.



Where  $m = 15 \times 10^3 \text{ kg}$  and  $k = 30 \times 10^5 \text{ N/m}$ . (16)

OR

5. Derive the governing equation of vibration for a tightly stretched string with tension  $P$ . Obtain the frequency equation and mode shape for the case when one end of the string is fixed while the other end is attached to a roller free to move vertically in a slot. (16)



Roll No. \_\_\_\_\_

[Total No. of Pages : 3]

6E 7015

6E7015

**B.Tech. VI Semester (Main) Examination, May-June 2015****Mechanical Engineering****6ME5A: Steam Engineering****Time : 3 Hours****Maximum Marks : 80  
Min. Passing Marks : 24****Instructions to Candidates:**

*Attempt any **five** questions, selecting **one** question from **each** unit. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination.*

1. Steam Tables and      2. Mollier Chart

**Unit - I**

1. a) Draw a neat sketch of Green's economizer and explain it's working. (8)
- b) Explain the unique features of high pressure boilers. (8)

**OR**

1. a) Explain with neat sketch the construction and working of lamont boiler. (8)
- b) What do you understand by fluidized bed boilers. Explain it's working principle with a neat sketch. (8)

**Unit - II**

2. a) show that the maximum discharge of steam through the nozzle takes place when the ratio of steam pressure at the throat to the inlet pressure is given by

$$\frac{p_2}{p_1} = \left( \frac{2}{n+1} \right)^{\frac{n}{n-1}} \quad \text{Where } n \text{ is the index of expansion.} \quad (8)$$

- b) Describe the changes which occur in a convergent divergent nozzle as the back pressure is slowly increased from the design pressure upto the pressure at entry. (8)

OR

2. a) What are the effects of friction on the flow through a steam nozzle? Explain with the help of h-s-diagram. (8)
- b) Steam at a pressure of 10 bar and 0.98 dry is passed through a convergent-divergent nozzle to a back pressure of 0.1 bar. The mass flow rate is 0.55 kg/sec. Find:
- The pressure at the throat and
  - Number of nozzles used if each nozzle has a throat area of  $0.5 \text{ cm}^2$ . The enthalpy drop used for reheating the steam by friction in the divergent part is 10% of the overall isentropic drop. Take index of expansion = 1.13. (8)

Unit - III

3. a) What do you mean by compounding of steam turbines? Discuss various methods of compounding steam turbines. (8)
- b) Derive the expression for maximum blade efficiency in a single - stage impulse turbine. (8)

OR

3. a) In a simple impulse turbine the nozzles are inclined at  $20^\circ$  to the direction of motion of the moving blades. The steam leaves the nozzle at 375 m/s. The blade velocity is 165 m/s. Calculate suitable inlet and outlet angles for the blades in order that the axial thrust is zero. The relative velocity of steam as it flows over the blades is reduced by 15% by friction. Also determine the power developed for a flow rate of 10 kg/s. (10)
- b) Explain with neat sketch the method of throttle governing of steam turbines. (6)

Unit - IV

4. a) Prove that the diagram or blade efficiency of a single stage reaction turbine is given by  $\eta_{bl} = 2 - \frac{2}{1 + 2\rho \cos \alpha - \rho^2}$

Where  $R_d = 50\%$  and  $c_{f1} = c_{f0}$ . Further prove that the maximum blade



123

efficiency is given by  $(\eta_{bl})_{\max} = \frac{2 \cos^2 \alpha}{1 + \cos^2 \alpha}$  (10)

- b) Define degree of reaction. Deduce an expression for work done per stage of reaction turbine. (6)

**OR**

4. a) What are open and closed feed water heaters? Mention their merits and demerits. How are the number of heaters and the degree of regeneration get optimized. (8)
- b) Discuss briefly the advantages of using regenerative feed heating in a steam power plant. Also show that the ideal efficiency of a regenerative cycle is greater than the corresponding Rankine cycle efficiency. (8)

**Unit - V**

5. a) Mention the effects of reheating in a steam power plant on
- i) The efficiency
  - ii) The work ratio
  - iii) The specific steam consumption and
  - iv) Condition of steam at exit. Explain why reheat cycle is not used for low pressure boilers? (8)
- b) How and where back pressure and pass-out turbines are used? Give the schematic layout of such plants. (8)

**OR**

5. a) Explain the working of binary vapour power cycle with neat sketch. (8)
- b) Steam at 28 bar and 50°C superheat is passed through a turbine and expanded to a pressure where the steam is dry and saturated. It is then reheated at constant pressure to its original temperature and then expanded to the condenser pressure of 0.2 bar. The expansion being isentropic, find
- i) work done per kg of steam
  - ii) Thermal efficiency with and without reheat. (8)

(14)

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	<div style="border: 1px solid black; display: inline-block; padding: 5px 15px; margin: 5px;">6E 7018</div>	
	<b>B.Tech.VI Semester(Main/Back) Examination, May 2015</b>	
	<b>Mechanical Engineering</b> <b>6ME6.3A Maintenance Management</b>	

**Time : 3 Hours**

**Maximum Marks : 80**  
**Min. Passing Marks : 24**

**Instructions to Candidates:**

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions **carry** equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

**Unit - I**

1. a) What are the primary and secondary functions of maintenance. **(8+8=16)**
- b) What is maintenance engineering? Discuss the roll of engineering in maintenance with respect to energy conservation.

**OR**

1. You are placed as maintenance Engineer in a chemical industry of 500 crore yearly turn over. Industry have civil maint work mechanical maintenance of plant equipment(Includes 100 Nos Stationary and 50 Nos Rotary)Electrical maintenance of motors and others.

You have been asked by mgt.

- i) Aligning of spare part control,so that stock out condition should not occur
- ii) Aligning maintenance cost which is very high at present
- iii) Aligning maintenance practice for reducing break down of systems
- a) Write a procedure for spare part control philosophy to justify above **(8)**

- b) Maintenance policy and changes in methods of maintenance with a schedule of maintenance. (8)

### Unit - II

2. a) What are the primary rules and regulations of industrial safety management. (8)
- b) What is the role of TQM in improving the total productivity Maintenance. (8)

### OR

2. a) What are the basic human reliability problems while working at workplace support your answers with suitable example of maintenance of vessel (by inside) (8)
- b) What is ISO 9000? How different tiers of ISO 9000 are being laid down as procedure in industry practice, support your answer with suitable example, where ISO 9003 is applicable. (8)

### Unit - III

3. a) Explain in detail the term tribology in maintenance with a suitable example of Industry. (8)
- b) You are working as equipment integrity engineer in a petroleum co., where about 100 equipments like pumps different types, compressors, turbines are there. What are the basic properties of Lubricant you are going review, so that equipment life will be maximize, based on lubricants, also the frequency of changing lubrication will be reduced. (8)

### OR

3. a) Explain in detail the different seals and packings are used for maintenance purpose support your answer with suitable diagram as well as any company name, who are manufacturing these packings and seals. (8)
- b) What is failure analysis. Explain failure analysis of a steam turbine or gear of lathe m/c with justification to management. (8)

**Unit - IV**

4. a) What is condition monitoring of a machine or static equipment. (4+12=16)  
b) What are the techniques used in machine health monitoring, Name any three equipment used in machine health monitoring.

**OR**

4. a) Explain in detail the signal processing data acquisition and analysis for a rotary equipment health monitoring like compreson or turbine. (8)  
b) Write detailed procedure of intelligent system used in equipment health or bridge load reliability monitoring. (8)

**Unit - V**

5. a) Explain the terminology RAM in maintenance practice of an Industry(6+10=16)  
b) Explain in detail the failure mechanism and failure analysis with suitable example.

**OR**

5. a) What is reliability testing, explain in detail the system reliability with a suitable example. (10+6=16)  
b) How you would ensure the reliability of repaired item, a vibrator screen which is segregating the polyester chips of different size. Its perforated sheet of screen size 4'×6' has been damaged and repaired by welding. Justify your answer with suitable procedure.
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6E 3050

Roll No. \_\_\_\_\_

[Total No. of Pages : 3]

6E3050

**B.Tech. VI Semester (Back) Examination, May - 2015****Mechanical Engineering****6ME2 I.C. Engines & Diesel Power Plant****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 24****Instructions to Candidates:**

*Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

**Unit - I**

1. a) Discuss the terms (Definition - 01 mark each  
Formula - 01 mark each.)
- i) Volumetric efficiency
  - ii) Thermal efficiency
  - iii) Energy Balance (6)

- b) The following data were recorded from a test on a single cylinder four stroke oil engine.

Cylinder Bore = 150mm, Engine stroke = 250mm, Area of indicator diagram = 450mm<sup>2</sup>, length of indicator diagram = 50mm, indicator spring rating = 1.2mm, Engine speed = 420 rpm, brake torque = 217 Nm, Fuel consumption = 2.95 kg/h, Calorific value of fuel = 44,000 kJ/kg, Cooling water rate of flow = 0.068 kg/s, Cooling water temperature rise = 45k, specific heat capacity of cooling water = 4.1868 kJ/kgk

Calculate:

- i) Mechanical efficiency
- ii) Brake Thermal efficiency
- iii) Specific fuel consumption and

iv) Draw up an energy balance in kw

Data = 01 mark, Formula = 04 marks, Calculation = 04 marks,  
Result = 01 mark

(10)

**OR**

1. a) Explain the Non - dispersive infrared (NDIR) Analyzer for Exhaust emission measurement. (Expl - 04 marks fig - 02 marks) (6)
- b) Write a short note on
  - i) Prony brake dynamometer (i. Expl with fig = 04 marks (03+01))
  - ii) Morse test (ii & iii = 03 marks each)
  - iii) Indicator diagram. (10)

**Unit - II**

2. a) Explain the stages of Normal combustion in S. I. Engine with help of pressure - Crank angle diagram. (Expl = 04 marks fig. = 02 marks) (6)
- b) What is the importance of delay period? Discuss the variables affecting delay period. (Expl = 07 marks fig. = 03 marks) (10)

**OR**

2. a) What are the effects of knocking in S.I. Engine. (Expl = 04 marks) (4)
- b) Explain the importance of Air swirl in C. I. Engine. (Expl = 04 marks) (4)
- c) Discuss the advantages of overhead valve combustion chamber over side valve combustion chamber. (Expl = 04 marks) (4)
- d) Briefly discuss major Hydrocarbon structure in petroleum. (Expl = 04 marks) (4)

**Unit - III**

3. a) Explain the draw backs of carburetion system over injection system. (Exple = 06 marks) (6)
- b) A simple jet carburettor is required to supply 6 kg of air/minute and 0.45 kg of fuel of density  $740 \text{ kg / m}^3$ . The air is initially at 1.013 bar and  $27^\circ\text{C}$ . Calculate the throat diameter of choke for a flow velocity of 92 m/s.  
Velocity coefficient = 0.8  
If the pressure drop across the fuel metering orifice is 0.75 of that of choke, calculate orifice diameter assuming coefficient of discharge is 0.60. (10)



(Data=01 mark, formula=04 marks, calculation steps=04 marks, result=01 mark)

**OR**

3. a) Compare battery (coil) ignition system with magneto ignition system. (6)  
(Expl = 06 marks)
- b) List the requirements of a diesel injection system. Discuss solid injection systems. (Expl =04+04 =08 marks fig. 02 marks) (10)

**Unit - IV**

4. a) Briefly compare Air and water cooling systems. (Expl=06 marks) (6)
- b) Explain different methods of determining the engine friction. (Expl=08 marks fig. = 02 marks) (10)

**OR**

4. a) Explain the important functions of a lubricating system. (Expl=04 marks) (4)
- b) Explain any two types of scavenging system. (Expl=02, fig.=02 marks) (4)
- c) Explain supercharging limits of C.I. Engines. (Expl=04 marks) (4)
- d) Compare two stroke engines with four stroke engines. (Expl=04 marks) (4)

**Unit - V**

5. a) What do you mean by multi fuel engine? Write the requirements of multi fuel engine. (Expl=02+04 marks) (6)
- b) Discuss the working principle of dual fuel engine. Explain the factors affecting dual fuel combustion. (Expl=04 marks+Expl with fig. = 04+02m) (10)

**OR**

5. a) Explain the modifications required for fuel system of a multi fuel engine. (6)
- b) Show the schematic arrangement of diesel power station layout and give its principle of operation. (Expl=07 marks, fig. = 03 marks) (10)



Roll No. \_\_\_\_\_

[Total No. of Pages : 2]

**6E 3051****6E 3051****B.Tech. VI Semester ( Back ) Examination, May 2015****Mechanical Engg.****6ME3 Manufacturing Science & Technology****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 24****Instructions to Candidates:**

*Attempt any Five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. any data you feel missing suitably be assumed and stated clearly.) Units of quantities used/ calculated must be stated clearly.*

**UNIT - I**

1. a) What are the main differences between a jig and fixtures (8)
- b) What is meant by angular location. Explain it for locating a connecting rod for machining. (8)

**(OR)**

1. a) Enumerate the design principles for drilling jigs (8)
- b) Write short note on broaching fixture and assembly fixture (8)

**UNIT - II**

2. a) Explain specific applications of new machining methods (8)
- b) Explain Electron discharge machining and its process characteristics (8)

**(OR)**

2. a) Explain working of electron beam machining with neat sketch (8)
- b) Explain economics of machining with respect to hybrid machining (8)

**UNIT - III**

3. a) Calculate the settings of gear tooth vernier to inspect a gear having 34 teeth with module 5 mm (8)  
 b) Explain the 'three wire method' of checking the pitch diameter of a screw (8)

**(OR)**

3. a) Define comparator. What are their types. Explain the working of a pneumatic comparator with neat sketch (8)  
 b) Find the value of the 'best wire size' for M20×2 Iso metric thread. Also determine distance over wires (8)

**UNIT - IV**

4. a) Discuss the various types of cutting tools (8)  
 b) Explain the design procedure of single point cutting tool (8)

**(OR)**

4. a) Why large positive rake angles cannot be used on cutting tools (8)  
 b) The feed of an 8 - tooth face mill is 0.33 cm per tooth at 200 rev/min. The material cut is 300 BHN steel depth of cut is 0.32 cm and the width is 10cm. Calculate  
 i) Horsepower at the cutter  
 ii) Horsepower at the motor if the efficiency of the machine is 60%. (8)

**UNIT - V**

5. a) Which is the best section for machine body. Justify your answer (8)  
 b) What are the principal requirements of guideways. (8)

**(OR)**

5. a) List the properties which should be possessed by machine tool parts for their proper performance (8)  
 b) Discuss the principal requirements for machine beds (8)

6E 3053

6E 3053

B.Tech. VI Semester (Back) Examination, May -June 2015

Mechanical Engg.

6ME5 Hydraulic Machines &amp; HYdroelectric Power Plant

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

**Instructions to Candidates:**

*Attempt any Five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. any data you feel missing suitably be assumed and stated clearly.) Units of quantities used/ calculated must be started clearly.*

**UNIT - I**

1. a) Prove that the maximum efficiency for curved vane, jet strikes at centre is given by  $\eta_{\max} = \frac{8}{27}(1 + \cos \theta) = \frac{16}{27} \cos^2 \frac{\theta}{2}$  (6)
- b) A jet discharges 150 litres/sec of water with velocity of 70 m/sec impinges without shock on a series of curved vanes which move in the same direction as the jet. The shape of each vane is such that it would deflect the jet through an angle of  $150^\circ$  surface friction reduces the relative velocity by 10% as the water passes across the vanes and there is a further windage loss equivalent to  $(0.25u_1^2)$ . Find :
  - i) The velocity of vane corresponding to maximum efficiency and the value of this efficiency
  - ii) The corresponding force on the vanes in and at right angles to the direction of their motion and
  - iii) The power of this arrangement (10)

(OR)

1. a) What is specific speed of turbine? Derive an expression of specific speed for turbine (7)
- b) A one twentieth scale model propeller turbine 4.78 KW when running at 1460 rpm under a head of 5.25 m. The model starts to cavitate when the pressure head at the turbine exit falls to 8.6 m below the atmospheric pressure head of

7353 mm of Hg. The full size prototype is to deliver 16.4 MW at a head of 22 m at an expected efficiency of 90%. What is the specific speed of the turbines the speed and the flow through the prototype? The prototype turbine has an exit diameter of 3m and the draft tube is expected to recover 75% of kinetic energy rejected by the turbine. What is maximum height the prototype turbine exit can be mounted above the tail race water level if it is not to cavitation at full load when the atmospheric pressure of 900 mb? Assume that for the model the water vapour pressure is 0.8 m of water and that for the prototype is 0.7 m of water

### UNIT - II

2. a) Show that the maximum efficiency of a pelton wheel turbine can be expressed as
- $$\left( \frac{C_v^2 (1 + K \cos \phi)^2}{2(1 + K \cos \phi) + K_1} \right)$$

Where  $C_v$  = Coefficient of velocity for nozzle

$k$  = Ratio of relative velocity at exit to the inlet

$\phi$  = Bucket angle at exit

The loss of energy due to windage and bearing friction is

$$\frac{K_1 u_1^3}{2g}$$

Where  $u_1$  is bucket velocity

(8)

- b) A double jet pelton wheel required to develop 5400 KW has a specific speed of 20 and is supplied through a pipe line 800 m long from a reservoir the level of which is 350 m above the nozzles. Allowing for 5% friction loss in pipe line calculate :-

i) Speed

ii) Dia of jets

iii) Mean diameter of bucket circle

iv) Diameter of the supply pipe. Assuming  $C_v$  for the jets is 0.98 bucket speed is equal to 0.46 of jet speed, over efficiency of wheel is 85% and

$$\lambda = uf = 0.024$$

(8)

(OR)

2. a) Prove that loss in nozzle is given by

$$h_n = H(1 - C_v^2) = \frac{V_1^2}{2g} \left( \frac{1}{C_v^2} - 1 \right)$$

Where symbols has the usual meanings

(7)

- b) In a hydroelectric scheme a number of pelton wheels are to be used under the following conditions : Total output required 30MW; gross head 245 m, speed 6.25 rps; 2 jets per wheel ;  $C_v$  of nozzle 0.97; maximum overall efficiency

(Based on conditions immediately before the nozzle) 81.5%; dimension less specific speed not to exceed 0.022 revolution per jet ; head lost to friction in pipeline not to exceed 12 m. calculate :

- i) The number of wheel's required
- ii) The diameter of the jets and wheels
- iii) The hydraulic efficiency, if the blades deflected the water through  $165^\circ$  and reduce its relative velocity by 15%
- iv) The percentage of the input power which remain as kinetic energy of the water at discharge (9)

### UNIT - III

3. a) Explain the theory and function of draft tube. Derive an expression of draft tube
- $$\frac{p_2}{\rho g} = \frac{p_a}{\rho g} - \left[ H_s + (1-K) \left( \frac{V_2^2 - V_3^2}{2g} \right) \right] \quad (8)$$
- b) In a reaction turbine with radial vanes at the inlet, the velocity of flow at outlet is K times that at inlet, prove that hydraulic efficiency
- $$\eta_h = \frac{2}{2 + K^2 \tan^2 \alpha}$$

and  $u_1 = \sqrt{\frac{2gH}{2 + K^2 \tan^2 \alpha}} \quad (8)$

(OR)

3. a) What are causes and prevention method of cavitation in turbine? Also prove that  $\sigma_c = \frac{H_a - H_{\min} - H_s}{H}$  (8)
- b) Water flows through a vertical Francis turbine at the rate of  $15.5 \text{ m}^3/\text{sec}$  and makes its runner to rotate at 428.4 rpm. The velocity and the pressure head at the inlet of the spiral casing are 8.5 m/sec. and 240 m respectively and the centre line of its inlet is 3 m above the tail race level. The diameter and the width of the runner at inlet are 2 m and 300mm respectively. If the hydraulic and overall efficiencies are 93% and 90% respectively, determine :-
- i) Output power
  - ii) Guide vane angle
  - iii) Runner blade angle at inlet (8)

### UNIT - IV

4. a) Prove that for single acting reciprocating pump, the ratio of work - done against friction without air vessel to with air vessel is given by  $\left( \frac{2\pi^2}{3} \right)$  (8)

- b) A double acting reciprocating pump running at 50 rpm, delivers 8.4 litres/sec of water. The diameter of piston is 150 mm and stroke length 300mm The static head of pump is 25m. The suction pipe is 5m long and 100 mm in diameter. Find the percentage slip and power required to run the pump. Also calculate the acceleration head at the beginning of the suction stroke (8)

(OR)

4. a) Define the following with reference to torque converter :

- i) Fluid drive efficiency
- ii) Speed ratio
- iii) Torque ratio
- iv) Stall speed
- v) Design point
- vi) Coupling point
- vii) Run away point

(7)

- b) The torque coefficient of a particular fluid coupling is found to be  $C_T = \frac{T}{\rho \omega^2 D^5} = 0.008\sqrt{5}$  is the efficiency of transmission is 98% when the output is 11 KW from the coupling 300 mm diameter filled with oil of density 355 kg/m<sup>3</sup> find the speed of primary shaft (9)

## UNIT - V

5. a) Give the advantages and disadvantages of hydraulic power plant over other methods of power generation (7)
- b) What are the various components of hydro electric power station? Explain with the help of neat & clean diagrams and layout (9)

(OR)

5. Describe the followings

- i) Surge tank
- ii) Run of river plant
- iii) Mini and micro hydro - electric plant
- iv) Hydro - graphs
- v) Site selection of HEPP
- vi) Present scenario of hydro - power in India
- vii) Classification of HEPP
- viii) Selection of hydro - turbine

(8×2=16)



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[Total No. of Pages : 3]

6E 3054

6E3054

**B.Tech. VI Semester (Back) Examination, May 2015****Mechanical Engg.****6ME6 Numerical Methods And Applied Statistics****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 24****Instructions to Candidates:**

*Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly)*

**Unit - I**

1. a) Find the real root of  $x^4 - 12x + 7 = 0$  using newton Raphson method, which is near to  $x = 2$  correct to three places of decimal. (16)
- b) Find all the roots of the equation  $x^3 - 4x^2 + 5x - 2 = 0$  by Graffe's root squaring method. (16)

**OR**

1. a) Find the root of the equation  $xe^x = \cos x$  using the secant method to four places of decimal. (16)
- b) Find the real root of the equation  $x^3 - 3x - 5 = 0$  by bisection method correct to three places of decimals. (16)

**Unit - II**

2. a) Find the solution of system of equations by partition method
 
$$\begin{aligned} x_1 + x_2 + x_3 &= 1 \\ 4x_1 + 3x_2 - x_3 &= 6 \\ 3x_1 + 5x_2 + 3x_3 &= 4 \end{aligned}$$
(16)
- b) By Means of Newton's divided difference formula find the values of  $f(8)$  and  $f(15)$  from the following table. (16)

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

OR

2. a) Using the operators  $\delta$  and  $\mu$ , prove that (16)

$$i) \quad \delta \left[ \frac{f(x)}{g(x)} \right] = \frac{\mu[g(x)] \cdot \delta[f(x)] - \mu[f(x)] \cdot \delta[g(x)]}{g(x - \frac{h}{2})g(x + \frac{h}{2})}$$

$$ii) \quad \mu[f(x)g(x)] = \mu[f(x)]\mu[g(x)] + \frac{1}{4}\delta[f(x)]\delta[g(x)]$$

- b) Solve the system 
$$\begin{aligned} 27x + 6y - z &= 85 \\ 6x + 15y + 2z &= 72 \\ x + y - 54z &= 110 \end{aligned}$$
 (16)

by Gauss - seidal method.

## Unit - III

3. a) Use milne's method to obtain the solution of the equation  $\frac{dy}{dx} = x - y^2$  at  $x = 0.8$  given that  $y(0) = 0$ ,  $y(0.2) = 0.02$ ,  $y(0.4) = 0.0795$  and  $y(0.6) = 0.1762$ . (16)
- b) Using Runge - kutta Method, Find approximate value of  $y$  for  $x = 0.2$  if

$$\frac{dy}{dx} = x + y^2, \text{ given that } y = 1 \text{ when } x = 0. \quad (16)$$

OR

3. a) Using Adam - Bash forth method, obtain the solution of  $\frac{dy}{dx} = x^2y + x^2$  at  $x = 1.4$  given the values. (16)

x:	1	1.1	1.2	1.3
y:	1	1.233	1.5484	1.9789

- b) Evaluate  $\int_0^6 \frac{dx}{1+x^2}$  by using. (16)

- i) Simpson's one third rule  
ii) Simpson's three eight rule

T.B.L

d

## Unit - IV

4. a) Define poisson distribution and find mean variance and m.g.f of the same. (16)
- b) Calculate the coefficient of correlation for the following height (in inches) of fathers (x) and their sons (y). (16)

x:	65	66	67	67	68	69	70	72
y:	67	68	65	68	72	72	69	71

OR

4. a) Obtain the rank correlation coefficient for the following data (16)
- |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|
| x: | 68 | 64 | 75 | 50 | 64 | 80 | 75 | 40 | 55 | 64 |
| y: | 62 | 58 | 68 | 45 | 81 | 60 | 68 | 48 | 50 | 74 |
- b) Define Normal distribution and find mean and variance and m.g.f for the same. (16)

## Unit - V

5. a) A survey of 800 families with four children each revealed the following distribution. (16)

No. of boys	:	0	1	2	3	4
No. of girls	:	4	3	2	1	0
No. of families	:	32	178	290	236	64

In this result consistent with the hypothesis that male and female births are equally probable.

- b) Fit a second-degree parabola to the following data taking x as the independent variable. (16)

x:	1	2	3	4	5	6	7	8	9
y:	2	6	7	8	10	11	11	10	9

OR

5. a) In a large city A, 20% of a random sample of 900 school boys had defective eye sight. In an other large city B, 15% of a random variable of 1600 school boys had the same defect. In this difference between the two populations significant? (16)
- b) If  $\theta$  be the acute angle between the two lines of regression in the case of two variables x and y,  
 Show that  $\tan \theta = \frac{1-r^2}{r} \cdot \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2}$ .  
 Where  $r, \sigma_x, \sigma_y$  have their usual notations. Explain the significance where  $r = 0, r = \pm 1$ . (16)