F 3115 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

COMPUTER PROGRAMMING (MU)

(Improvement/Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 4 *marks.*

1. What are different types of C tokens ?
2. What is the purpose of a pre-processor directive ?
3. How many different types can the elements of an array have ?
4. Write a program to read a two dimensional integer array.
5. Distinguish between local and global variables.
6. Where can the declaration of a function be placed ?
7. Explain the difference between the following two declarations :—

   int $n_1 = n$; int & $n_2 = n$;
8. Explain how string is passed as a function argument.
9. Explain the seekg ( ) function.
10. Explain how binary files are appended.

(10 × 4 = 40 marks)

Part B

Each question carries 12 *marks.*

11. Write a C program to find the value of sin (x) using summation concept.

Or

12. Write a program that read users age and then prints "You are a Child" if the age <18, "You are an Adult" if 18 ≤ age ≤ 65 and "You are a Senior Citizen" if age ≥ 65.
13. Explain the syntax of structure and union. Explain how a structure can be used to represent the details of a student.

Or

14. Write a program to multiply a 3 × 3 integer matrix after reading from console.

Turn over

15. What are the differences between passing a parameter by value and by reference ? Give example.

Or

16. Write a function that reads a string and return its length as output.

17. What is the advantage of dynamic memory allocation ? Explain the use of Calloc ( ) and malloc ( ) functions ?

Or

18. Write a program to pass a *three* dimensional integer array using function.

19. Write short notes on :

    (i) Transfer of data in blocks. (6 marks)

    (ii) Different types of file. (6 marks)

Or

20. Write a program to read two text files and append one file to other.

(5 × 12 = 60 marks)

F 3144 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical / Automobile Engineering

THERMAL ENGINEERING – I (M, U)

(Improvement / Supplementary / Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 4 *marks.*

1. List the advantages of super heated steam.
2. Define quality and dryness fraction of steam.
3. Discuss the different types of steam nozzles.
4. State the difference between impulse and reaction steam turbines.
5. Why constant pressure heat addition is more advantageous in a gas turbine?
6. What is a centrifugal compressor? How does it differ from an axial flow compressor?
7. How is the energy continuously being produced in the sun?
8. Define concentration ratio of Solar collector.
9. What is the function of a cooling tower in a modem steam power plant?
10. Why ash and dust handling problem in more difficult than coal handling problems?

(10 × 4 = 40 marks)

Part B

Each question carries 12 *marks.*

11. (a) Steam at 10 bar and 200° C is cooled till it becomes dry saturated and is then throttled to 1 bar pressure. Determine the change in enthalpy and heat transferred during each process. Also find the quality of steam at the end of throttling process. Take c_{ps} = 2.25 kJ/kg K for superheated steam.

Or

(b) Explain the working of any *one* water tube boiler with a neat sketch.

Turn over

12. (a) Steam is expanded in a set of nozzles from 10 bar and 200° C to 5 bar. What type of nozzle is it? Neglecting the initial velocity, find minimum area of the nozzle required to allow a flow of 3 kg/s under the given conditions. Assume that expansion of steam to be isentropic.

Or

(b) A single row impulse turbine develops 132.4 kW at a blade speed of 175 m/s, using 2 kg of steam per second. Steam leaves the nozzle at 400 m/s. Velocity coefficient of the blades is 0.9. Steam leaves the turbine blades axially. Determine nozzle angle, blade angles at entry and exit, assuming no shock.

13. (a) A gas turbine operates on a pressure ratio of 6. The inlet air temperature to the compressor is 300 K and the air entering the turbine is at a temperature of 577° C. If the volume rate of air entering the compressor is 240 m^3/s, calculate the net power output of the cycle in MW. Also compute its efficiency. Assume that the cycle operates under ideal conditions.

Or

(b) What are the requirements of a gas turbine combustion chamber? Explain the factors affecting the gas turbine combustion chamber performance?

14. (a) Write notes on : (i) Liquid flat plate collectors ; (ii) Overall loss coefficient ; (iii) Focusing type solar collectors .

Or

(b) Explain about solar heating system.

15. (a) Describe the burning sequence of coal in overfeed and underfeed stokers.

Or

(b) Describe with neat sketches the operation of the following condensers :

(i) Jet condenser.

(ii) Surface condenser.

(iii) Evaporative condenser.

(5 × 12 = 60 marks)

F 3105 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

MANUFACTURING PROCESSES (MU)

(Improvement / Supplementary / Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 4 *marks.*

1. Explain various types of colour coding used in patterns.
2. What is meant by permeability of molding sand? How it is testing?
3. Explain the welding procedure used to join rails.
4. What are the advantage of LASER welding over other welding process?
5. Explain the wheel rolling operation.
6. What is the significance of recrystallization temperature, in rolling operation?
7. What is meant by explosive forming?
8. What is meant by flow-board pattern?
9. What is meant by forge welding?
10. What is meant by spinning?

(10 × 4 = 40 marks)

Part B

Each question carries 12 *marks.*

11. Explain various properties of moulding sand.

Or

12. Explain any *five* testing methods used to evaluate various qualities of moulding sand.
13. With the help of a neat sketch, explain gas welding process.

Or

Turn o er

14. Explain the various types resistance welding process.

15. Explain hydro forming process with the help of a neat sketch.

Or

16. Explain various energy sources in high energy forming.

17. What are the common components manufactured by cold drawing process ? Explain the manufacturing process of any *one* such component with the help of a neat sketch.

Or

18. With the help on a neat sketch, differentiate forward and reverse extrusion process. Mention any *four* components manufactured by these processes.

19. Explain why crankshaft of an automobile is manufactured by forging and not by casting.

Or

20. Differentiate drop forging and press forging.

(5 × 12 = 60 marks)

F 3083 (Pages : 2) Reg. No.....2 copy.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

AU 010 505 / ME 010 505 I.C. ENGINES AND COMBUSTION (AU, ME)

(Regular—New Scheme)

Time : Three Hours Maximum : 100 Marks

Necessary charts are permitted.

Answer **all** *questions.*

Part A

Each question carries 3 *marks.*

1. What is the significance of valve timing diagram ?
2. What is CRDI technology ?
3. Write a note on variation of specific heat due to dissociation.
4. Distinguish between Petrol knock and Diesel knock.
5. How will you find frictional power of I.C. engines ?

(5 × 3 = 15 marks)

Part B

Each question carries 5 *marks.*

6. Write a note on various alternative fuels.
7. What are the desirable properties of lubricants ?
8. Discuss a method to measure exhaust gas composition.
9. How does the flame propagation affect performance of a C.I. engine ?
10. Compare the effect of pollutants in S.I. and C.I. engines.

(5 × 5 = 25 marks)

Part C

Answer any **one** *full question from each module.*
Each full question carries 12 *marks.*

11. Explain the working of a (i) Stratified change engine; and (ii) Free piston engine.

Or

12. With neat sketches, explain the ignition systems used in I.C. engines.

Turn over

13. Explain the need of fuel injection. Discuss the mechanism of fuel injection in S.I. and C.I. engines.

Or

14. Discuss :

    (i) Solex carburettor. (4 marks)

    (ii) GDI engines. (4 marks)

    (iii) Stoichiometric F/A ratio. (4 marks)

15. Explain the thermodynamic aspects and energy interactions during the combustion reaction of (i) gasoline and (ii) diesel.

Or

16. Discuss the variation in engine cooling requirements at various parts of an I.C. engine. Differentiate between air cooling and water cooling systems. Draw neat sketches.

17. With a 'P-Q' diagram, explain all the stages of combustion in a C.I. engine.

Or

18. What is ignition delay ? Discuss various types of air motion and their effect on combustion.

19. Explain :

    (i) Exhaust gas treatment. (4 marks)

    (ii) Catalytic converter. (4 marks)

    (iii) Particulate trap. (4 marks)

Or

20. Discuss the procedure for conducting heat balance test on an I.C. engine. Draw a typical heat balance chart and explain its relevance.

[5 × 12 = 60 marks]

F 3071 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

AU 010 504 / ME 010 504 } KINEMATICS OF MACHINERY (AU, ME)

(Regular—New Scheme)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 3 *marks.*

1. Define kinematic chain and inversion.
2. List the advantages and vector approach of kinematic analysis.
3. How will you choose precision points in synthesis ?
4. What are polynomial cams ?
5. Discuss the significance of contact ratio.

(5 × 3 = 15 marks)

Part B

Each question carries 5 *marks.*

6. Explain the working of a double slider crank chain.
7. Discuss complex number method of kinematic analysis.
8. Explain the role of function generator in synthesis.
9. Sketch any *three* types of followers.
10. Discuss the applications of rack and pinion gears.

(5 × 5 = 25 marks)

Part C

Each question carries 12 *marks.*

11. Describe the working of a Whitworth quick-return motion mechanism.

Or

12. With neat sketch, explain any *two* straight line generation mechanisms.

Turn over

13. Explain in detail the application of digital computers in kinematic analysis of mechanisms. Discuss with flowcharts, any three of such applications.

Or

14. Explain the method of (i) displacement ; (ii) velocity ; and (iii) acceleration analysis of all inversions of a slider crank mechanism. Discuss how components of acceleration are determined.

15. Discuss the technique of three position synthesis of a four link mechanism.

Or

16. Explain the overlay method for kinematic synthesis. What are its applications ?

17. Discuss how the (i) Velocity and (ii) Acceleration curves vary with the follower motion and type of cam. What is the procedure for drawing cam profile ? Give any two typical examples.

Or

18. Explain the motion analysis in (i) Convex ; and (ii) Concave cams with footed followers. Draw neat sketches.

19. What is interference in gears ? Discus its effect. What are the conditions necessary to avoid interference ? Explain.

Or

20. With neat sketch, explain the application of a planetary gear trains to the differential of an automobile.

(5 × 12 = 60 marks)

F 3067 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical Engineering/Production Engineering

PE 010 503 / ME 010 503 ADVANCED MECHANICS OF MATERIALS (ME, PE)

(Regular—New Scheme)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 3 *marks.*

1. Distinguish between Stress vector and Stress tensor.
2. Give an example for plane strain problems.
3. What are thick cylinders ? Write one of their applications.
4. What do you mean by "strain energy due to torsion" ?
5. State the importance of shear flow in beams.

(5 × 3 = 15 marks)

Part B

Each question carries 5 *marks.*

6. What are stress invariants and strain invariants ? Explain.
7. State and explain Saint Venant's principle.
8. Which are the parameters used to identify the effects of stress concentration ? Explain.
9. Derive reciprocal relations. State Maxwell reciprocal theorem. Discuss its limitations.
10. How will you find torsion effect in a solid bar of non-circular cross-section ? Give a standard methodology.

(5 × 5 = 25 marks)

Part C

Each question carries 12 *marks.*

11. Derive and explain all the constitutive equations. Explain the generalized Hooke's law. Discuss how these relations can be used to deduce expressions for plane stress conditions.

Or

12. Derive all the relations between elastic constants in solid mechanics. How are they useful in simplifying problems in elasticity ?

Turn over

13. Define Airy's stress function. Discuss how this function can be applied using polynomial method for finding solutions to 2-D plane strain problems.

Or

14. A horizontal cantilever 2 m. long is loaded at the free end by a vertical load of 2 kN. The cross-section of the cantilever is of angle section 15 cm. × 10 cm. × 1.2 cm. and is arranged in such a way that shorter leg is horizontal. If the load passes through shear centre of the angle, determine the maximum tensile and compressive stresses in the section.

15. Derive expressions for stresses and strains in rotating discs. State and discuss all the assumptions made.

Or

16. Explain :

    (i) Unsymmetrical bending. (6 marks)

    (ii) Curved beams with circular cross-section. (6 marks)

17. With necessary assumptions, derive the expressions for evaluation of stresses using (i) Castigliano's first theorem and (ii) Castigliano's second theorem. Give any *three* practical applications.

Or

18. A flat ribbon spring steel 3.2 mm. wide and 0.5 mm. thick is wound round a cylinder 50 mm. dia. Find the maximum stress and energy stored in ribbon per metre length of ribbon. Take E = 220 GPa.

19. With neat sketches and assumption, derive the torsional formula for any two thin walled open sections.

Or

20. Explain :

    (i) Prandtle's method. (6 marks)

    (ii) Torsion for circular bars. (6 marks)

[5 × 12 = 60 marks]

F 3052 (Pages : 2) Reg. No.....2 copy.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

AU 010 502 / ME 010 502 } COMPUTER AIDED DESIGN AND MANUFACTURING (AU, ME)

(Regular—New Scheme)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 3 *marks.*

1. Define computer integrated manufacturing.
2. Differentiate between Incremental and Absolute systems.
3. List any *five* geometric commands in APT.
4. What are the advantages of CAPP ?
5. What is the function of a robot end effector ?

(5 × 3 = 15 marks)

Part B

Each question carries 5 *marks.*

6. Discuss the various storage devices used in CAD.
7. Explain the practical application of straight-cut NC system.
8. Discuss the main aspects of word address format in NC.
9. What are the elements of responsive manufacturing ? Explain.
10. What are the challenges in application of a robot for welding ?

(5 × 5 = 25 marks)

Part C

Answer **either** *(a)* **or** *(b) section from each module.*
Each full question carries 12 *marks.*

Module I

11. (a) Discuss a scheme for networking an integrated CAD/CAM system used in a foundry shop and machine shop.

Or

(b) Describe all the 2D transformation operations used in CAD.

Turn over

Module II

12. (a) Discuss all the steps in an engineering design process. What is the effect of using computers in design ?

Or

(b) With neat sketches, explain all the feedback devices used in CNC.

Module III

13. (a) Write a manual part program in (i) fixed format ; (ii) Tab sequential format ; and (iii) Word address format to machine the internal surfaces of a tapered threaded hole of a component. Assume suitable dimensions and use incremental positioning.

Or

(b) Write an APT part program to perform milling operation of pockets. Assume suitable dimensions of the part and list all the statements.

Module IV

14. (a) Define group technology. Discuss any one method of group technology and apply it to a production system.

Or

(b) Explain the following :—

(i) Types of FMS.

(ii) FMC.

(iii) JIT.

(3 × 4 = 12 marks)

Module V

15. (a) With neat sketches, explain the kinematics and dynamics of a robotic system. What are the challenges involved in design of a SCARA robot ? Explain.

Or

(b) Explain robotic control, drives, actuators and sensors of a robotic system when applied to a manufacturing industry.

[5 × 12 = 60 marks]

F 3093 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering/Production Engineering

AU 010 506 / ME 010 506 THERMODYNAMICS (AU, ME)

(Regular—New Scheme)

Time : Three Hours Maximum : 100 Marks

Use of Steam tables and Psychrometric chart are permitted.

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Differentiate between Macroscopic and Microscopic analysis.
2. How will you compare "heat" and "work" in terms of grade ?
3. Why entropy is important in a thermodynamic process ?
4. Define Gibb's function.
5. List applications of mixtures of gases.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Distinguish between mechanical equilibrium and chemical equilibrium in thermodynamics.
7. Derive the relation between internal energy and enthalpy.
8. Give an example for an irreversible process. Explain.
9. Write a note on application of thermodynamic relations.
10. What is a Mollier diagram ? Discuss.

(5 × 5 = 25 marks)

Part C

Answer any **one** *full question from each module.*
Each full question carries 12 *marks.*

11. **Explain the following :—**

    (i) **PVT system.** (4 marks)

    (ii) **Compressibility factor.** (4 marks)

    (iii) **Equation of state.** (4 marks)

Or

Turn over

12. A vehicle accelerates a glider of 125 kg. mass from rest to a speed of 50 km./hr. Make calculations for the work done on the glider by the vehicle. What change would occur in the kinetic energy of the glider if subsequently its velocity reduces to 20 km./hr. on the application of brakes.

13. List any *five* physical properties of matter which can be used for the measurement of temperature. With neat sketches, explain any *four* of them.

Or

14. A closed rigid vessel containing 10 kg. of oxygen at 290 K is supplied heat until its pressure becomes two-fold that of initial value. Identify the process and calculate the final temperature, change in internal energy and enthalpy, and heat interaction across system boundary.

15. A reversible heat engine works between three heat reservoirs A, B and C. The engine receives equal amount of heat from reservoir A and B at temperature T_A and T_B respectively and rejects heat to a reservoir C at temperature T_C. If the efficiency of the engine is 'α' times the efficiency of a reversible engine operating between A and C only, show that $\frac{T_A}{T_B} = 2(1-\alpha)\frac{T_A}{T_C} + (2\alpha - 1)$.

Or

16. Write necessary assumptions, explain Carnot theorem in the context of a heat pump/refrigeration.

17. Derive the combined first and second law equations. State the assumptions made. Also, explain Maxwell relations.

Or

18. Derive the expression for specific heats, internal energy and enthalpy. Derive the relations between specific heats.

19. Draw and explain the (P-T) and (T-S) diagrams. Discuss their significance in thermodynamics.

Or

20. A vessel contains 10 kg. of oxygen, 8 kg. of nitrogen and 25 kg. of CO_2 at 375 K temperature and 250 kPa pressure. Make calculations for capacity of the vessel, the partial pressure of each gas present in the vessel, and total pressure in the vessel, when the temperature is raised to 450 K.

(5 × 12 = 60 marks)

F 3136 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical Engineering/Automobile Engineering

MECHATRONICS AND CONTROL SYSTEMS (MU)

(Improvement/Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Discuss the advantages of mechanic systems in machine tools compared to conventional machine tools.
2. Distinguish between active and passive transducers.
3. What is a 'token ring' in computer networks ?
4. Explain the working of a differential amplifier.
5. Explain a sample and hold circuit.
6. Explain time constant of a sensor.
7. What is a PIR sensor ? Where is it used ?
8. Explain response time.
9. Explain a servomotor.
10. Define transfer function and state its use.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each question carries 12 *marks.*

11. (a) Explain any *two* types angular position sensors and their uses. (5 marks)

    (b) Explain with a circuit diagram the working of an instrumentation amplifier. (7 marks)

Or

12. (a) Explain the construction and signal conditioning circuitry of a strain gauge load cell. (8 marks)

    (b) Explain how an op-amp can be used for correcting nonlinearity of signals in a logarithmic amplifier. (4 marks)

Turn over

13. (a) Differentiate between 'polling' and 'interrupt' modes of data inputs. (6 marks)

(b) What are the different flag registers in a microprocessor and what are they used for ? (6 marks)

Or

14. (a) What is latching of a coil in PLC ladder logic ? (2 marks)

(b) Construct a PLC ladder diagram to automate a drilling machine in the following sequence :

(i) clamp work (ii) drill motor on

(iii) drill (iv) dwell for 3 seconds

(v) retract drill bit (vi) motor stop

(vii) declamp work.

(10 marks)

15. (a) Distinguish between open-loop and closed-loop control systems and their relative merits and demerits.

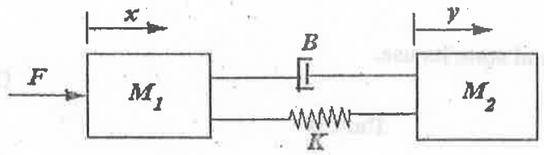
(4 marks)

(b) Explain with a neat circuit diagram, the working of a PID controller for controlling the position of a motor using a potentiometer as position sensor.

(8 marks)

Or

16. Find the transfer function $\frac{y}{F}$ for the following mechanical system.



(12 marks)

17. For a unity feedback control system having an open-loop transfer function $G(s)=\frac{24(s+12)}{s^2+25}$. Find the steady state step response and evaluate the steady state error following step response.

(12 marks)

Or

18. Find the steady state step and ramp errors for the unity feedback system with open-loop transfer function $G(s)=\frac{s+4}{s(s+5)}$.

(12 marks)

19. What is a Routh-Hurwitz stability criterion ? With a suitable example explain the method of analyzing the stability of a system using the characteristic equations.

(12 marks)

Or

20. Draw the root locus of the system with transfer function $G(s)=\frac{K(s+2)}{s(s+1)}$ and find the exact break away point values.

(12 marks)

[5 × 12 = 60 marks]

F 3125

(Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Mechanical Engineering

THEORY OF MACHINES–II (M)

(Improvement/Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*
Drawing sheets may be supplied.

Part A

Each question carries 4 *marks.*

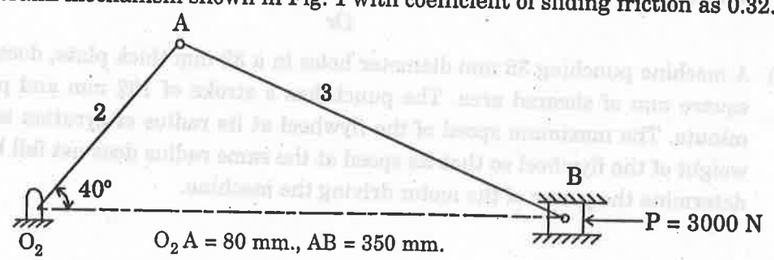
1. Explain free body diagram.
2. What are the conditions of static equilibrium of a three force member and a member with two forces and a torque ?
3. Explain the difference between centrifugal and inertia type governors. Why is the former preferred to the latter ?
4. Prove that the sensitiveness of a Proell governor is greater than that of a Porter governor.
5. Explain how the moment of inertia of the flywheel is determined with the help of turning moment diagram.
6. Derive an expression for energy stored in the flywheel.
7. Write notes on gyroscopic stabilization of ships.
8. Explain and derive the stability equation of a two wheeler taking a left turn.
9. What is pressure angle in cam action ? How is it important in cam design ?
10. Derive an expression for acceleration of follower in a tangent cam with roller follower.

(10 × 4 = 40 marks)

Part B

Each full question carries 12 *marks.*

11. (a) Find the force on the crank, torque on crank shaft forces on bearing and connecting rod of the slider crank mechanism shown in Fig. 1 with coefficient of sliding friction as 0.32.



Or

(b) The following data relate to a horizontal reciprocating engine :

Mass of reciprocating parts = 120 kg.

Crank length = 90 mm.

Engine speed = 600 r.p.m.

Connecting rod mass = 90 kg.

Length between centres = 450 mm.

Distance of centre of mass from big end centre = 180 mm.

Radius of gyration about an axis through centre of mass = 150 mm.

Find the magnitude and the direction of the inertia torque on the crank shaft when the crank has turned 30° from the inner-dead centre.

12. (a) The arms of a Proell governor are 30 cm long. The upper arms are pivoted on the axis of rotation while the lower arms are pivoted at a radius of 4 cm. Each ball weighs 5 kgf and is attached to an extension, 10 cm. long, of the lower arm. The central load is 50 kgf. At the minimum radius of 15 cm. The extensions to which the balls are attached are parallel to the governor axis. Find the equilibrium speed corresponding to radii of rotation of 16 cm.

Or

(b) In a spring loaded governor of the Hartnell type the mass of each ball is 1 kg., the length of the vertical arm of the bell crank lever is 100 mm and that of the horizontal arm 50 mm. Distance of the fulcrum of each bell crank lever is 80 mm from the axis of rotation of the governor. The extreme radii of rotation of the balls are 75 and 112.5 mm. The maximum equilibrium speed is 5 % greater than the minimum equilibrium speed which is 360 r.p.m. Find neglecting the obliquity of arms, initial compression of the spring in mm. and equilibrium speed corresponding to radius of rotation of 100 mm.

13. (a) The torque delivered by a two-stroke engine is represented by $T = (1000 + 300 \sin 2\theta - 500 \cos 2\theta)$ N-m where θ is the angle turned by the crank from the inner-dead centre. The engine speed is 250 r.p.m. The mass of the flywheel is 400 kg and radius of gyration 400 mm. Determine (i) the power developed ; (ii) the total percentage fluctuation of speed ; (iii) the angular acceleration of flywheel when the crank has rotated through an angle of 60° from the inner-dead centre ; (iv) the maximum angular acceleration and retardation of the flywheel.

Or

(b) A machine punching 38 mm diameter holes in a 32 mm thick plate, does 6 N-m of work per square mm of sheared area. The punch has a stroke of 102 mm and punches 6 holes per minute. The maximum speed of the flywheel at its radius of gyration is 27.5 m/s. Find the weight of the flywheel so that its speed at the same radius does not fall below 24.5 m/s. Also determine the power of the motor driving the machine.

14. (a) The mass of a turbine rotor of a ship is 8000 kg. and has a radius of gyration of 0.75 m. It rotates at 1800 r.p.m. clockwise when viewed from the stern. Determine the gyroscopic effects in the following cases (a) if the ship travelling at 100 km/hr. steers to the left along a curve of 80 m radius ; (b) if the ship is pitching and the bow is descending with maximum velocity. The pitching is with simple harmonic motion with periodic time of 20s and the total angular movement between extreme positions is 10° ; (c) if the ship is rolling with an angular velocity of 0.03 rad/s clockwise when looking from stern. In each case, determine the direction in which the ship tends to move.

Or

(b) An epicyclic gear consists of a pinion, a wheel of 40 teeth and an annulus with 84 internal teeth concentric with the wheel. The pinion gears with the wheel and the annulus. The arm that carries the axis of the pinion rotates at 100 r.p.m. If the annulus is fixed, find the speed of the wheel and if wheel is fixed, find the speed of the annulus.

15. (a) Draw the profile of a cam that gives a lift of 40 mm. to a rod carrying a 20 mm diameter roller. The axis of the roller passes through the centre of the cam. The least radius of the cam is 50 mm. The rod is to be lifted with simple harmonic motion in a quarter revolution and is to be dropped suddenly at half revolution. Determine the maximum velocity and maximum acceleration during the lifting. The cam rotates at 60 r.p.m.

Or

(b) The following particulars relate to a symmetrical tangent cam having a roller follower :

Minimum radius of the cam = 40 mm.

Lift = 20 mm.

Speed = 360 mm.

Roller diameter = 44 m.

Angle of ascent = 60°.

Calculate the acceleration of follower at the beginning of lift. Also find its values when the roller just touches the nose and is at the apex of the circular nose. Sketch the variation of displacement, velocity and acceleration during ascent.

(5 × 12 = 60 marks)

	D	F	G	H	Supply
A	19	30	50	10	7
B	70	30	40	60	9
C	40	8	70	20	18
Demand	5	8	7	14	34

(10 marks)

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Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Common to all branches except Computer Science and Engineering/Information Technology

ENGINEERING MATHEMATICS—IV (CMELPASUF)

(Improvement/Supplementary/Mercy Chance)

Time : Three Hours Maximum : 100 Marks

Answer any **one** *question from each module.*
All questions carry equal marks.

Module I

1. (a) Evaluate $\int_C z^2 dz$ where C is given by :

(i) The line $x = 2y$ from (0, 0) to (2, 1).

(ii) The line segment along the real axis from (0, 0) to (2, 0) and then vertically to (2, 1).

Can you expect path independency for the above integrals ? Give reason. (12 marks)

(b) Find the Laurents series expansion of $f(z) = \frac{z}{(z^2-1)(z^2+3)}$ in $|z| > 4$. (8 marks)

Or

2. (a) Using contour integration, evaluate $\int_0^{2\pi} \frac{d\theta}{5+4\cos\theta}$. (10 marks)

(b) Using contour integration, evaluate $\int_{-\infty}^{\infty} \frac{x^2}{(x^2+1)^2} dx$. (10 marks)

Module II

3. (a) Find by Newton-Raphson method, the positive root of the equation $x^3 + x^2 + x = 100$. (10 marks)

(b) Find by method of false position, the root of the equation $xe^x = 1$. (10 marks)

Turn over

4. (a) Apply Gauss-Seidel method to solve the equations :

$10x+y+z=12,\ 2x+10y+z=13,\ x+y+5z=7.$ (12 marks)

(b) Find a root of the equation $x^3-2x=5$, using bisection method correct to 3 decimal places. (8 marks)

Module III

5. (a) Use Taylor's series method to find $y(4.1)$ and $y(4.4)$ correct to three decimal places, given that $\frac{dy}{dx}=\left(x^2+y\right)^{-1}$, $y(4)=5$.

(8 marks)

(b) Use Runge-Kutta method to find $y(0.4)$ in steps of 0.2 given $\frac{dy}{dx}=1+y^2$ $y(0)=0$ correct to five decimal places.

(12 marks)

Or

6. (a) Use Euler's modified method to compute $y(1, 1)$, given that $\frac{dy}{dx}=x(1+y)$ $y(1)=1$ taking $h = 0.05$. Correct to 3 decimal places.

(10 marks)

(b) Using Milne's Predictor-Corrector method find $y(1.2)$ taking $h = 0.1$, given $\frac{dy}{dx}=y-x^2$, $y(1)=1$.

(10 marks)

Module IV

7. (a) Prove Shifting rules and hence show that $Z\left(\frac{1}{n!}\right)=e^{\frac{1}{z}}$. (8 marks)

(b) Using Z-transform solve $y_{n+2}-5y_{n+1}+6y_n=5^n$ with $y(0) = 0, y(1) = 1$. (12 marks)

Or

8. (a) If $Z(u_n)=\frac{2z^2+3z+4}{(z-1)^3}$, find the values of u_1 and u_2. (10 marks)

(b) Compute the following :

(i) $Z\left[\frac{2z^2+3z}{(z+2)(z-4)}\right]$. (ii) $Z^{-1}\left[\frac{z}{(z+1)^2(z-1)}\right]$. (10 marks)

Module V

9. (a) Use graphical method to solve the following L.P.P. :

Minimize $Z=20x+10y$

subject to the constraints,

$x+2y\le 40,$

$3x+y\ge 30,$

$4x+3y\ge 60$ with $x, y \ge 0$.

(8 marks)

(b) How will you identify alternate solution of an L.P.P. ? Using simplex algorithm, solve the following L.P.P. :

Maximize $Z=3x+2y+5z$

subject to the constraints,

$x+2y+z\le 430,$

$3x+2z\le 460,$

$x+4z\le 420$ with $x, y, z \ge 0$.

(12 marks)

Or

10. (a) Use Big-M method to solve the following L.P.P. :

Minimize $Z=2x_1+9x_2+x_3$

subject to the constraints,

$x_1+4x_2+2x_3\ge 5,$

$3x_1+x_2+2x_3\ge 4,$

with $x_1, x_2, x_3 \ge 0$.

(10 marks)

(b) The following table gives cost matrix of transporting one unit of product from the sources A, B and C to the destinations D, F, G and H. Determine the optimum allocation minimum cost using MODI method :

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Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Fifth Semester

Branch : Common to all Branches Except CS and IT

EN 010 501 A—ENGINEERING MATHEMATICS—IV

(Regular—New Scheme)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 marks.

1. For the conformal transformation $w = z^2$, find the coefficient of magnification at $z = (1 + i)$.

2. Expand $\cos z$ in a Taylor's series about $z = \pi/4$.

3. Using bisection method, find the negative root of $x^3 - x + 11 = 0$.

4. Solve $\frac{dy}{dx} = y - \frac{2x}{y}$, $y(0) = 1$ in the range $0 \le x \le 0.2$ using Euler's method.

5. Obtain the dual of :

   Minimize $Z = 8x_1 + 3x_2 + 15x_3$

   subject to $2x_1 + 4x_2 + 3x_3 \ge 28$

   $3x_1 + 5x_2 + 6x_3 \ge 30$

   $x_1,\ x_2,\ x_3 \ge 0.$

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Prove that the function $\sinh z$ is analytic and find its derivative.

7. Find the sum of the residues of the function $f(z) = \frac{\sin z}{z \cos z}$ at its poles inside the circle $|z| = 2$.

8. Find the real root of $x^4 - x - 9 = 0$ using Newton-Raphson method, correct to three decimal places.

9. Using Runge-Kutta method, find y when $x = 1.2$ in steps of 0.1, if $\frac{dy}{dx} = x^2 + y^2$ and $y(1) = 1.5$.

Turn over

10. By graphical method or otherwise,

Maximise $Z = x_1 + \frac{3}{5}x_2$

subject to $5x_1 + 3x_2 \leq 15$

$3x_1 + 4x_2 \leq 12$

$x_1,\ x_2 \geq 0.$

(5 × 5 = 25 marks)

Part C

Answer any one **full** *question from each module.*
Each full question carries 12 *marks.*

Module 1

11. (a) Show that the function $u = e^{-2xy} \sin(x^2 - y^2)$ is hormonic. Find the conjugate function v and express $u + i$ V as an analytic function of z.

(7 marks)

(b) Determine the analytic function whose real part is $e^{2x}(x \cos 2y - y \sin 2y)$. (5 marks)

Or

12. (a) Under the transformation $w = \frac{z-i}{1-iz}$, find the map of the circle $|z| = 1$ in the w-plane.

(6 marks)

(b) Find the bilinear transformation which maps the points $z = 1, -i, -1$ into the points $w = i, 0, -i$.

(6 marks)

Module 2

13. (a) Evaluate by contour integration $\int_0^{2\pi} \frac{\cos 2\theta\, d\theta}{1 - 2p\cos\theta + p^2}, 0 < p < 1.$ (7 marks)

(b) Obtain the Laurent's series expansion of $f(z) = \frac{1}{(z-1)(z-2)}$ valid in the region $|z - 1| < 1$.

(5 marks)

Or

14. (a) Evaluate $\int_0^{2+i} (\bar{z})^2\, dz$ along

(i) the real axis to 2 and then vertically to $2 + i$.

(ii) along the line $2y = x$.

(9 marks)

(b) Evaluate $\oint_C \frac{(2z-1)}{z(z+1)(z-3)} dz$, where C is the circle $|z| = 2$. (3 marks)

Module 3

15. Find the real root of :

(a) $xe^x = 3$ and

(b) $x^6 - x^4 - x^3 - 1 = 0$

by Regular-Falsi method, correct to three decimal places.

Or

16. Solve the following system of linear equations by Gauss-Seidel iterative method

$9x + 2y + 4z = 20$

$x + 10y + 4z = 6$

$2x - 4y + 10z = -15.$

Module 4

17. Using Runge-Kutta method of fourth order solve for $y(0.1)$, $y(0.2)$ and $y(0.3)$ if $y^1 = xy + y^2$, $y(0) = 1$.

Or

18. Solve by Milne's predictor-corrector method, $\frac{dy}{dx} = y - x^2$ with starting values : $y(0) = 1$, $y(0.2) = 1.12186$, $y(0.4) = 1.4682$, $y(0.6) = 1.7379$ and find the value of y when $x = 0.8$.

Module 5

19. Using Big M method, solve the LPP :

Minimize $Z = 10x_1 + 3x_2$

subject to $x_1 + 2x_2 \geq 3$

$x_1 + 4x_2 \geq 4$

$x_1,\ x_2 \geq 0.$

Or

20. Goods have to be transported from sources S_1, S_2 and S_3 to destinations D_1, D_2 and D_3. The TP cost per unit capacities of the sources and requirements of the destinations are given in the following table. Determine a TP schedule so that the cost is minimized.

	D_1	D_2	D_3	Capacity
S_1	8	5	6	120
S_2	15	10	12	80
S_3	3	9	10	80
Requirement	150	80	50	

(5 × 12 = 60 marks)